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Diploma Thesis

Food Security in the Democratic Republic of the Congo

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Declaration

I declare that I have worked on my diploma thesis titled "Food Security in the Democratic Republic of the Congo" by myself and I have used only the sources mentioned at the end of the thesis.

In Prague on 16.4.2012   _____

                                                                                    Bc. Barbora Kadlecová

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Food Security in the Democratic Republic of the Congo

Potravinová bezpečnost v Demokratické Republice Kongo

ABSTRACT

This thesis is concerned with food security phenomenon in the particular conditions of a selected Central African country, the Democratic Republic of the Congo (DRC). The country of a focus was selected from a reason that it is according to many indicators considered as a least developed country in the world. As the food security is also one of the targets of the United Nations Millennium Development Goals (MDGs) and the progress of the DRC towards achieving it is rather stagnating, the main objective of the thesis is either to prove or disprove that in the reference period 2000 – 2010, the selected indicators influenced the state of prevalence of undernourishment (one of the indicators of food security) in the DRC, hence to reveal potential sources for the progress stagnation. The side objectives of the thesis are to verify economic and econometric assumptions of the formulated model, to identify missing variables in the model and to comprehensively describe the conditions and characteristics of the DRC regarding, either directly or indirectly, food security.

For achievement of the very objectives, the quantitative correlational and explanatory analysis of the econometric model was utilized. From the statistical and econometric verification of the model implies that five of total seven selected variables have shown the statistically significant relationship with the state of prevalence of undernourishment in the reference period. These variables are total population, domestic cassava production, adult literacy rate, total number of refugees in the DRC territory, and annual Gross Domestic Product growth. The results of the thesis may serve to the policy makers when setting new policies on the national level with the aim of food insecurity alleviation or eradication.

Keywords: food security, the DRC, malnutrition, undernourishment, the MDGs, econometric analysis, Vicious Circle of Poverty, civil war

ABSTRAKT

Tato práce se zabývá problematikou potravinové bezpečnosti v konkrétních podmínkách vybrané země ve střední Africe, Demokratické Republiky Kongo. Země, na kterou se tato práce zaměřuje, byla vybrána z toho důvodu, že se jedná z hlediska mnoha indikátorů o nejméně rozvinutou zemi na světě. Protože je potravinová bezpečnost také jedním z témat, na které se zaměřují Rozvojové cíle tisíciletí Spojených národů, a pokrok Demokratické Republiky Kongo k jeho dosažení je spíše stagnující, hlavním cílem této práce je buď potvrdit, či vyvrátit, že v referenční časové periodě 2000 – 2010 měly vybrané indikátory vliv na stav rozšíření podvyživenosti (jeden z indikátorů potravinové bezpečnosti) v Demokratické Republice Kongo, a tím odhalit potenciální zdroje pro stagnaci vývoje. Vedlejší cíle práce jsou verifikace ekonomických a ekonometrických předpokladů modelu, identifikace chybějících proměnných v modelu, komplexní popis podmínek a charakteristik Demokratické Republiky Kongo, které se vztahují, ať už přímo, či nepřímo, k potravinové bezpečnosti.

Pro dosažení samotných cílů byla použita kvantitativní, korelační a explanatorní analýza ekonometrického modelu. Ze statistické a ekonometrické verifikace modelu vyplývá, že pět z celkových sedmi vybraných proměnných vykázalo statisticky signifikantní vztah se stavem rozšíření podvyživenosti v referenční časové periodě. Tyto proměnné jsou celková populace, domácí produkce kasavy, míra gramotnosti u dospělých, celkový počet uprchlíků na území Demokratické Republiky Kongo, a roční růst hrubého domácího produktu. Výsledky studie mohou sloužit programovým tvůrcům při vytváření programů na celostátní úrovni, které mají za cíl snížení či vymýcení potravinové nezajištěnosti.

Klíčová slova: potravinová bezpečnost, Demokratická Republika Kongo, podvýživa, podvyživenost, Rozvojové cíle tisíciletí, ekonometrická analýza, začarovaný kruh chudoby, občanská válka

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LIST OF ABBREVIATIONS

ABAKO	Association des Bakongo
APR	Rwandan Patriotic Party
CIA	Central Intelligence Agency
DES	Dietary Energy Supply
DEVs	Development Operations
DRC	Democratic Republic of the Congo
EMOPs	Emergency Operations
FAO	Food and Agricultural Organization
FAOSTAT	FAO statistical database
GDP	Gross Domestic Product
GHI	Global Hunger Index
HDI	Human Development Index
HIPCs	Heavily Indebted Poor Countries
IDPs	Internally Displaced Persons
IMF	International Monetary Fund
MDER	Minimum Dietary Energy Requirement
MDGs	Millennium Development Goals
MONUC	UN Mission in the Democratic Republic of the Congo
MONUSCO	UN Stabilization Mission in the Democratic Republic of the Congo
MNC	Congo National Movement
MPI	Multidimensional Poverty Index
MSF	Médecins Sans Frontières
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PPP	Purchasing Power Parity
PRROs	Protracted Relief and Recovery Operations
PRSP	Poverty Reduction Strategy Paper
RPF	Rwandan Patriotic Front
SGBV	Sexual and Gender-Based Violence
SOs	Special Operations
UN	United Nations
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNDP	United Nations Development Programme
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WB	World Bank
WFP	World Food Programme
WHO	World Health Organization
WTO	World Trade Organization

1. INTRODUCTION

This thesis focuses on the food security issue in the particular conditions of the Central African country, the Democratic Republic of the Congo (DRC). The food security itself is very actual topic nowadays as many people suffer from hunger and diseases connected to the hunger phenomenon worldwide. Another reason for it is very frequently discussed topic is also the linkage of hunger and poor economic performance of hungry people. For the potential expansion of economy it is needed to have healthy and productive labour force, which is impossible to reach when the majority of the country's inhabitants are undernourished, hence unable of any economic activity.

The country, in which the phenomenon is studied, was selected based on the fact that its performance towards betterment of the food insecurity situation is very poor. According to FAO (2007), the DRC is one of five countries, which drove the increase in prevalence of undernourishment since the World Food Summit base year period 1990-92. Moreover, also according to FAO (2010a), the situation regarding the achievement of the first Millennium Development Goal (Hunger target) is either stagnating or worsening in this country.

From these reasons the very topic of the thesis was chosen and the study itself attempts to identify the possible reasons for such poor performance in the question of hunger alleviation.

The following chapter of the thesis contains the formulated objectives of the study. It presents the general and side objectives, which the study intends to achieve through the conducted quantitative research and through the investigation of literature.

The outcome of the literature study is presented in the Literature Review chapter, which comprehensively covers the topic from food security phenomena description, through the characteristics of the selected country of the study and description of the selected programs that target food insecurity in the DRC.

The Literature Review is followed by Methodology chapter, which provides the description of type of research and variables selected, preliminary economic assumptions about the selected independent variables of the model, and the sources, from which the information and data for the research were obtained. It further describes the process of model formulation and the way how the data were analysed. The Methodology chapter also contains an important sub-chapter, which deals with the various limitations that the author had to challenge during the work.

The Results chapter presents all of the results of the quantitative research and their description. It covers results of the parameters estimation of the explanatory variables of the model, figures that show their statistical significance and the degree, to which they are influential. Besides the statistical verification, also the econometric verification of the model is included in this chapter.

The next chapter, Discussion, analyses and interprets the results. The analysis of results is conducted through referring to individual economic assumptions that are presented in the Methodology chapter and also with the reference to other authors' results, who have conducted similar research.

The last, Conclusion chapter, intends to summarize the overall work and provide recommendation for the further study in the field in order to obtain even more comprehensive results.

2. OBJECTIVES

This thesis attempts to examine the relationships among the state of food insecurity in the Democratic Republic of the Congo (DRC) and the selected factors that might influence this phenomena.

As an indicator for the food insecurity in the country, the prevalence of undernourishment, expressed in the number of people that suffer from insufficient daily calorie intake nation-wide, was chosen. Among the selected influencing variables the total population, domestic cassava production, quantity of wheat imported, adult literacy rate, total refugees in the DRC, net exports and Gross Domestic Product (GDP) growth were included. All the input variables for the research are quantitative ratio variables.

The general objective of the thesis is through the quantitative analysis of formulated econometric model to prove or disprove the hypothesis: *The selected main factors (indicators) were influencing the prevalence of undernourishment in the Democratic Republic of the Congo in the reference period from 2000 to 2010.*

Aim of the thesis is to find out, which of the indicators show the statistically significant relationship with the prevalence of undernourishment. The ultimate purpose of the study is also to reveal the degree to which the significant factors influenced the state of food insecurity in the country in the reference period 2000 – 2010, making the study to be retrospective.

Among the specific objectives belongs the aim of comprehensive description of the particular conditions of the DRC related, either directly or indirectly, to food insecurity phenomena, hence to understand the complexity of the issue. The fulfilment of this objective enables the right interpretation of results of the econometric analysis.

Another specific objective is to verify the economic assumptions, in other words, to verify whether the resulting quantified model corresponds to the economic theory.

As it is dealt with the econometric model, beside the verification of economic assumptions, another aim is to verify the econometric assumptions, which is another specific objective of the thesis.

The last specific objective of the study is to identify the quantitative variables, which might be missing in the model, or other factors, which cannot be quantified and hence included in the model, that might play significant role in the variation of prevalence of undernourishment in the DRC.

3. LITERATURE REVIEW

The issue of hunger, malnutrition and starvation has become one of the much discussed topics nowadays. Among the main reasons for this fact we can consider the United Nations' (UN) Millennium Development Goals (MDGs), which were adopted in the year 2000 in order to eradicate extreme poverty through cooperation of the governments of the UN member states. (UN Millennium Project, 2006a) Due to continuous monitoring and reporting of the progress towards achieving of the selected development goals, the interested audience obtains update information regarding the topic regularly.

Another reason for the issue being so discussed is the fact that the problem of food security covers according to the Food and Agricultural Organization (FAO) of the UN estimate, which was presented on the 14th September 2010, around 925 million people who suffer from chronic hunger worldwide. Moreover, according to this estimate, two-thirds of all of the undernourished people from the entire world are concentrated in just seven countries; these are: Bangladesh, China, the Democratic Republic of the Congo, Ethiopia, India, Indonesia and Pakistan. (FAO, 2010b)

The importance of solving this situation is quite clear. It is not only the question of moral duty of all of us but as the poor conditions these people live in are directly linked with the inability of the people in question to actively participate in the economy and hence the overall economic development of their country, the central governments should have the greatest interest in the problem solution.

The purpose of this chapter is to bring closer the background of the studied issue to the reader and to provide comprehensive information regarding the topic of the thesis.

3.1 Food security

According to the FAO definition, "food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life." (FAO, 2010c)

Food insecurity is on the other hand the situation when people lack one of the above described opportunities.

The World Health Organization (WHO, 2012) under UN further anatomizes this definition. WHO states that the food security is composed from three pillars; these are:

- food availability
- food access
- food use.

In this context, the food availability is defined as "sufficient quantities of food available on a consistent basis." The food access means, according to the WHO (2012) definition, "having sufficient resources to obtain appropriate foods for a nutritious diet." And the last, being food use, stands for "appropriate use based on knowledge of basic nutrition and care, as well as adequate water and sanitation."

The food security phenomenon is negatively correlated with the poverty. We can say that the more people suffer from extreme poverty, the more people also experience a hunger as they cannot afford to buy food. Such people are usually very dependent on their own agricultural production; hence also the climatic conditions play a very important role. Marcia Amidon Lüsted writes in her book *Poverty* that in the 2008 around 1.4 billion people worldwide lived in extreme poverty, which means earning less than $1.25 a day and that in the same year almost half of the world's population lived with less than $2.50 per day. (Lüsted, 2009) All of these people did not have or still do not have sufficient monetary resources to purchase food, which is rich in nutrients, and therefore consequently suffer from other complications regarding health.

3.1.1 Malnutrition

One of such health complications is definitely malnutrition. Malnutrition is also directly linked to poverty as it is most often caused by bad sanitation, poor water supply and hygiene.

These alarming conditions usually result in infectious disease diarrhoea, which is mainly in developing countries a cause of subsequent malnutrition. (WHO, 2001)

According to the information provided by WHO, "malnutrition essentially means 'bad nourishment'. It concerns not enough as well as too much food, the wrong types of food, and the body's response to a wide range of infections that result in malabsorption of nutrients or the inability to use nutrients properly to maintain health. Clinically, malnutrition is characterized by inadequate or excess intake of protein, energy, and micronutrients such as vitamins, and the frequent infections and disorders that result." (WHO, 2001) There are three types of malnutrition.

a. Secondary malnutrition, which occurs when a person is unable to fully use the food he eats (e.g. as a result of some disease).
b. Overnutrition means that the person has a too high consumption of calories.
c. Undernutrition or protein-energy malnutrition is the shortage of sufficient calories and protein in the content of food for a proper growth. (WHO, 2001)

Health complications that are connected with malnutrition and even malnutrition itself can result in the premature death.

As the third category of malnutrition, being undernourishment, is also considered as one of the indicators according to which the progress towards achievement of MDGs is measured, this category will be the most important for the purposes of this thesis, too.

In its report *The State of Food Insecurity in the World 2010*, the FAO defines undernourishment as follows: "Undernourishment exists when caloric intake is below the minimum dietary energy requirement (MDER). The MDER is the amount of energy needed for light activity and to maintain a minimum acceptable weight for attained

height. It varies by country and from year to year depending on the gender and age structure of the population." (FAO, 2010c)

3.1.1.1 *Starvation*

The term starvation then refers to the severe malnourishment, which can, when long-lasting, cause a serious harm to body organs or even death. (Stratton, *et al.*, 2003) The subsequent state of the body resulting from starving is called inanition. This term stands according to *The American Heritage Medical Dictionary* for the state of total exhaustion from the shortage of nourishment. (Your Dictionary, 2012)

3.1.1.2 *Kwashiorkor*

Kwashiorkor represents a type of malnutrition occurring mainly by children. It is most frequent in drought areas and areas with famine. "Kwashiorkor is due to inadequate protein in the diet despite an adequate caloric intake. Symptoms may include irritability and fatigue followed by slowed growth, weight loss, muscle wasting, generalized swelling, skin changes, enlargement of the liver and abdomen, and weakening of the immune system, leading to frequent infections. Once kwashiorkor develops, some of the effects, such as short stature and intellectual disability, cannot be corrected." (Better Medicine, 2011)

Figure 1 Impact of hunger and malnutrition throughout the life cycle
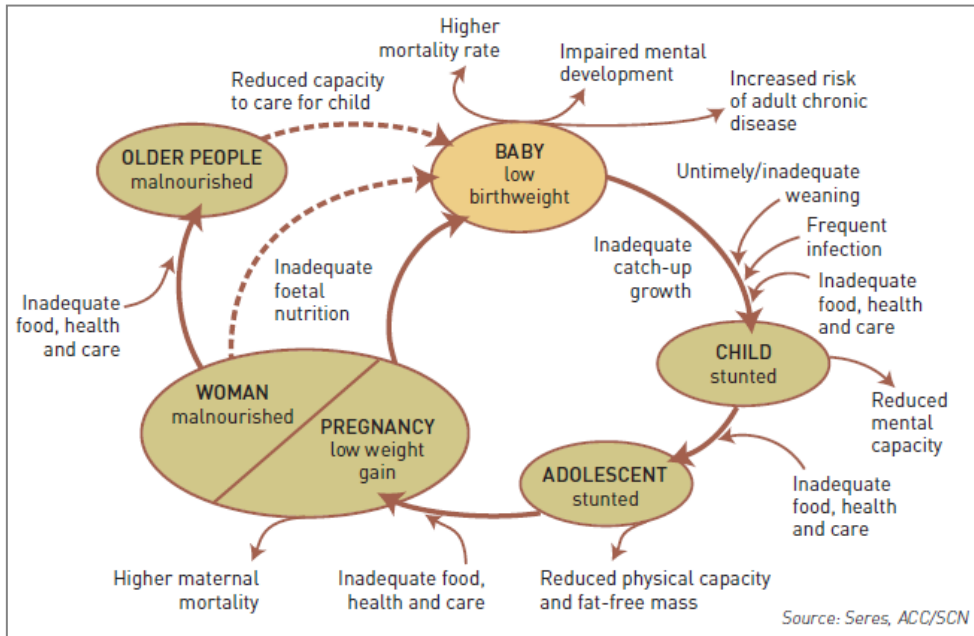
Source: FAO, The State of Food Insecurity in the World 2004.

3.1.2 Famine

According to the Chamber's Encyclopedia, the famine can be defined as "lack of food over large geographical areas sufficiently long and severe to cause widespread disease and death from starvation." (West, 2006) Another source defines famine as: "the regional failure of food production or distribution systems, leading to sharply increased mortality due to starvation and associated disease." (Burg, 2008)

There are many more definitions for the term famine; nevertheless, those mentioned above will sufficiently serve for the purposes of this thesis, as the main intention of this part of the chapter is to provide fundamental information on the terminology used regarding the food insecurity issue and thereby prevent potential confusion of the reader.

Even though it is clear what famine stands for, it is always difficult to reveal first signals when the food crisis is overgrowing into much more serious situation. The author Cormac Ó Gráda identifies in his book *Famine: a short history* a few major warning signals that are preceding the famine. First of them is rising in the prices of grain, second one is the increased migration and the last warning signal is the increased level of crime.

Besides the warning signals, the author also describes the situation, when the stage of course cannot any longer be called food crisis but famine. According to Ó Gráda's definition, the situation, when daily death rate rises above one per ten thousand of the population, also the proportion of children weighing two standard deviations or less below the average rises above 20 percent and finally, there is a rise in the prevalence of the children's protein-energy malnutrition – kwashiorkor – already means famine. (Ó Gráda, 2009)

3.2 Interconnection of hunger and poverty

The fact that there is undoubtedly a certain relationship between hunger and poverty phenomena was already mentioned before. In the following scenario, the relationship is clearly visible.

When a person is born into a family, which lives in an extreme poverty, it is quite hard for him or her to get out of the poverty trap. As the family have not sufficient monetary resources to feed its children with food of proper quality and quantity, some of the children might prematurely die, the rest, again due to shortage of money, will probably have an access to primary education only, if any. There are many reasons for not getting higher education. First and very obvious reason for that will be the school fees. Among other reasons belongs gender inequality, lack of time due to working on the field or due to taking care of younger siblings, etc.

As the person has a low level of education, also his or her future earnings will be most probably low. With a low income, the person's propensity to safe will be negligible, which means no extra money for investments into better housing, land, technology and other possible improvements. Without investments, the person is more vulnerable to price changes, climate conditions and other factors, which influence productivity. And with low productivity, again, the low income is connected. The circle is closed.

Figure 2 The vicious circle of poverty
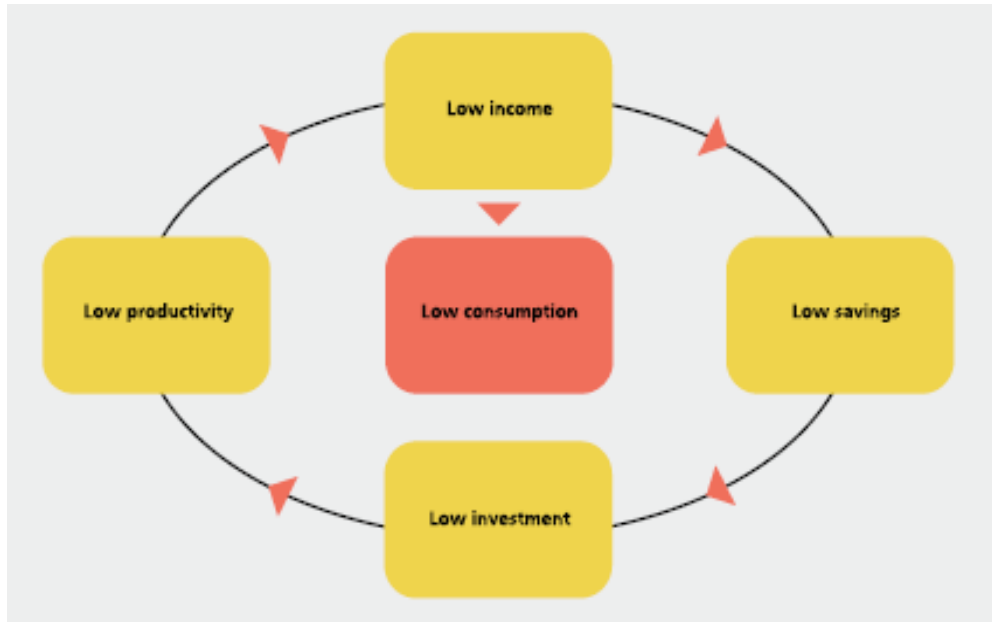
S*ource: The World Bank, Beyond Economic Growth, 2004*

The low income situation might also be caused by the inability of the person to actively participate in any economic activity due to health complications that are a consequence of long-lasting undernourishment. This situation is shown in a well arranged way in the Figure 3.

Figure 3 The vicious circle of hunger
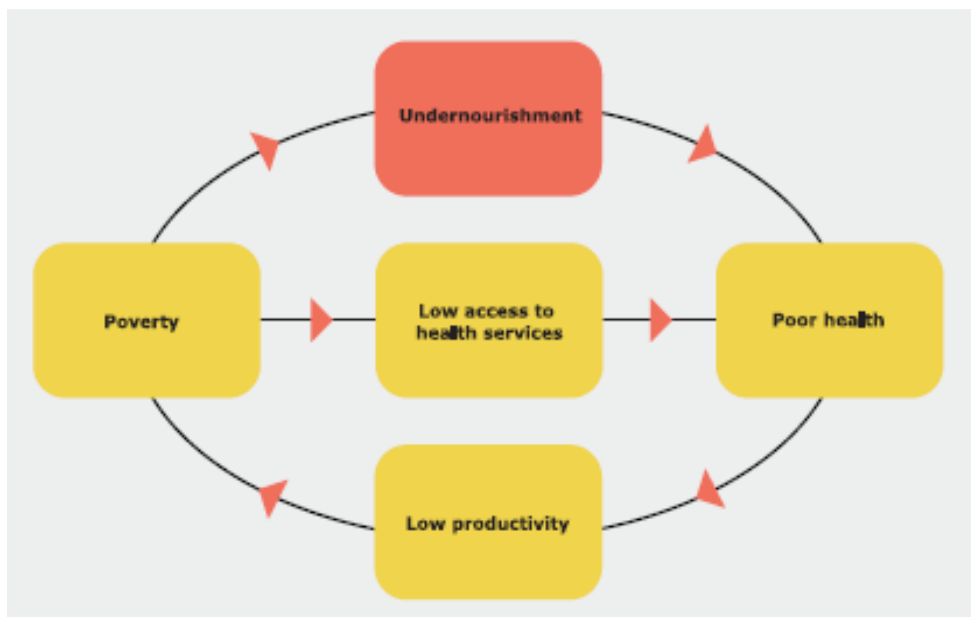
Source: The World Bank, Beyond Economic Growth, 2004

This thesis is focused on the topic of hunger in particular conditions of a selected country – the Democratic Republic of the Congo. The following part of this chapter intends to bring closer these conditions in order to illustrate the environment in which the very objective of the thesis is tested.

3.3 The Democratic Republic of the Congo

The Democratic Republic of the Congo (DRC) is according to many factors ranked among the poorest, least developed countries in the world. With its value of Human Development Index (HDI) scoring 0.286 in the 2011, the DRC is ranked on the 187th place out of 187 countries covered in the United Nations Development Programme (UNDP, 2011a). According to data of the World Bank (WB) from the year 2010, the DRC's position of the gross domestic product (GDP) per capita, which was counting $199 that year, is the second worse among countries, for which the figures were available in the selected year. (WB, 2010)

3.3.1 Geography

Figure 4 Map of the Democratic Republic of the Congo

Source: Lonely Planet, 2012

The Democratic Republic of the Congo (formerly Zaire) is situated in central Africa, neighbouring with the Central African Republic, Sudan, Uganda, Rwanda, Burundi, Tanzania, Zambia, Angola and the Republic of Congo. With total area of 2,344,858 square kilometres it is, after Algeria, the second-largest country on the African continent. (CIA, 2012) The capital city, Kinshasa, is lying in the south-west of the country.

Although the DRC is spread across such a big area, only 2.86% of its total land is arable land, from which only 110 square kilometres is irrigated. Despite these conditions, according to the 2011 estimate, agriculture plays an important role in the overall GDP, comprising 37.5% out of the total $25.19 billion purchasing power parity (PPP) in the same year. (CIA, 2012)

The landscape of the country is divided into four physical regions. First region is the central plateau, which is lying low and is surrounded from the west, south, southeast and northwest by mountain terraces, plateaux and dense grasslands. (Atlapedia, 2011) The dominant of the whole country is, with its many tributaries, the river Congo.

Another dominant of the country is the Congo rainforest that stretches across the central Africa on the basin of the Congo River and almost two-thirds of its area is situated in the DRC. After the Amazon rainforest, it is the second biggest rainforest in the world. (Greenpeace, 2012)

3.3.1.1 *Climate*

The territory of DRC is crossed by the equator and that is why the weather in this country is tropically hot and humid. The highlands in the east have rather temperate weather. Due to the location on the equator, in DRC we can find reversed seasons on the north and south. During the year, dry and wet seasons are changing in both regions but in different times. (CIA, 2012) Average temperatures are ranging between 18 – 32 degrees Celsius depending on the altitude and the season. (Atlapedia, 2011)

3.3.1.2 *Natural hazards*

Due to equatorial climate, the DRC is subject to heavy rainfalls during the year, which bring flooding and subsequent soil erosion, sometimes even landslides. (UNDP, 2012) On the other hand, during the dry season, the DRC is experiencing serious draughts, especially in the south of the country. (CIA, 2012)

The volcanoes represent another natural threat. In the east of the country there are still active volcanoes. (CIA, 2012) Their activity is caused by permanent tectonic moves in East Africa's Great Rift Valley, which is according to specialists one of the geologic wonders of the world. (Wood, *et al.*, 2012) Probably the most known is the volcano Nyiragongo, which is one of the most active volcanoes in the world. As the volcano towers right above the city of Goma, which population is steadily growing due to inflow of people running from the present conflicts, the problem is more serious. (National Geographic, 2011)

3.3.2 Demography

According to 2011 estimate, the DRC population counts nearly 71,713,000 inhabitants, from which 44.4% are children in the age 0-14, 53% of population is in the age range 15-64 years and the remaining 2.6% are people older than 65 years. The estimate from the same year states the median age of the total population regardless of the gender as 17.4 years. (CIA, 2012) This central tendency measure shows quite young age distribution of the population, which is correlated with further predominantly negative economic consequences.

The reasons for such a young population are certainly many conflicts, civil war, and violence that is taking place even in the present days. More information on the topic of disorders in the DRC can be found in a latter chapter.

According to the latest World Bank figures from the year 2009, the life expectancy at birth for both genders in the DRC was only 48 years (WB, 2009a), which is even lower in the comparison with the average 58 years for the least developed countries (UN classification) and the average life expectancy of 54 years for the Sub-Saharan Africa in the same year. (WB, 2009b)

3.3.2.1 *Health situation*

Even though, the DRC expenditures on health were 9.5% of the gross domestic product (GDP) in the year 2009, which is quite high figure (e.g. Switzerland spent 11.3% of its GDP on health) (WB, 2009c), when looking at these expenditures per capita, the DRC spent only $16 per inhabitant, which is on the other hand among the lowest figures according to WB data in the year 2009 (for comparison, Switzerland spent $7,141 per capita on health in the respective year). (WB, 2009d)

According to the United Nations Children's Fund (UNICEF), in the year 2009 the under-5 mortality rate in the DRC was 199 deaths per 1,000 live births, which was the second worse ranking in the world. UNICEF considers the under-5 mortality rate as one of the critical indicators which shows the well-being of the children. Maternal mortality ratio from the year 2008 counts for 670 deaths per 100,000 live births, which is really high and alarming figure corresponding to the low health standards, low number of childbirths assisted by trained medical staff, lack of information and many other causes. (UNICEF, 2011)

To the health situation in a country also relates the access to the improved drinking-water sources. In the year 2008, 80% of urban population in the DRC had access to such source, whereas in the rural areas it was only 28%. Similar alarming situation applies also in the case of usage of improved sanitation facilities, which is 23% of population both in urban and rural areas in the same year. (UNICEF, 2011)

The most prevalent diseases in the DRC are malaria, tuberculosis and diarrhoeal infections, including cholera. (WHO, 2004) According to the United States Agency for International Development (USAID), the DRC ranks on the 10th place out of 22 countries, which are burdened by the tuberculosis seriously and identifies this disease as one of the leading causes of death in the country. (USAID, 2009) Another serious disease occurring in the DRC is HIV/AIDS; the estimated data provided by Joint United Nations Programme on HIV/AIDS (UNAIDS), available from the year 2009 show that in this year there were 430,000 – 560,000 people living with HIV, where the numbers represent low and high estimate respectively. (UNAIDS, 2010)

There are only the most frequently occurring diseases in the country in question mentioned above but naturally, poor conditions that are taking place in the DRC are unfortunately connected with many other health complications.

3.3.2.2 *Education*

The actual situation of education is best described by several factors or indicators. First of them would be the literacy rate of the population of the country. The literacy rate among adults (15 years and older) was 67% out of the specified group in the 2009. (WB, 2009e)

The actual mean of years of schooling of the Congolese population is 3.5 years according to Human Development Report 2011. Another indicator presented in this source is the proportion of the population with at least secondary education, which is only 10.7% by women and 36.2% by men in the DRC. (UNDP, 2011a) From the national survey which was conducted by the Congolese ministry of planning and reconstruction follows that in the year 2010 still 31% of children being in the age between 6 and 11 have never stepped into a classroom.

The government expenditures on education counted 8% of the national budget in the year 2008, which was only the half of the amount the government wanted to invest originally. (International Rescue Committee, 2010)

3.3.2.3 *Food security and poverty*

The latest available data show that 59.2% of Congolese population lives under the $1.25 poverty line and that 71.3% of the country's inhabitants must survive under the national poverty line (national poverty line is the line that is considered as appropriate for a country by its authorities). (UNDP, 2011a) When considering the income level of $2 a day, into such criterion falls 79.6% of the Congolese population. (UNDP, 2011b)

According to the Multidimensional Poverty Index (MPI), which is newly developed measure of poverty covering comprehensively broad variety of deprivations, 73.2% of DRC population is living in the multidimensional poverty that makes around 44.5 million people who lack one or more of the indicators which are shown in the Figure 5. (UNDP, 2011a)

Figure 5 MPI: Deprivations in each Indicator in the DRC in 2011

Percentage of the Population who are MPI poor and deprived in each indicator
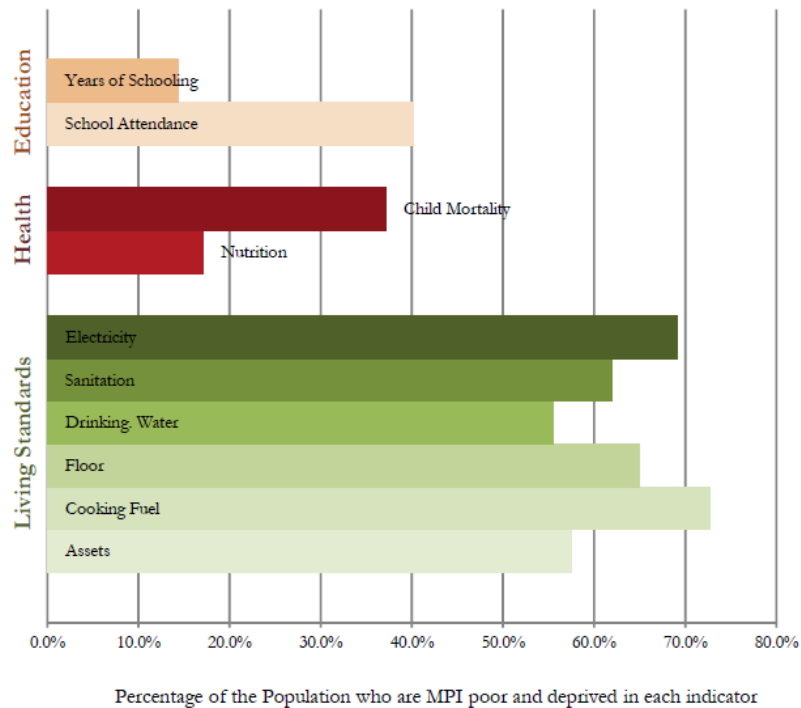
Source: UNDP, 2011

With the poverty of the population there are linked many other problems, including the food insecurity. The DRC is not an exception in this and therefore the similarly alarming numbers as by the poverty measures are occurring by the food security indicators as well. Based on the latest data of the FAO, the overall national proportion of undernourishment is the 69% of inhabitants, meaning 41.9 million people being undernourished in the country. The numbers correspond to the time period 2005-07, when the MDER of the population was 1750 kcal/person/day but the Dietary Energy Supply (DES) was only 1590 kcal/person/day. (FAO, 2010d) DES is according to FAO definition an "estimate of the per capita amount of the energy (kcal) in food available for human consumption, during the reference period (3-year average period) and represents

only the average supply available for each individual in the population as a whole and do not indicate what is actually consumed by individuals." (FAO, 2012a) As the DRC is a country of huge inequalities we can assume that also the food distribution among the inhabitants is unequal.

Another measure of hunger is the Global Hunger Index (GHI) which is composed from 3 indicators:

- proportion of the population that is undernourished (in %),
- prevalence of underweight in children under five (in %),
- proportion of children dying before the age of five (in %). (von Grebmer, *et al.*, 2010)

The GHI ranges from 0 to 100, however, these extreme values never occur in the practice. The interpretation of this index is the higher the value, the more hunger in the country. For the DRC the value of GHI was 41 in the year 2010, which might not be seen as extra high, although it is the highest score from all of the countries for which the index was calculated that year. (von Grebmer, *et al.*, 2010)

These are the statistics for the whole country but the figures differ when we focus on each region of the DRC individually. As each of the regions is affected by the conflicts and war differently, they have different climatic conditions and natural resources and differ in many other aspects; also the data among them differ. For the purposes of this thesis, only the overall data will be used.

From the following chapter dedicated to the history and conflicts, which either took place in the DRC or in which DRC took part, the reader obtains important background information for the state, in which the DRC presently is. The political situation and conflicts over the history have heavily influenced or are still influencing the well-being of DRC inhabitants as well as the lives of inhabitants of the neighbouring countries.

3.3.3   From Belgian Congo to the DRC

As the documentation of the Congolese history covers rather the modern times, also this part of the chapter will focus on the events regarding DRC from the end of the 19th century, when the Europe steps on the scene in this country for the first time.

From the year 1885 till 1908, the Congo Free State is ruled by the king Leopold II of Belgium, who was inconsiderate to its inhabitants and just wanted to become rich. Due to the terrible treatment of Congolese people, he is forced by the international pressure to leave the Congo Free State to the Belgian government.

3.3.3.1 *Belgian Congo (1908 – 1960)*

Under the authority of Belgium, the Congo is not a typical colony. The governance is undertaken from the Brussels. Due to the past events, the strict supervision and transparency are demanded. The attitude of the Brussels towards Congolese citizens is so called paternalism, where the philosophy of this approach is based on the idea that Africans need to be cared for as if they were children. (Encyclopedia Britannica, 2012)

Under the ruling of Belgium various minerals are mined. The most important would be copper and diamonds. As the Belgian Congo's prosperity is dependent upon exports of these and other commodities, it suffers a lot during the recession in the 1930s. On the other hand, the period of World War II is ironically prosperous for the region due to the exports of uranium to the United States. (Ezakwantu, 2012)

During and after the World War II, there is a great inflow of immigrants from the Belgium. As it is also in other African colonies, the rights and opportunities are greatly different for the local people and for the Belgian immigrants. The only thing common for both whites and blacks is that they cannot vote as there is no representative body in the Belgian Congo to vote for.

During the 1950s, there are serious pressures across Africa calling for independence from Europeans that naturally influence further events that take place in the Belgian Congo. But the colonial regime has been challenged in the Belgian Congo since the beginning. There were several rebellions, anti-European religious groups were

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established and actively stimulated the local people. The disorders were even worse during the recession in the 1930s when the Belgian Congo's economy was worsened. All of the events finally led to the establishment of the first nationwide Congolese political party – The Congo National Movement (MNC) – in the year 1958 by Patrice Lumumba. (Encyclopedia Britannica, 2012) Besides this political party, also the political party led by Joseph Kasavubu – Association des Bakongo (ABAKO) – appears in the same year. (Oppong, *et al.*, 2007) These two political parties will play a very important role in the events that are about to come after year 1960.

Due to the unrests in the country the authorities in Brussels started to consider whether to introduce greater autonomy to Belgian Congo. The talks were interrupted by riots in the Leopoldville (present Kinshasa) in the January 1959. Even though the Belgium originally stated that immediate autonomy was impossible for Congo, after the conference held in Brussels with the delegates of the main Congolese political parties in the January 1960, the Belgian Congo achieved autonomy in just six months on the 30 June 1960. (Ezakwantu, 2012)

3.3.3.2 *The Democratic Republic of the Congo (1960 – 1965)*

The president of the newly independent state is Joseph Kasavubu and the prime minister is Patrice Lumumba. These two were leaders of the biggest nationwide political parties. Also a coalition comprising of a few minor political parties was established. The problem was that these parties were very heterogeneous; therefore the possible future problem could have been anticipated. Another historically significant political party was led by Moise Tsombe and was based in the eastern province of Katanga, which is very rich in minerals. (Ezakwantu, 2012) The celebrations of independence were very short because the Congo was soon facing many internal conflicts, leaving its population to suffer from torment, which brought the civil war. (Lanotte, 2010)

Just few days after the independence, there are first signs of unrests. The soldiers of the Congolese army rise up against the fact that even though the DRC is already the independent state, the officers of the army are still Belgians. The dismissal of these officers is followed by the great chaos in the country when all the Belgian citizens

are furiously chased, raped, and attacked. Belgium sends its troops to the DRC to protect their citizens and also helps Tsombe with the protection of the Katanga province, which Tsombe proclaimed as independent during the chaos.

Lumumba wants to get Katanga back and calls Soviet Union for help. The tense situation in the DRC awakes interest in the general assembly of the United Nations, which sends its forces to the country for a peacekeeping mission.

Meanwhile, both president and prime minister are dismissed from their offices and the chaotic situation is solved by the minister of defence, Joseph Mobutu, who temporarily overtook the duties of the government. Mobutu and Kasavubu share a disagreement with the Lumumba's positive relationships with the Soviet Union. In the February 1961 Kasavubu gets back to the office of a president of the DRC and appoints Mobutu a commander of the Congolese army. Lumumba is murdered in the circumstances that are unknown.

The dispute over the independence of Katanga province continues with Tsombe supported by Belgian government and troops on the one side and the Congolese government supported by the international community on the other. Belgium has a clear interest in Katanga due to its mineral wealth. Nevertheless, in 1962 the UN attitude towards this situation changes and it launches rather active intervention than a peacekeeping stand that it had before. The Katanga is conquered and Tsombe leaves the country. Not a long time after these events in the 1965, Mobutu, who strengthened his power in the Congolese army, stages a coup and declares himself as a president of the Congo. (Ezakwantu, 2012)

Each of the change was accompanied by many rebellions, which tried to achieve their objectives through bloody and violent practices. Unfortunately, in such times, mainly the civil population is exposed to most brutal attacks, rapes and killing. The precise numbers of deaths from the early independence period are not available but from the fact that nearly each governmental change was done through violence, or the violence came right after the change, we can assume that years between 1960 and 1965 were years of brutality, fear and endless killing among the citizens of the same country.

3.3.3.3 *Republic of Zaire (1965 – 1997)*

With the change of the leadership, there also came a change in a name of a country – Republic of Zaire (the name means "river" in African). (Ezakwantu, 2012) Mobutu created a strong government and granted himself nearly unlimited powers, which transformed the political system to a dictatorship. He eliminated any political competition through permitting only one political party – the Popular Movement of the Revolution (MPR). (Lanotte, 2010)

Moreover, he wanted to strengthen the African identity through the policy called Authenticité, "which he defined as a return to the sources and values of his ancestors and the refusal of the people of Zaire blindly to embrace imported ideologies," (Lanotte, 2010) therefore he changed the name of the capital Leopoldville to Kinshasa in 1966 and ordered to all of the citizens to rename themselves with African names. To be an example, the dictator changed his name to Mobutu Sese Seko Koko Ngbendu Wa Za Banga (meaning "the all-powerful warrior who, because of his endurance and inflexible will to win, sweeps from conquest to conquest, leaving fire in his wake" (Ezakwantu, 2012)).

Mobutu nationalized the majority of the economic sectors, which, in spite of the independence, often remained under the Belgian control. During the years 1977 and 1978 Mobutu had to face many attacks against his regime but they were all averted. Even though the opposition of the regime was successfully supressed for the first fifteen years, in the 1980s it started to mobilize and publicly criticized Mobutu's practices that visibly worsened the living conditions in the Zaire.

In 1982, the first opposition political party – the Union for Democracy and Social Progress (UDPS) – was established. Later, at the beginning of the year 1990, the dictator showed certain openness to the opinion of the public and what he learned really shocked him. Mobutu was accused from many reasons, starting with his policy strengthening the African identity, to deteriorated economic situation and many more. The leader decided to transform the system towards greater democracy, but when he realized the consequences for his power, that would have followed free elections, he started to do

many tricks. In such circumstances, living conditions continued to deteriorate and that led to an increase in the number of demonstrations all over the country.

Finally, in the year 1996, after long period of unrests, violent oppression of the opposition, secret and also public negotiations, the national bankruptcy in 1994, the Zaire was attacked by the Rwandan Patriotic Party (APR) under command of Laurent Kabila, who initially targeted refugee camps in the eastern part of the Zaire, where the forces, responsible for the massacre in the Rwanda in 1994, were preparing themselves to re-attack the Rwanda and regain the power. This attack overgrew into the fight for national liberty and caused the fall down of the Mobutu's ruling in 1997. (Lanotte, 2010)

3.3.3.4 *The Democratic Republic of the Congo (1997 – present)*

Still in the same year, Kabila took over the seat of a president and renamed the country on the previous – The Democratic Republic of the Congo (DRC). "Laurent Kabila came to power in a country destroyed by 32 years of President Mobutu's kleptocratic and authoritarian regime, and was seen as a saviour who would take the country out of its political, economic and social difficulties." (Kabemba, 2001) Despite the change, the DRC was far from reaching a peace.

The forces, which previously helped Kabila to gain power, were now unsatisfied how the country was ruled and challenged Kabila's regime in 1998. This rebellion was supported by Rwanda and Uganda. But Kabila was able to obtain a backup from the neighbouring countries and soon Angola, Zimbabwe, Namibia, Chad and Sudan sent their troops to help protect the regime. In the year 1999, the Lusaka peace agreement was signed but the peace was very fragile and the conditions, which were agreed upon, were not obeyed by those who signed the accord. (The Washington Post, 2001) Moreover, in 2001, Laurent Kabila is assassinated and his son, Joseph Kabila, is named as a head of the state. (Oppong, *et al.*, 2007)

On 30 July 2002, the Pretoria Agreement is signed between DRC and Rwanda in order to obtain peace after long-lasting Congolese conflict.

The Security Council of UN sends a peacekeeping mission – the United Nations Organization Mission in the Democratic Republic of the Congo (MONUC) – to assist the signing parties with the implementation of the steps that were agreed upon in the accord. (UN, 2002) Between the years 1998 and 2003 it is estimated, that 5 million people died from the causes connected to the war – mainly diseases and starvation. (International Crisis Group, 2010) This period of civil war is by some sources called the Africa's First World War. (Kabemba, 2001)

From 2003, Joseph Kabila continues to be in the seat of the president as a head of the state, sharing the ruling authorities with four vice-presidents. This so called transitional government lasted till 2006, when the first democratic national elections took place. In this transitional period, despite the peace accord from 2002, the internal conflict situation did not calm down much as the rebels were still fighting the national army. The worse situation was in the eastern provinces of North and South Kivu, where the rebel forces from Rwanda concentrated. During the elections in 2006, Joseph Kabila was re-elected and unfortunately, this event was again accompanied by violence between his and his opponent's supporters.

The unrests all over the country continued practically till the 2009, when the peace deal between the government and rebels was arranged. A new political party was established from the rebel group and its forces joined the official national army. Nevertheless, the violence was not stopped completely, it continued mainly in the eastern part of the DRC. In 2010, the MONUC mission was renamed to the United Nations Organization Stabilization Mission in the Democratic Republic of the Congo (MONUSCO) and prolonged the stay of its troops to provide assistance till the half of the year 2011 in spite of local voices calling for dismissal of the UN forces from the country. (Congo Now!, 2010)

On 28 November 2011 the presidential and parliamentary elections were held. The whole process, beginning from polling, through the transport of the ballots and finally the counting of the votes, was accompanied by violence and unrests. People were burning the polling stations, attacking the vehicles during the transportation of the ballots

and congregating in many demonstrations. As there were so many candidates to the parliament (18,000 candidates for 500 parliament seats) and 11 presidential candidates, the ballots often resembled a small book. With the nation's literacy rate counting only around 67%, for over one-third of the population it was even hard to vote. (BBC News, 2011)

Finally, the results were published and the winner of the presidential elections was Joseph Kabila with 48.9% of votes, leaving his major competitor Etienne Tshisekedi on the second place with only 32% of votes. The participation in the polling was 58% of the population. The loosing candidate Tshisekedi rejected the results of the polling and stated that he is the winner and the new official president of the DRC. "Tshisekedi called on his supporters to remain calm until further instructions and urged the international community to step in to avoid what he says could be a new bloodbath in Congolese territory." (Voice of America, 2011)

However, the Congolese electoral commission published the voting results from polling station to polling station so these materials can be eventually used to prove the reliability of the elections in the case that some of the loosing opponents used legal means to question the results. Despite the disagreement of Kabila's opponents, the re-elected president started his new term. (Voice of America, 2011)

3.3.4 The genocide in Rwanda

The ethnical conflict, which originated in Rwanda, also significantly influenced the events in former Zaire after 1994. This chapter serves to bring closer the conditions, which took place in to Zaire neighbouring Rwanda, and hence clarify reasons for subsequent Zairian/Congolese civil war in years 1998 to 2003 and also the reasons for the follow-up conflicts on the Congolese territory, which are taking place till the present days.

In Rwanda, there lived two ethnic groups, Hutu and Tutsi, the relationships of which were really negative and the conflict between them dates much further before the genocide in the Rwanda. The discrimination of the Tutsi ethnic in Rwanda might have its roots in events from the neighbouring Burundi, where the then Tutsi president let 100,000 – 300,000 Hutus to be killed in 1972. (Johnson, 2012)

The then Rwandan president, who was Hutu, did not allow Rwandan Tutsis in exile to come back to the country or even visit their relatives, who lived in Rwanda. Those who lived in exile did their best to survive as refugees and for example in Uganda many of them joined local army. Some of them used the skills gained in the army and established military organization called Rwandan Patriotic Front (RPF).

In 1986 came sudden economic deterioration, as the price of tea and coffee, main Rwandan exports, dropped down, which had serious consequences for the population, both Hutus and Tutsis. The president started to lose his support among the public. But for the Hutu president it was inconceivable to lose the sympathy of the Hutu inhabitants, which were his main supporters. (Spalding, 2009) After the first RPF attacks he started to spread the hate in the public against Tutsis and claimed that this ethic is responsible for the then bad economic conditions. When he was assassinated on April 6, 1994, the Tutsi ethnic was blamed by the Hutu extremists, who immediately overtook the government, for his death. The horror was about to come.

In 100 days, according to the estimates, 800,000 Tutsis, moderate Hutus and Tutsi sympathizers were killed in a terrible massacre, usually done by hand weapons, that some of the sources refer to as slaughtering of people. The terror was stopped by RPF, which attacked the Rwanda from abroad, and then took over the government. (Rosenberg, 2012)

During the killing many of people were leaving the country to find a refuge in the neighbouring countries. In the eastern part of the DRC, mainly in the provinces of North and South Kivu, a lot of refugee camps were established. By the year 1996, the continuing Rwandan conflict and genocide spread over to the then Zaire. The refugee camps situated in the east of the DRC served as places for mobilization of Hutu forces that fled Rwanda after the RPF intervention. (Global Security, 2011) In the following years after the genocide, the Tutsi Rwandan army killed tens of thousands of Hutu civil refugees, regardless the age or gender of the people, on the Congolese territory. (BBC, 2010)

The established refugee camps represented not only the nest of serious violence in the country, as the ethnical fighting was reported there even in the much later years,

particularly in 2008 (BBC, 2008), but also a future heavy burden to the nation's economy. In time of the authoritarian regime nobody paid much attention to either refugees or internally displaced persons (IDPs) – the care must have been, and is still, from the lion's share provided by international and multilateral organizations, as the local poor economic growth does not generate enough money to cover these (for local economy) extra expenses.

Another, rather historical, prove that Rwandan conflict influenced the events in the DRC is also the fact that the former president of DRC, Laurent Kabila, was the leader of a group of exile Tutsi forces, by which help he managed to conquer Mobutu and gained the power. (Ezakwantu, 2012)

3.3.5 Refugees and IDPs in the DRC

As it was already mentioned, after the genocide in Rwanda, many refugee camps were founded on the territory of the then Zaire, mainly in the eastern part of the country, in the provinces of North and South Kivu, on the borders with Rwanda. Nevertheless, people from Rwanda are not the only refugees that are found within DRC borders. There are also people from Angola, Burundi and various other countries. (UNHCR, 2011)

The refugee is someone, who "…owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group, or political opinion, is outside the country of his nationality and is unable to, or, owing to such fear, is unwilling to avail himself of the protection of that country." (MSF, 2009)

People living in the camps are extremely vulnerable to still persisting violence, as the majority of them are women, children and the elderly.

According to the United Nations High Commissioner for Refugees (UNHCR), also known as the UN Refugee Agency, report on the refugee situation in the world, there were around 166,300 refugees in the DRC by the end of the year 2010, from which estimated 59,000 came from Rwanda and were situated in the Kivus.

Life as a refugee is really tough as in the camps there is usually limited supply of water, food, drugs, sanitation facilities – practically, these people lack almost all what is needed for healthy and active life.

Moreover, in the eastern part of the country, contrary to the relatively stable situation in the rest of the DRC, the conflict continues and particularly women refugees often face the sexual and gender-based violence (SGBV) and children are at risk that they will be recruited to the armed groups.

The UNHCR also estimates that at the end of the 2010 more than 1.7 million IDPs lived in the DRC. (UNHCR, 2011) Internally displaced persons are described as people who have either due to conflict or due to some natural disaster left their homes and fled searching for refuge within the country's territory. (MSF, 2009)

3.4 Targeting the food insecurity in the DRC

Let us begin with the already mentioned project of the UN, the Millennium Development Goals (MDGs), which covers wide range of nations, including the DRC.

3.4.1 The Millennium Development Goals (MDGs)

In September 2000, the UN Millennium Declaration was adopted on the largest meeting of world leaders, the Millennium Summit. In this Declaration, the leaders agreed upon higher cooperation of the nations in order to fight and to lower world extreme poverty through eight time-bound and quantitatively measurable targets. The time limit for reaching the set objectives is the year 2015 and the progress towards reaching these objectives is continuously monitored. The programme is addressing many dimensions of poverty, from the fundamental deprivations, such as hunger, health, and shelter, to equal rights, environmental sustainability and many more. (UN Millennium Project, 2006a)

Well, the hunger, being the main topic of this thesis, is also due to its importance ranked on the first place of the selected goals, together with poverty, as these two issues are very closely related.

Precisely, the intention of the first MDG is to halve the prevalence of hungry people in the period between 1990 and 2015 and the selected indicators for measuring the level of progress are:

a. prevalence of underweight children under five years of age, and
b. proportion of population below minimum level of dietary energy consumption.

The sources of data for the indicators of measurement are UNICEF with WHO and FAO respectively. (UN Millennium Project, 2006b)

Unfortunately, the progress towards achieving the set goals is not uniform across all countries included in the programme. In the Figure 6 the different situation regarding the progress is clearly visible.

Figure 6 Progress towards MDG 1: Hunger target (1990-92 to 2005-07)
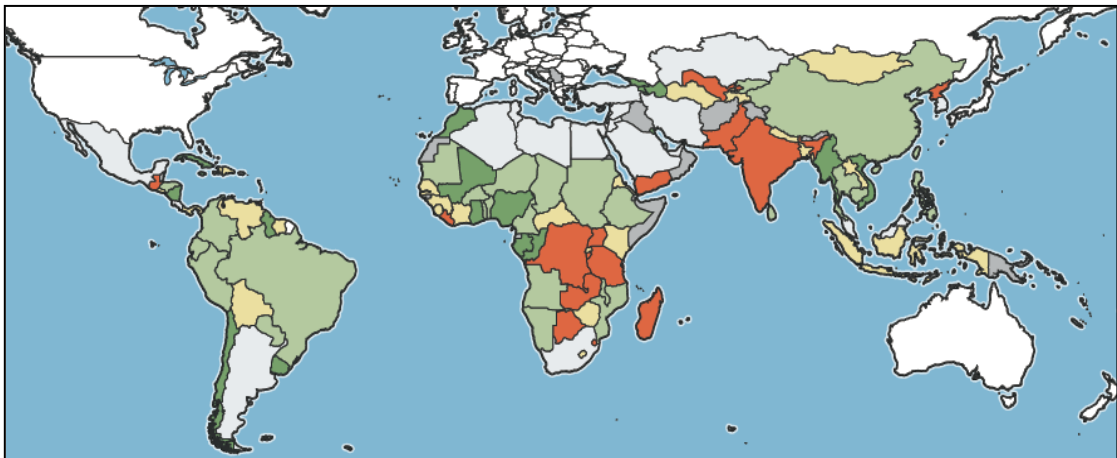
Source: FAO, 2010a

Progress achieved (1990-92 to 2005-07)

🟩	Already met MDG 1 or very close to meeting the target
🟢	Progress sufficient to reach MDG 1 if prevailing trends persist
🟨	Progress insufficient to reach MDG 1 if prevailing trends persist
🟥	No progress or deterioration
⬜	Not relevant - prevalence of hunger was below 5% in 1990
◻	Missing or insufficient data

What is also clearly visible from the Figure 6 is the fact that the DRC ranks among the countries, the progress of which is either negligible or their situation has even worsened in terms of the prevalence of hunger in the studied period. The WHO statistical data on DRC show that there has been slight improvement in the number of under-5

underweight children when comparing 30.7% in the year 1995 with the latest data from 2007, when the figure was 28.2%. With bad nutrition and insufficient food intake the improper body development is connected. The WHO states the percentage of stunted children aged under-5 in DRC as 45.8% in the year 2007. (WHO, 2011) According to FAO report from the 2007, the prevalence of undernourished people in the DRC tripled from the 12 million in the base year 1990 to 36 million in 2006, making 72% of the population undernourished. FAO identifies the main reasons for such deterioration in natural disasters, conflicts of 1990s and continuous spreading of HIV/AIDS. (FAO, 2007)

It is needed to say that the pace of improvement in the question of food insecurity has decelerated all over the world mainly due to the high food prices and the world economic recession in the period from 2006 to 2009, hence lowering the chances of successful achievement of halving the number of hungry people in the world by 2015. Even though the world's economy recovers and food prices are getting lower, the total number of hungry people is still higher than it was before the year 2006. (FAO, 2010c) More precisely, in years 1990-92 there were estimated 817 million undernourished people comparing to 830 million in 2005-07. After the food prices reached its peak in the year 2008, the estimated 915 million were left undernourished according to FAO. (UN, 2010) Further development resulted in 925 million undernourished people worldwide in 2010 as it has been already mentioned at the beginning of the Literature Review chapter of this thesis.

The goals and targets are set but how does the programme operate in practice? In the Declaration, the developing countries pledged to make their policies better and improve the governance of their countries. On the other hand, developed countries agreed to provide the needed resources.

This implies rather macroeconomic strategy, solving the problem top-down, beginning from the central governments. The international cooperation, covering also the support of major financial institutions, such as WB and International Monetary Fund (IMF), and even the World Trade Organization (WTO), which ensures fair international trade, seems as a right way for achievement of what was set. (End Poverty 2015, 2003)

3.4.2 World Food Programme (WFP) of the UN

WFP targets the food insecurity rather on a smaller scale, precisely, it focuses on the smaller target groups. While MDGs have global development aims, WFP conducts projects operating in case of emergencies and humanitarian crises (Emergency Operations (EMOPs). However, it has also certain development projects (Development Operations (DEVs) and so called Special Operations (SOs), which through the constructing a building of infrastructure enhance the food supplies delivery. The last and, according to the WFP's operations that are or were held in the DRC, also very frequent type of WFP projects in this country are Protracted Relief and Recovery Operations (PRROs). All of the operations types do not cover the whole population of the country but intervene in the locations, where the help is needed at most.

PRROs are implemented in the regions, where either some disaster occurred or there has been a conflict that resulted in destroyed fields, lost yields and overall increase in food insecurity in certain community. These operations intend to re-establish livelihoods of the farmers and hence improve and make the situation regarding food security stable. PRROs are usually implemented when it is already clear that certain EMOP cannot reach the set objectives in the time limit (usually 24 months). In the PRRO, the WFP can implement one or more following approaches how to achieve improvement in the question of food insecurity.

First possible component of the programme is *Food for education and training*. This and also the other approaches enable to target more problems at once, as people who participate in the education process or visit some training in order to gain new skills, for example women, obtain food that is rich in nutrients there. This implies that people are more motivated to participate in such trainings or to send children to school, because as parents they can be assured that the child gets sometimes even more food than it would if stayed home helping on the field.

Some of the PRROs implement so called *Food for recovery* strategy, in which people who participate in rebuilding or fixing the damaged infrastructure or buildings, but are also replanting the ruined fields, obtain food in exchange for their work. (WFP, 2012)

Extended relief and *Relief for refugees* focus mainly on the refugees and other vulnerable groups of people. Specifically, Relief for refugees provides assistance exclusively to these people in their host countries where they cannot, from any reasons, be self-sufficient. According to WFP, majority of the food supplies in the camps origin from this very agency. Extended relief focuses, besides the refugees, also on IDPs and undernourished or from other reasons vulnerable households. (WFP, 2012)

3.4.2.1 *Targeted Food Aid for Victims of Armed Conflict and other Vulnerable Groups (PRRO in the Democratic Republic of the Congo)*

This particular project was launched in July 2007 and lasted for 30 months till December 2009. According to the approved Operation Document, over the implementation period, the WFP expected to help almost 3.4 million beneficiaries, among which we could find IDPs, returned IDPs, returned refugees, malnourished people, other vulnerable people, children benefiting from school feeding, demobilized children and other groups suitable for such help.

The total food cost approved in the document counted 71,830,601 USD for 210,084 million tonnes of food and the total cost amount, which was expected to WFP, was 230,874,212 USD.

The operation targeted the localities, where the consequences of long-lasting conflicts were the worst and also the areas, which were hit by the impacts of the financial crisis the most. To be specific, help was provided in the eastern and Equator regions where the population heavily suffered from the conflict-related poverty and malnutrition and in the western part of the country where the mining industry was seriously hit by the economic crisis, leaving the population unemployed and malnourished.

The operation also supported local agriculture through the promotion of local purchasing that at the same time reduced transportation costs. (WFP, 2007)

3.4.3 The Heavily Indebted Poor Countries Initiative (HIPCs Initiative)

The Initiative is the joint project of the IMF and the WB that aims at reducing the external debt of the developing countries, which were not able over the past decades

enhance their economic growth in the manner that would bode positively for future debt repayment. The HIPCs Initiative was launched in 1996 and after the Millennium Summit in 2000 its main mission is to accelerate the ability of developing countries to fight extreme poverty through lowering or complete relief from external debts. Due to the relief, the countries in question have extra monetary resources to be spent in sectors through which they fight the poverty.

One of the conditions that must HIPCs fulfil in order to reach the Initiative's assistance is the development of the Poverty Reduction Strategy Paper (PRSP) and its adoption and implementation in the country for at least one year.

Even though the DRC belongs among the poorest countries, it is one of the 32 countries (by December 2011) which have already fulfilled all of the conditions to obtain the assistance, thereby the debt relief. (IMF, 2011) In July 2003 the authorities of the Initiative agreed that the DRC satisfied all of the necessary conditions and is convenient candidate for obtaining the assistance. The originally determined total amount of the debt relief was 6,311 million USD and this was later adjusted to 7,252 million USD, which accounted for 82.4% from the total external debt of the DRC.

The DRC satisfactorily implemented all of the needed requirements, such as implementation of the PRSP, sufficient pro-poor spending, it improved the government expenditures and public debt management and many others. (IMF, 2010) As the Initiative's requirements are targeting policies and macroeconomic performance of the countries in order to eradicate extreme poverty, due to the linkage of poverty and hunger, it fights acute malnutrition at the same time.

3.4.4 Food and Agricultural Organization (FAO) of the UN

The FAO rather provides the assistance and training to local farmers to increase their yields, hence increasing the overall agricultural production, and to be able to profit more from their crops.

In May 2009, FAO launched a two-year project as a response to the high prices of staple food, where the objective was to boost the agricultural production and to make it

easier for the farmers to access the market. FAO focused on "strengthening technical expertise in the production, storage, transformation and marketing of agricultural products, while improving the network of access roads to enable farmers to get their goods to the market," and also supported "capacity building activities among farmers' associations". (FAO, 2012b) Estimated 180,000 vulnerable people benefited from the activities of this project.

Besides this programme, FAO implemented the Technical Cooperation Programme (TCP), the projects of which are specially designed to reflect the food price crisis. One of the examples is the purchase of seeds and hand tools in the value of 500,000 USD distributed among farmers in 2008 in the time of planting season and the residual inputs distributed at the same time in 2009. (FAO, 2012b)

These were just examples of the programmes, projects and activities that are or were held on the DRC grounds. The scope of the thesis does not enable to go through all of the humanitarian and development initiatives fighting food security in the country. Nevertheless, we can say that the UN with its many organizations and programmes plays a crucial role in this fight.

The chapter 3.4 intended to illustrate and show that there is a lot being done to eradicate poverty and hunger at the same time but that, in spite of all of the intentions, it is not easy and fast process. Sometimes the internal conditions of the country negatively influence the progress towards achieving the development goals, so the fight must be complex, incorporating many spheres and stakeholders.

4. METHODOLOGY

The own research of this thesis was focused on the analysis of the relationships between the chosen dependent variable and other selected factors. This dependent variable was chosen in such manner that would express the issue of food insecurity most accurately. More precisely, as an indicator of the food insecurity the prevalence of undernourishment in the Congolese population was selected. This FAO indicator, expressing the number of people suffering from the insufficient daily calorie intake on the national level, is probably the most often used figure regarding the food insecurity. (OECD, 2012)

The selected independent variables were chosen based on the author's knowledge of interconnections of economic phenomena and as visible from the latter presented assumptions, which were set before the computation itself, also based on the potential influence that these variables might logically have on the state of prevalence of undernourishment. Concrete indicators selected as explanatory variables are named below.

The total number of seven explanatory variables was chosen and these are: total population of the DRC, total production of cassava in the DRC in tonnes, the quantity of imported wheat also expressed in tonnes, the adult literacy rate that covers population in the age of fifteen and above, the total number of refugees in the DRC territory, net exports of the country and finally, the GDP growth expressed as an annual percentage change.

4.1 Preliminary economic assumptions of the model

It is assumed that the higher the number of total population in the country, the higher the number of undernourished people, when all other variables are in ceteris paribus, meaning all other variables staying constant.

On the other hand, the increase in the cassava production, where cassava flour is the staple food in the DRC (FAO, 2010d), is expected to have a positive impact, or decrease, on the number of undernourished people.

The similar situation applies to the imported quantity of wheat. According to FAO (2010d), among the main components of the diet of Congolese people also belongs wheat, which is produced in the DRC only in the negligible amount compared to the demand, and therefore the quantity of imports is considered in the model. The change that is caused in the variation of dependent variable by an increase in the quantity imported is assumed to be similar as it was in the case of cassava production.

An increase in the proportion of the literate population of the DRC is also assumed to decrease the prevalence of undernourishment, rather indirectly, as with the higher education people have better opportunity to get higher-paid job and hence the food is more affordable for them.

The opposite impact is assumed with the increase in the number of refugees in the country. Considering the desperate conditions these people live in, the more people in such conditions live in the country, the higher is the prevalence of undernourishment expected to be.

The positive value of net exports indicates higher receipts from selling goods abroad than the costs of purchasing the foreign goods. The higher the income from international trade, the more money to be spent on developing purposes in the domestic economy, hence there is an expected decrease in the number of undernourished people.

The development of the GDP shows the economic performance of the country. The positive annual percentage change in the GDP growth indicates expanding economy that is assumed to result in betterment of population's well-being, covering also food security situation.

4.2 Sources of data and information

For purposes of the theoretical background regarding the topic of the thesis, the secondary sources of information were utilized.

The issue of food insecurity is most comprehensively described and analysed by the UN and other organisations and programmes that are under the UN system, such as FAO, WHO, WFP, UNICEF, UNDP, and many others, which were also principally used in the

collection of information. Besides these sources, the sources such as IMF and WB were used mainly for purpose of topics connected with the economy and economic figures.

For the collection of quantitative secondary data for computation, the statistical databases of some of the above mentioned sources were also predominantly used.

More precisely, the data for the prevalence of undernourishment were collected from the FAO series, *The State of Food Insecurity in the World*, which is published annually in order to track the progress of the individual countries towards achievement of the first MDG.

For the rest of the data, the statistical databases of the World Bank, the Food and Agricultural Organisation (FAOSTAT), the United Nations Development Programme's reports (*Human Development Reports)* presenting the annual performance of 187 countries in the ranking of Human Development Indices, and the United Nations High Commissioner for Refugees (the annual report series *The State of the World's Refugees)* were used.

These databases are not only the reliable source of the data, but also for most of the indicators the data are usually available for the whole time period that one is looking for and are also well accessible. Nevertheless, some complications regarding the statistical data collection are more examined in the latter chapter dedicated to limitations of methodology.

4.3 Model formulation

For analysis of the food insecurity phenomena in the particular conditions of the DRC, the applied correlational, explanatory research was utilized. The econometric analysis enables the researcher to reveal statistically significant relationships between the dependent and selected independent (explanatory) variables.

Economic model:

$y_i = f(x_1; x_2; x_3; x_4; x_5; x_6; x_7; x_8)$ or $y_{1t} = \gamma_1 x_{1t} + \gamma_2 x_{2t} + \gamma_3 x_{3t} + \gamma_4 x_{4t} + \gamma_5 x_{5t} + \gamma_6 x_{6t} + \gamma_7 x_{7t} + \gamma_8 x_{8t}$

(Equation 1)

Econometric model:

$$y_{1t} = \gamma_1 x_{1t} + \gamma_2 x_{2t} + \gamma_3 x_{3t} + \gamma_4 x_{4t} + \gamma_5 x_{5t} + \gamma_6 x_{6t} + \gamma_7 x_{7t} + \gamma_8 x_{8t} + u_{1t} \qquad \text{(Equation 2)}$$

The main characteristic of the economic model is that it is represented by deterministic relationship between the dependent and independent variables. The dependent variable is here exactly determined by the variables on the right-hand side of the equation. The econometric model is extended by the stochastic variable u_{1t}, which covers all unincorporated explanatory variables, so called error or disturbance term. It also covers the potential errors of data measurement or errors, which are connected with wrong functional form of the model. The econometric model is hence composed from the deterministic part and stochastic part.

The notation of indices serves for exact identification of the variable in the model. The notation "y" represents the dependent variable of the model, while "x" is used for the notation of independent variables. The notation "γ" (gamma) stands for the parameter of explanatory variables in the model and its index exactly identifies to which variable the parameter belongs. Each variable has its own indices in the model as well. Again, the number represents the order in which the variables occur in the model, in other words, it defines the variable, while the notation of index "t" represent time, when time-series data are utilized.

The variable y_{1t} is the dependent variable of the model, in this case, the prevalence of undernourishment (in millions). The first explanatory variable (x_{1t}) stands for the necessary constant of the model. The rest of the explanatory variables represent the total population (x_{2t}), cassava production (x_{3t}), wheat import quantity (x_{4t}), adult literacy rate (x_{5t}), total refugees in the DRC (x_{6t}), net exports (x_{7t}), and the GDP growth (x_{8t}). The variable u_{1t} is so called error term, which stands for all of the explanatory variables that are not included in the model.

The input data for the computation are annual panel data in the time period from 2000 to 2010. The base year of the reference time period was set from the main reason that since this year, the MDGs initiative is in force and hence the variation in studied data

might be more significant than in the previous decade. Moreover, the selected time period covers years of the food price crisis and also the financial crisis, the impact of which might also play its role in the results of the study.

4.4 Analysis of data

For the quantitative analysis of the econometric model, more precisely, for the estimation of the unknown parameters (γ_{1-8}) of explanatory variables, the multiple regression analysis, which uses the method of ordinary least squares (OLS), was utilized.

The computation was conducted through statistical computer software Gretl, which provides very convenient and reliable way of parameters estimation. This software was used not only for the entire procedure of the parameters estimation, but also for the testing of their statistical significance and measuring of the strength of the relationships among variables, covering the testing of econometric assumptions.

4.5 Limitations of methodology

4.5.1 Availability of data

Although the availability of the data for selected indicators was really good, the problem with the missing values occurred during the data collection. Computation of the missing values was essential for the analytical procedure; therefore the missing figures were calculated in the computer software MS Excel using the trend function, the type of which was selected for each of the indicators, where some values were missing, individually, based on the coefficient of determination value (the higher, the better).

Another limitation of the data collection was the unavailability of certain indicators, which might also play crucial role in the variation of prevalence of undernourishment. Such indicator would be for example the domestic price of cassava or maize. It was impossible to find the figures for the domestic market both due to the unavailability of the data and also due to the large size of the country, where the prices vary significantly on the local level.

The last identified limitation of the data is the form, in which the FAO presents the statistics for the undernourishment prevalence. While all of the other utilized databases use annual data, FAO provides the figures for the 3-year periods. As the consequent time periods overlap, the final figure was always used for the middle year in the period (e.g. for the year 2006, the number from the time period 2005-07 was used). The limiting fact is that when even a small inaccuracy in data occurs, it will bias the result.

4.5.2 Limitation in model formulation

The possible limitation in the model for the analysis would be the simultaneous relationship of the dependent variable with some independent variables, meaning that they influence each other. Such obstacle will again bias the result. In the case of the model from this particular study, such relationship should be considered between the prevalence of undernourishment and the adult literacy rate (see Vicious Circle of Poverty).

During the model formulation it was also difficult to cover some potentially significant factors, which might importantly influence the prevalence of undernourishment. Among these potentially influential indicators, rather unquantifiable, belongs certainly the variation of climatic conditions in the reference period, the consequences of long-lasting conflicts, which resulted not only in the desperate conditions of the people, but also in poor infrastructure, damaged fields, and other consequences, from which it would take long to recover due to the poor economy of the country. Other factors might be natural hazards, poor medical services, hence the health situation in the country and many other factors. Thanks to the complexity of the food insecurity issue and interconnection of various phenomena, the identification of all of the factors is nearly impossible and the further study would have to be conducted in order to identify them more comprehensively.

4.5.3 Limitation regarding the data type

Due to the fact that as an input for the computation, the secondary data were utilized, one has to question the methodology of collection and reliability of the data. According to study conducted by the team of Christopher J. Evans, PhD. on the impact of

the different data collection methods on accuracy of the results, it was concluded and proved that the method of collection has a significant overall impact on the validity of the results. (Evans, *et al.*, 2000)

Besides the possible limitation in the primary data collection methodology used in the UN system, one has to also think about the quality of the data provided by the governments of individual countries to these organisations, as not all of the data are primarily collected by them. The data provided by national statistical offices might be biased both due to the instability in the country, poor infrastructure, and other obstacles complicating the data collection and probably also due to the tendency of the countries to sometimes misrepresent the data.

5. RESULTS

This chapter presents the results of the study is such order, in which the individual steps of the computation were conducted. Beginning with the results of parameters estimation conducted through OLS method, continuing with the testing of their significance and ending with the verification of the econometric assumptions that must be fulfilled to obtain correct results.

5.1 Statistical verification

The results for the formulated linear econometric model are presented in the Table 1 below.

Table 1 OLS parameter estimation using observations 2000-2010 (own research)

	coefficient	std. error	t-ratio	p-value	
x1t	-57.6829	45.7709	-1.260	0.2967	
x2t	0.000976843	6.74784e-05	14.48	0.0007	***
x3t	-5.94369e-06	6.74784e-05	-4.683	0.0184	**
x4t	-8.73040e-09	2.21350e-06	-0.003944	0.9971	
x5t	1.86189	0.464368	4.010	0.0278	**
x6t	4.67942e-05	7.32170e-06	6.391	0.0078	***
x7t	-2.97562e-06	1.36942e-06	-2.173	0.1181	
x8t	-0.778975	0.0916670	-8.498	0.0034	***

In the first column "coefficient" we find the resulting figures of parameters for individual variables. If we substitute these numbers into the theoretical equation (see Model formulation chapter), the resulting equation for the prevalence of undernourishment will look like as it is shown below.

y_{1t} = -57.6829 x_{1t} + 0.000976843 x_{2t} - 5.94369e-06 x_{3t} - 8.73040e-09 x_{4t} + 1.86189 x_{5t} + + 4.67942e-05 x_{6t} - 2.97562e-06 x_{7t} - 0.778975 x_{8t} + u_{1t} (Equation 3)

However, after the testing for verification of statistical significance of fitted parameters was conducted (in this case through the P-value testing of hypothesis, using the level of significance 5%; α = 0.05), the resulting equation must be adjusted, as only the statistically significant parameters can be included.

In the Table 1, the statistically significant parameters at the given level of significance are visually highlighted with stars in the last column. The lower is the P-value, which is compared to the level of significance, the higher is the number of stars. The resulting equation after inclusion of only statistically significant parameters is shown below.

$$y_{1t} = -57.6829\ x_{1t} + 0.000976843\ x_{2t} - 5.94369e\text{-}06\ x_{3t} + 1.86189\ x_{5t} + 4.67942e\text{-}05\ x_{6t} - 0.778975\ x_{8t} + u_{1t} \qquad \text{(Equation 4)}$$

The obtained results show that in the selected period from year 2000 to 2010, the impact of the variation in quantity of wheat imported (x_{4t}) and the variation of net exports (x_{7t}) was not statistically significant, hence did not crucially influenced the variation in the prevalence of undernourishment in the DRC. Even though the parameter of constant did not show statistically significant relationship with the prevalence of undernourishment as well, this variable with its parameter must stay in the equation, as it is needed for eventual prediction computation based on this specific model.

The statistical software Gretl provides together with the results presented in Table 1 also further information on the estimated model. These results are presented in the Table 2 and more analysed below.

Table 2 Model verification (own research)

Mean dependent var.	39.72294	S.D. dependent var.	4.478546
Sum squared resid.	4.000275	S.E. of regression	1.154740
R-squared	0.980056	Adjusted R-squared	0.933519
F(7, 3)	1066.985	P-value(F)	0.000044
Log-likelihood	-10.04490	Akaike criterion	36.08979
Schwarz criterion	39.27296	Hannan-Quinn	34.08326
rho	-0.773778	Durbin-Watson	3.510512

For the further statistical verification of the model, the most important figure is R-squared, or also the coefficient of determination or the measure of goodness of fit. This percentage indicates how well is the dependent variable explained by the selected independent variables.

The resulting number shows that the variance of the prevalence of undernourishment is from 98% explained by the variance of selected explanatory variables. Looking at the Adjusted R-square result, which is adjusted to the number of explanatory variables in the model, also shows high value, meaning that the variance of endogenous variable is from 93.35% explained by the variance of the selected exogenous variables.

The P-value of Significance F statistic, also visible in the Table 2, is less than the 5% level of significance, meaning that the selected exogenous variables are explaining the variation in dependent variable and that the correlation among them is meaningful.

5.1.1 Statistically significant variables

The statistically significant parameters must be further analysed more in detail to obtain the precise measure of goodness of fit for each of them. Therefore the calculation of the partial coefficients of determination was conducted. Also the partial coefficients of correlation must be calculated in order to reveal the strength of the relationship between endogenous variable and individual significant parameters. The results of these computations are shown in Table 3.

Table 3 Partial coefficients for statistically significant variables (own research)

	Coeff. Of Deter.	Coeff. Of Corr.
x2t	0.843265	0.91829445
x3t	0.405995	-0.63717711
x5t	0.635114	0.79694055
x6t	0.581458	-0.76253385
x8t	0.450863	0.67146336

The absolute value of the coefficient of correlation occurs in the interval <0;1>. The higher the number is, the stronger the relationship between variables. The value in the interval <0;0.33> means weak dependence, in <0.33;0.66> means medium dependence and in the interval <0.67;1> it is strong dependence between variables.

The partial coefficients of determination, when multiplied by one hundred, show in percentage the proportion of variance of dependent variable that is explained by variance of each independent variable.

5.2 Econometric verification

After statistical verification, the researcher has to verify all of the econometric assumptions of the model. The results of verification of individual econometric assumptions for the particular model of this thesis are presented in this chapter.

5.2.1 Assumption 1: The mean of residuals is equal to zero

The econometric model estimated in this thesis violates this assumption, as according to the results, the mean equals -1.2919e-015. However, the parameters of individual explanatory variables will not be biased by this fact.

Another purpose of the constant in the econometric model is that in case the mean of residuals is different from zero, we subtract this number from the parameter of the constant, hence this only parameter in the equation will be biased, and add the same number to the error term, which will result in the mean of residuals to be equal to zero.

5.2.2 Assumption 2: Homoscedasticity assumption

According to the Breusch-Pagan test for heteroscedasticity results, the H_0 hypothesis, meaning homoscedasticity, cannot be rejected. The P-values are higher compared to the level of significance 5%. The rejection of the null hypothesis is possible only if the P-vale is lower than the level of significance. The precise results of the test are shown in the Table 4.

The fact that the model did not show the heteroscedasticity is probably caused due to the utilization of the robust errors, which are consistent to heteroscedasticity and autocorrelation of the model, for estimation of parameters.

Table 4 Breush-Pagan test for heteroscedasticity (own research)

```
OLS, using observations 2000-2010 (T = 11)
Dependent variable: scaled uhat^2

              coefficient    std. error    t-ratio   p-value
    ---------------------------------------------------------
    const       -41.0390        60.3430     -0.6801   0.5452
    x2t          -0.000202234    0.000116744  -1.732   0.1816
    x3t           1.00815e-06    2.41242e-06   0.4179   0.7041
    x4t          -6.69352e-06    3.19628e-06  -2.094   0.1273
    x5t           0.585294       0.518480      1.129    0.3411
    x6t           3.03824e-06    9.32677e-06   0.3258   0.7660
    x7t          -4.41205e-06    1.97485e-06  -2.234    0.1116
    x8t          -0.0302994      0.211236     -0.1434   0.8950

Explained sum of squares = 6.35481

Test statistic: LM = 3.177407,
with p-value = P(Chi-square(7) > 3.177407) = 0.868120
```

5.2.3   Assumption 3: Multicollinearity assumption

According to the correlation matrix that reveals high correlation coefficients between and among the exogenous variables, the formulated model violates the multicollinearity assumption. The correlation matrix is presented in the Table 5.

Table 5 Correlation Matrix (own research)

Correlation Coefficients, using observations 2000 - 2010								
5% critical value (two-tailed) = 0.6021 for n = 11								
y1t	x2t	x3t	x4t	x5t	x6t	x7t	x8t	
1	0.9183	-0.6372	0.7343	0.7969	-0.7625	-0.8265	0.6715	y1t
	1	-0.5328	0.6988	0.7875	**-0.9035**	**-0.8507**	0.6492	x2t
		1	-0.5228	**-0.8422**	0.5777	0.6198	**-0.9345**	x3t
			1	0.7179	-0.6639	-0.7612	0.6032	x4t
				1	**-0.8728**	**-0.8120**	**0.9066**	x5t
					1	**0.8131**	-0.6957	x6t
						1	-0.7572	x7t
							1	x8t

The high correlation between the explanatory variables is expressed by the absolute value of the correlation coefficient higher than 0.8. As visible from the Table 5, the coefficients, which have higher absolute value than the set condition, are highlighted in bold.

Despite the multicollinearity assumption is violated, the estimated parameters are still significant and from the statistical point of view can be used for the interpretation of the model.

5.2.4 Assumption 4: Autocorrelation

Testing for autocorrelation reveals that there is probably no correlation of residuals in the model. For the computation, the Durbin-Watson test for detection of autocorrelation of the first order was used. Again, the P-value of result of the test was compared to 5% level of significance, where null hypothesis (H_0) meant no autocorrelation of residuals and alternative hypothesis (H_A) implied the autocorrelation in the model. Precise results of the test are presented below.

Durbin-Watson statistic = 3.51051

P-value = 0.982705

As the P-value is higher that the level of significance 0.05, the null hypothesis cannot be rejected, this means that there is no autocorrelation of residuals of first order in the model. Again, since the robust errors for the parameters estimation were used, the autocorrelation was not proved. However, the relatively high figure of Durbin-Watson statistic would, on the other hand, indicate the negative correlation of residuals. (Bil, *et al.*, 2009) Only when the value of Durbin-Watson statistic is around two, it is assumed that there is probably no autocorrelation.

The possible reasons for autocorrelation are both misspecification of the model, meaning that some important variables are omitted, and errors of input data of the model.

6. DISCUSSION

In the following chapter, the outcomes of the study are presented and interpreted. The chapter also discusses the fulfilment of the set objectives, both general and specific, of the research.

The general objective to prove or disprove the hypothesis: "*The selected main factors (indicators) were influencing the prevalence of undernourishment in the Democratic Republic of the Congo in the reference period from 2000 to 2010,*" was partially achieved. From the resulting quantified Equation 4 it is clearly visible that not all of the selected variables shown the statistically significant relationship with the state of prevalence of undernourishment in the country and were therefore excluded from the equation. The insignificant variables are the quantity of wheat imported to the country (x_{4t}) and net exports of the country (x_{7t}).

The rest of the variables proved, through the statistical hypothesis testing of parameters, significant relationship with the dependent variable and that is why they were further analysed in order to calculate the precise degree of their influence. The statistically significant explanatory variables are: total population (x_{2t}), domestic cassava production (x_{3t}), the adult literacy rate (x_{5t}), number of refugees in the DRC (x_{6t}), and GDP growth (x_{8t}). In the Table 4, where the partial coefficients of determination and correlation are presented, we can see that the variance of the prevalence of undernourishment is from 84.32% explained by the variance of the total population of DRC. The variation of domestic cassava production explains only 40.59% of the variation in the dependent variable, the variation of literacy rate explains 63.51%, and the variations of total number of refugees in the country and GDP growth explain it from 58.14% and 45.08%, respectively. The partial coefficients of correlation of individual independent variables with the dependent variable, also presented in the Table 4, show either medium or strong dependence.

All of the above presented numbers and also the value of the coefficient of determination for the whole model 93.35% give evidence of the model being correctly formulated and of the right selection of the explanatory variables as the variation in prevalence of undernourishment is well explained by them.

For the specific objective to verify the economic assumptions, it is needed to compare the resulting quantified Equation 4 with the pre-set preliminary economic assumptions of the model (see Methodology chapter).

$$y_{1t} = -57.6829 \; x_{1t} + 0.000976843 \; x_{2t} - 5.94369\text{e-}06 \; x_{3t} + 1.86189 \; x_{5t} + 4.67942\text{e-}05 \; x_{6t} - 0.778975 \; x_{8t} + u_{1t}$$ (Equation 4)

The negative parameter of the constant of the model (denoted x_{1t}) is according to the economic theory nonsense – in case all of the other variables were zero, the prevalence of undernourishment can never reach negative value. As it was already said, despite the statistical insignificance of the constant and the fact that its value makes no sense, it must stay in the equation for the eventual calculation of prediction.

The positive value of the parameter of total population variable affirms the economic assumption that with the higher population in the country, also the prevalence of undernourishment rises if all other variables are in ceteris paribus. The exact interpretation of the relationship is when all other variables are zero and total population increases by one thousand inhabitants, the prevalence of undernourishment increases by 0.000976843 - the parameter of x_{2t}. The situation with the rising population might be solved through the higher awareness of the contraception and other ways of natality control. As the prevalence of undernourishment and the total population variables are highly correlated and strongly dependent, the solution of this problem should be of the highest priority of the policy makers.

For the statistically significant variable cassava production, the economic assumption is also valid. It was assumed that with the increased production of cassava in the country, being the staple food of the inhabitants, the prevalence of undernourishment decreases. The result of the computation shows that when the

production of cassava increases by one tonne, the prevalence of undernourishment decreases by the parameter of x_{3t} variable. In order to significantly decrease the prevalence of undernourishment in the country, local government should also focus on the enhancement of the agricultural production. The agricultural production can be increased through enlargement of the agricultural land, introduction of new technologies or through training of farmers to gain new skills and experience and to be able to resist to unpredictable, for example climatic, events. However, the emphasis should also be put on the differentiation of the production because in case of the uniform production there is serious threat of losing all the production when some pest appears. Stephen Devereux in his article confirms the dependence of the agricultural production with the state of food insecurity in the country stating that "poor harvests threaten food security and livelihoods from household to national level, to varying degrees according to the extent that the family or nation depends on agriculture for its food and income." (Devereux, 2007) Precisely, the GDP of DRC is from 37.5% composed from revenues coming from agriculture, which is relatively high dependence. (CIA, 2012)

The result of the computation for the adult literacy rate variable is rather startling. The assumption was based on the Vicious circle of poverty, where it is assumed that the higher is the education, the higher the income, hence better access to food. The result shows that when the adult literacy rate (age 15 and above) rises by one percent, the prevalence of undernourishment also rises by the parameter of the adult literacy rate variable. The disconcordance of the result and the assumption might be caused due to various reasons coming from the specificity of environment of the particular country, from which the data origin. The possible reasons might be the level of unemployment in the DRC, where there are no suitable jobs offered to people, or the job opportunities are unequally distributed across the country. Another reason might be the health situation, where people who are literate but sick cannot go to work. This is of course not a finite number of potential reasons for this relationship but the further research would be needed to identify all of them. On the other hand, in the study of team of Edward Frongillo, which was focused on the impact of various factors on prevalence of stunting of children, the literacy rate of women has shown negative relationship with the prevalence

of the stunting among children, meaning when the proportion of literate women was higher, the stunting of children was decreasing. (Frongillo, *et al.*, 1997) As the stunting is one of the consequences of undernourishment, from this study implies, that the literacy rate has, maybe only indirect, impact on the prevalence of undernourishment.

The positive parameter of the total refugees in the DRC variable indicates that when the number of refugees in the territory increases by one, the prevalence of undernourishment increases by the parameter of this variable. This result also affirms the pre-set assumption that with the higher number of people living in the desperate conditions, also the prevalence of undernourishment increases. Therefore the government should focus on the refugees and either try to solve their situation locally or encourage them to return to their countries of origin. The government of the country does not have to solve the situation on its own as there are agencies, for example UNHCR, which focus entirely on the protection and assistance of the refugees, help them recover and safely return to their home countries or restart their lives in the country of asylum. (UNHCR, 2012)

The last statistically significant variable is the GDP growth. The result corresponds with the economic assumption that with the rise in GDP, which was in the model expressed as a percentage change, there is a decrease in the number of people who suffer from undernourishment. Hence, the precise interpretation of the resulting equation is, when the GDP growth variable increases by one percent annually, in that year the prevalence of undernourishment decreases by *0.778975*, all other variables being constant. This negative relationship is also mentioned in the article of Peter Timmer, where he states that "food security and economic growth interact in a mutually reinforcing process." (Timmer, 2005) He also adds that the innovations, be it technical or institutional, are the basis of the economic growth in modern times and without them the progress towards achieving the food security would be impossible.

Regarding the econometric assumptions, the results of which are presented in the previous chapter, the objective of their verification was achieved. Through the hypothesis testing, the assumptions of homoscedasticity, autocorrelation and multicollinearity were verified. Also the assumption that the mean of residuals is equal to zero was tested.

The results show that there is no heteroscedasticity and autocorrelation in the model. Both results were achieved through tests in the Gretl software, the Breusch-Pagan test for heteroscedasticity and Durbin-Watson test for autocorrelation. Both tests proved according to the hypothesis testing of P-value with the level of significance 5% that there is no heteroscedasticity and autocorrelation present in the model. Moreover, the robust errors were utilized in the computation, so even if these assumptions were violated, the parameter estimates would stay significant.

The multicollinearity assumption was tested through the correlation matrix, which shows partial coefficients of correlation between all of the variables in the model. As visible in the Table 5, the assumption is violated, as there should be no correlation of exogenous variables in the model (meaning that the figure should not exceed the 0.8 value). The consequence of the multicollinearity is the estimation of parameters with high standard errors. One of the possible solutions of multicollinearity is its ignorance with the parameters being still significant from the statistical point of view. But it is needed to say that the estimated parameters are biased as one econometric assumption was violated.

The last econometric assumption tested was the normality of residuals, which means that the mean of residuals is equal to zero. From the results of Gretl it is visible that also this assumption was violated, nevertheless it was also solved by the author. The avoidance of bias of the estimated parameters by this result was ensured through subtraction of the value of the mean from the parameter of constant and addition of the same number to the error term (making its mean to be zero).

The estimated parameters using OLS method are not best, linear and unbiased estimates as the multicollinearity assumption was violated. Despite the bias, the estimates may be used for the model interpretation.

The objective to identify the missing variables in the model was partially achieved. All of the missing variables are covered in the error term and the aim was to identify them. Both in the Literature Review chapter and in the Methodology chapter, precisely in the sub-chapter Limitations of Methodology, some of the potentially influencing factors were identified. Even though the level, to which the prevalence of undernourishment was explained in the model, was very high (adjusted R-Squared equals 93.35%), there is still space for better explanation, hence addition of some meaningful variables into the model.

In the Literature Review chapter many of the possible influencing factors of prevalence of undernourishment were identified. Due to the complexity of the issue and interconnections of various factors, many of them might have either direct or indirect impact on the state of undernourishment in the particular country. Beginning with the principal definition of food security used in this thesis, the possible influencing factor would be the food access covering not only the sufficient monetary resources to obtain food, but also the equal distribution of food across country. The indicator for food access would therefore be the income of inhabitants or the proportion of people living in extreme poverty or below national poverty line, the GINI coefficient for income or other economic measures. The equality of food distribution is hard to measure but might also play its important role in prevalence of undernourishment.

Another dimension of food security is the food use, which is based on the knowledge of people about basic nutrition. Therefore another variable would be the awareness of inhabitants about the contents of food and vital nutrients needed for proper growth. To obtain such information, the statistical survey using representative sample would have to be conducted in order to obtain primary data. Among other factors belongs access to improved water sources and proper sanitation facilities.

The prevalence of undernourishment might be also dependent upon the availability of arable land, climatic conditions, and natural threats. Therefore another explanatory variable would be for example the agricultural growth. Health situation in the country might also play its significant role. That is why other possible explanatory variables may

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be the prevalence of cholera or other diarrhoeal infections, HIV/AIDS, malaria, or tuberculosis. The rather macro-economic indicator of health situation in the country would be the government expenditures on health per inhabitant.

The political and historical conditions of particular country are usually reflected in the indicators mentioned above. Regarding the Democratic Republic of the Congo, the historical background provided in the Literature Review chapter shows that the history of DRC is full of violence and as many people were dying during the conflicts not only in the fight, but mainly from the severe starvation and illnesses connected with the war, the consequences to the present are obvious. One of the indicators of consequences of international conflicts in the Central Africa was used in the model – total refugees in the DRC – which not only represented the causes of war but also the burden for DRC economy. There are only few, if any, quantifiable variables, which would represent the factors of political instability and conflicts.

Another factor influencing the prevalence of undernourishment might be the system of governance of the country. The dictatorship may intend to leave people in hunger and poverty, because vulnerable people are more easily manipulated. Hence it might be assumed that autocracy regimes do not enhance the economic growth. In the study of the team of Adam Przeworski, this conclusion is challenged and through the study proved that there is no difference in the overall economic growth under the dictatorship and democracy ruling. (Przeworski, *et al.*, 1993) The reference period of the study covers only the times of democracy, but it is needed to say that the democracy in the country was at its beginning in the year 2000 and even till nowadays it is not the democracy we know from the western countries. Therefore the impact of the political chaos in the country should be considered as an influencing factor.

As it was stated, the objective of identification of missing variables in the model was only partially achieved due to the complexity of the issue. Without any sophisticated research it is nearly impossible to identify all of the missing variables. At least some of the factors and indicators were identified, but again, their statistical significance would have to be proven through another analysis of the newly formulated model.

The last specific objective to be discussed (mentioned first in the Objectives chapter) was left at the end purposefully. Even from the discussion of the fulfilment of the objective to identify main omitted variables of the model it is visible that the objective to comprehensively describe the particular conditions of the DRC regarding food security was achieved.

The Literature Review not only provides overall information on the food security phenomena and its dimensions but also focuses on the concrete conditions that are taking place in the DRC, covering the fields of demography, where health situation, education and state of food insecurity and poverty in the country are described, geography, which brings closer the climatic conditions and natural hazards that are connected to these conditions, and history, from which many of the present country characteristics proceed.

The last sub-chapter of Literature Review focuses on the main projects and incentives that are taking place in the country. As the issue of food security is studied on the national level in the thesis, also some of the projects that target hunger in the DRC from the macro level were chosen and described; these are the MDGs and HIPCs Initiative. The described WFP and FAO projects target the issue rather on the smaller scale due to the more specific focus and nature of the projects.

After reading the Literature Review, the reader obtains comprehensive picture about the studied issue and through the information provided more understands the situation and conditions that are taking place in the Democratic Republic of the Congo, hence the objective was fulfilled.

7. CONSLUSION

This thesis was focused on the issue of food security, in the context of the thesis rather food insecurity, in the particular conditions of the selected Central African country, the Democratic Republic of the Congo. The country of the study was selected from the main reason that it is considered to be the least developed country according to the HDI in the world and that its pace to food insecurity alleviation has been rather stagnating over the last decades. The history of the country is full of violence, disorders and political chaos, which have also contributed to the present alarming conditions that are taking place in this country, encompassing all the socio-economic factors of inhabitants, poor economy and other spheres.

The study intended to reveal the triggers and causes of such an alarming food security situation in this country (for the description of the situation see Literature Review chapter). Through the quantitative analysis of the formulated econometric model, the significant relationship with the prevalence of undernourishment was found and proved by the variation in the total Congolese population, domestic cassava production, adult literacy rate, total refugees in the DRC, and annual GDP growth.

From the further analysis of the statistically significant variables implies that the strongest relationship and the highest degree to which the variance of prevalence of undernourishment is explained, has the variable x_{2t} – total population, the increase of which negatively influences (increases) the prevalence of undernourishment in the country. Hence, the population growth should be the issue of greatest interest for the Congolese policy makers. Through the regulation of the population growth, the government ensures that the national DES and MDER get closer to their equilibrium. The DES increases with the decrease in the total population number, all other factors being constant. MDER either stays the same or adjusts slightly, but not to the number of population but rather to the composition and demographic characteristics of the population. However, as the DES figure does not show what is actually consumed by individuals, the equal distribution of food over the country is also essential.

The variable of domestic cassava production has according to the results not so high explanatory value and there is only the medium dependency between it and prevalence of undernourishment, but their relationship shows that with the increase of domestic food production, the number of undernourished people decreases. Therefore, the policy makers should not only focus on the regulation of population growth, but should at the same time enhance agricultural growth to be able to feed the entire population.

The result for the literacy rate variable was rather unexpected. Its positive relationship (when literacy rate increases, also prevalence of undernourishment increases) violates the economic assumption of the model, which was based on the WB's Vicious Circle of Poverty. However, despite its economic inconsistency, the literacy rate variable has shown the statistical significance. Hence to better understand and find the reasons for such result to be able to solve it, further research would be needed.

The variable of total refugees in the territory of the DRC proved the statistically significant relationship with the prevalence of undernourishment with the coefficient of correlation indicating strong dependence of prevalence of undernourishment upon this independent variable. As it was expected, with the increase in the number of refugees in the territory of DRC, also the prevalence of undernourishment in this country increases. There are already actions being undertaken from the UNHCR to help and solve the situation of refugees, which should the Congolese government support and assist in order to alleviate the food insecurity in the country. The primary solution is to help these people to get back to their home countries. If this is not possible, government should try to solve their situation locally in such manner that these people would be able to participate in the economy. With the boost of the economy, the overall conditions in the country improve. This is connected with the last result for the variable of annual GDP growth. It is assumed that when there is an increase in the annual GDP growth, it indicates expanding economy. In the expanding economy there are higher receipts from taxes, which might then serve for provision of various social securities. The expansion of economy is highly dependent on the private sector. The result regarding this variable is consistent with the pre-set assumption and the government of DRC should therefore

support local private sector and at the same time find its economic comparative advantage and utilize it as much as it can. Moreover, the DRC possesses enormous reserves of natural resources, which, when utilized responsibly, might bring the wealth into the country through export revenues ("it can produce 80 per cent of the world's industrial diamonds, plus tin, copper and cobalt" (Kabemba, 2001).

For someone, the major limitation of the study might be that it was conducted based on the secondary data and on the national level. It is presumable that if the research was conducted based on the primary data of the particular province of a country, the results would be completely different or at least would better reflect the specific conditions of that part of the country. Nevertheless, the methodology utilized in this particular study may be used in the exactly same way. The usage of primary data would moreover eliminate many limitations that were addressed in the Methodology chapter. However, such study would demand large monetary, time, labour, and other inputs.

Although the prevalence of undernourishment in the DRC was well explained by the formulated econometric model on the national level, there is still space for improvement of the model through inclusion of more potentially influencing factors and testing of their significance. In the thesis, some of such factors were identified, but again, without any sophisticated research and analysis of their indicators, we cannon state that the mentioned indicators are actually those, which are missing in the model.

In conclusion it is needed to state that the Democratic Republic of the Congo is the country with great economic potential, which can be utilized only if it has economically active population, which is able to participate in the economy. For such performance, it must be population, which is healthy and has satisfied all its fundamental needs for living. Moreover, the central tendency of age distribution in the country is very low; hence there are many people, who could work, if they were all healthy. This study reveals spheres, on which should the government focus in its fight with the food insecurity. The prevalence of undernourishment is just one indicator of this very complex issue; therefore the policies should address more problems simultaneously in order to succeed in its effort of food insecurity eradication.

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9. APPENDIX

9.1 Computation of missing data

Graph and trend line for Prevalence of undernourishment (in millions) (2000 – 2010)
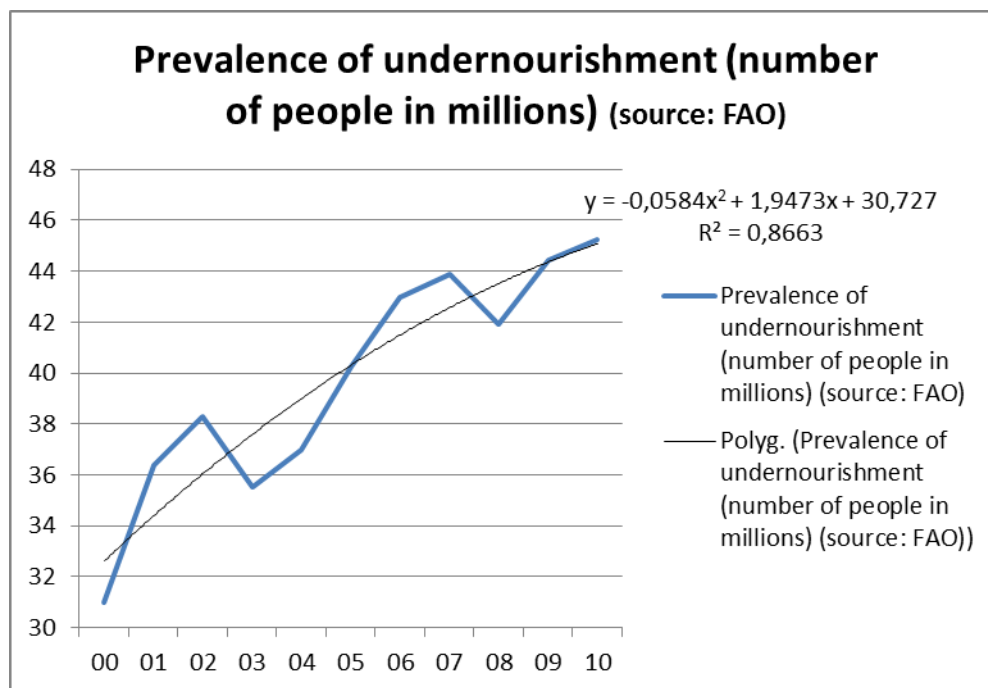

Table of figures of Prevalence of undernourishment (in millions) (2000 – 2010)
Source: FAO; shaded figures own computation

Year	Prevalence of undernourishment (in millions)
2000	31
2001	36,4
2002	38,3
2003	35,5
2004	37
2005	40,2444
2006	43
2007	43,9
2008	41,9
2009	44,456
2010	45,2519

Graph and trend line for Adult literacy rate (% age 15 and above) (1998 – 2010)

Adult literacy rate (% age 15 and above)
(source: UNDP)

$y = -0,1036x^2 + 2,124x + 56,449$
$R^2 = 0,9774$

Adult literacy rate (% age 15 and above) (source: UNDP)

Polyg. (Adult literacy rate (% age 15 and above) (source: UNDP))
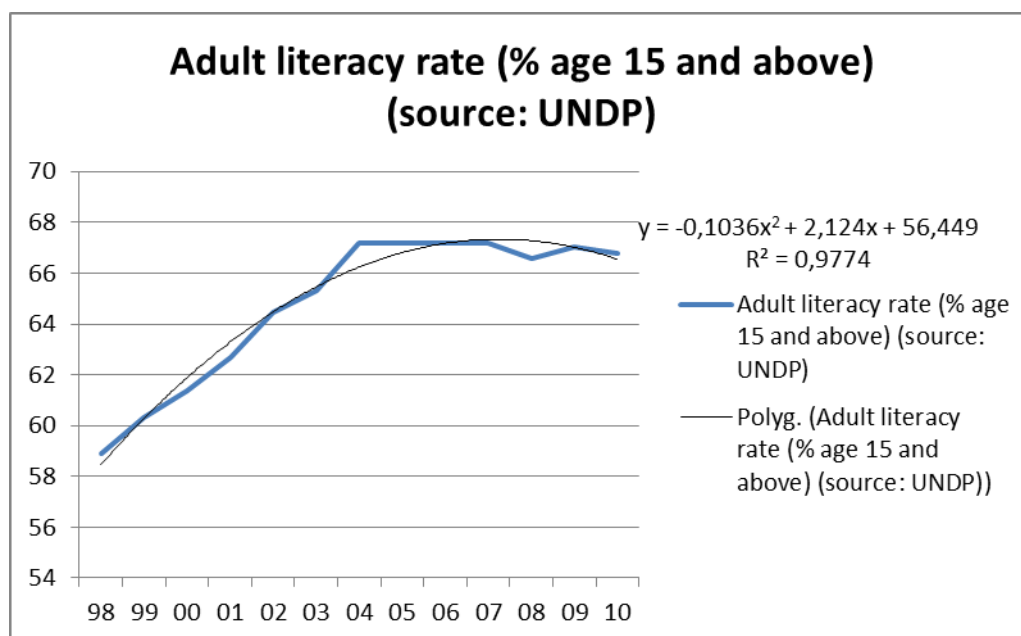
Table of figures of Adult literacy rate (% age 15 and above) (1998 – 2010)
Source: UNDP; shaded figures own computation

Year	Adult literacy rate (% age 15 and above)
1998	58,9
1999	60,3
2000	61,4
2001	62,7
2002	64,479
2003	65,3
2004	67,2
2005	67,2
2006	67,1734
2007	67,2
2008	66,6
2009	67,0186
2010	66,8

Note: The computation was based on the time-series from 1998 to have more observations, from which the missing values were calculated. However, in the model, only the period 2000 – 2010 was included.

Graph and trend line for Wheat import quantity (in tonnes) (2000 – 2010)

Wheat import quantity (tonnes) (source: FAOSTAT)

$y = 99392x^{0,5648}$
$R^2 = 0,7289$

— Wheat import quantity (tonnes) (source: FAOSTAT)

— Mocninný (Wheat import quantity (tonnes) (source: FAOSTAT))

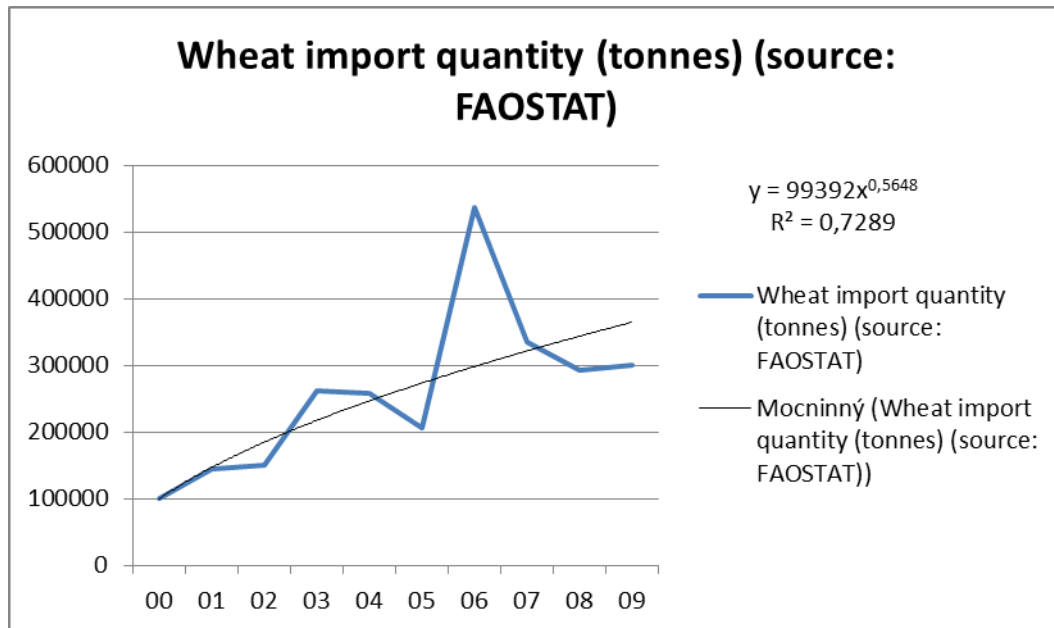Table of figures of Wheat import quantity (in tonnes) (2000 – 2010)
Source: FAOSTAT, shaded figures own computation

Year	Wheat import quantity (in tonnes)
2000	100000
2001	145000
2002	150000
2003	263000
2004	257765
2005	205469
2006	536286
2007	334663
2008	292317
2009	300000
2010	385061,4291

9.2   The data set of the econometric model

Year	Prevalence of undernourishment (in millions) y1t	Source: FAO	constant x1t	Total population (in thousands) x2t	Source: FAOSTAT	Cassava production (in tonnes) x3t	Source: FAOSTAT	Wheat import quantity (in tonnes) x4t	Source: FAOSTAT
2000	31		1	49626		15959000		100000	
2001	36,4		1	50989		15435700		145000	
2002	38,3		1	52491		14929600		150000	
2003	35,5		1	54098		14944600		263000	
2004	37		1	55755		14950500		257765	
2005	40,2444		1	57421		14974500		205469	
2006	43		1	59088		14989400		536286	
2007	43,9		1	60772		15004400		334663	
2008	41,9		1	62475		15013500		292317	
2009	44,456		1	64204		15034400		300000	
2010	45,2519		1	65966		15049500		385061,4291	

Year	Adult literacy rate (% age 15 and above) x5t	Source: UNDP	Total refugees in the DRC x6t	Source: UNHCR	Net exports (in thousand USD) x7t	Source: FAOSTAT [1]	GDP growth (annual %) x8t	Source: WB
2000	61,4		349700		216000		-6,90	
2001	62,7		366900		73000		-2,10	
2002	64,479		355900		-17000		3,50	
2003	65,3		237600		-156000		5,80	
2004	67,2		199323		-243000		6,60	
2005	67,2		204341		-198000		6,50	
2006	67,1734		208371		-468000		5,10	
2007	67,2		177390		-650000		6,30	
2008	66,6		155162		-700000		6,20	
2009	67,0186		111411		-300000		2,80	
2010	66,8		166336		-502482		7,20	

[1] *Data calculated from the Import value (in thousand USD) and Export value (in thousand USD), both accessed from FAOSTAT; Export – Import = Net export*