

**CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE**

**FACULTY OF ECONOMICS AND MANAGEMENT**

**DEPARTMENT OF ECONOMICS**



**BACHELOR THESIS**

**AGRICULTURE FEEDS THE WORLD:**

**A CASE OF CHINA AND ONE CHILD POLICY**

**DOMINIKA ŠTASTNÁ**

**© 2012 CULS**

**CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE**

Department of Economics  
Faculty of Economics and Management

# **BACHELOR THESIS ASSIGNMENT**

Šťastná Dominika

Agricultural Economics and Management

Thesis title

**Agriculture Feeds the World: A Case of China and One Child Policy**

---

## **Objectives of thesis**

Evaluate the effects of family planning program on food self-sufficiency in China, specifically to predict / forecast future development in Chinese agriculture provided expected population growth

## **Methodology**

Quantitative analysis (regression) of data (population, production function)

## **Schedule for processing**

2.2011 - 9.2011 - literature review

10.2011 - 3.2012 - bachelor thesis writeup

**The proposed extent of the thesis**

30 - 40 pages

**Keywords**

agriculture in China, population development in China, percentage ratio of working force in rural areas

**Recommended information sources**

Balabán, M., 2011, Transformace globální moci a vlivu: Politická, ekonomická a bezpečnostní dimenze, [online] [http://ceses.cuni.cz/CESES-65-version1-Transformace\\_globalni\\_moci\\_a\\_vlivu\\_Balaban.pdf](http://ceses.cuni.cz/CESES-65-version1-Transformace_globalni_moci_a_vlivu_Balaban.pdf) accessed 11. 1. 2012.

Beckwith, Ch., 2009, Empires of the Silk Road: A History of Central Eurasia from the Bronze Age to the Present, Princeton University Press, ISBN: 9781400829941.

Eberhard, W., 2004, A history of China, The Project Gutenberg EBook, ISO-8859-1.

Hook, L., 2010, Self-sufficient China watches on as wheat production falls, [online] <http://blogs.ft.com/beyond-brics/2010/08/13/self-sufficient-china-watches-on-as-wheat-production-falls/#axzz1nW4OMPap> accessed 23. 2. 2012.

Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, 2012, World Urbanization Prospects: The 2011 Revision Population database, [online] <http://esa.un.org/unpd/wup/unup/p2k0data.asp> accessed 27. 2. 2012.

**The Diploma Thesis Supervisor**

Procházka Petr, Ing., MSc, Ph.D.

**Last date for the submission**

březen 2012

**prof. Ing. Miroslav Svatoš, CSc.**  
Head of the Department



**prof. Ing. Jan Hron, DrSc., dr.h.c.**  
Dean

Prague February 28. 2012

STATUTORY DECLARATION

I, THE UNDERSIGNED, DECLARE THAT THE THESIS “AGRICULTURE FEEDS THE WORLD: A CASE OF CHINA AND ONE CHILD POLICY” IS WHOLLY MY OWN WORK, AND ONLY SOURCES I USED ARE LISTED IN THE REFERENCES.

In Prague, March 30<sup>th</sup>, 2012.

.....

Dominika Šťastná

## ACKNOWLEDGEMENT

I WOULD LIKE TO THANK MY SUPERVISOR ING. PETR PROCHÁZKA MSc. FOR PRECIOUS ADVICES AND HELP AND ALSO FOR OPPORTUNITY OF PRESENTING MY WORK ON THE STUDENT CONFERENCE IN WAGENINGEN.

AGRICULTURE FEEDS THE WORLD:  
A CASE OF CHINA AND ONE CHILD POLICY

---

ZEMĚDĚLSVÍ JAKO ZDROJ POTRAVIN:  
PŘÍPAD ČÍNY A POLITIKY JEDNOHO DÍTĚTE

SUMMARY:

The goal of this bachelor thesis is to introduce the family planning policies as necessity for insuring the food security in China. To investigate and verify the influence of such policies the quantitative methods were used.

This bachelor thesis is divided in to two parts. The first part is theoretical and introduces People's Republic of China in many aspects. This is followed by describing the natural conditions, agriculture production and population development. The explanation of the key terms, which were used, is also included in this part.

The practical part is focused on the quantitative research of food commodities demand and food commodities supply. By the regression analysis is done prediction and also comparison of the self-sufficiency of People's Republic of China with and without family planning policies.

SHRNUTÍ:

Cílem této bakalářské práce je představit rodinné politiky jako nutnost k zachování potravinové zabezpečení v Čínské lidové republice. Ke zjištění a ověření vlivu těchto politik bylo použito kvantitativních metod.

Bakalářská práce je rozdělena na dvě části. První část je teoretická a představuje Čínskou lidovou republiku v mnoha ohledech. Tato část je následována popsáním přírodních podmínek, zemědělské výroby a populačním vývojem. V této části je rovněž zahrnuto vysvětlení základních pojmů, které byly v práci použity.

Praktická část je zaměřena na kvantitativní výzkum nabídky a poptávky po potravních komoditách. Díky regresní analýze byla provedena predikce a také porovnání, jak je Čínská lidová republika soběstačná teď a jak by to vypadalo bez implikace rodinných politik.

KEYWORDS:

Agriculture in China, population development in China, percentage ratio of working force in rural areas

KLÍČOVÁ SLOVA:

Zemědělství v Číně, populační vývoj v Číně, procentuální podíl pracovníků v zemědělských oblastech

## CONTENT

1. Introduction.....	9
2. Thesis objectives and Methodology.....	10
2.1. Objectives.....	10
2.2. Methodology.....	10
3. Literature review.....	11
3.1. Introduction to People’s Republic of China.....	11
3.1.1. History of China.....	11
3.1.2. Policy and economics.....	13
3.1.3. Economic position of People’s Republic of China in the present world.....	13
3.2. Natural conditions.....	16
3.3. Agriculture in People’s Republic of China.....	17
3.3.1. Key factor: Labour.....	17
3.3.1.1. Allocation of labour in the market.....	18
3.3.1.2. Influence of Family-planning policies.....	19
3.3.2. Key factor: Water.....	20
3.3.2.1. Water quality.....	20
3.3.2.2. Water quantity.....	21
3.3.3. Key factor: Land.....	22
3.4. Family planning policies.....	23
4. Analysis of one child policy and its effects upon agriculture.....	24
4.1. The qualitative analysis of the influence of family planning policies on the development of People’s republic of China.....	25
4.2. The quantitative analysis of total demand for the food commodities, total food commodities supply, comparison.....	31
5. Conclusion.....	36
6. References.....	37



## 1. INTRODUCTION

There are four main global economic centres – North America (United States, Canada), EU, Japan and China. From the wider perspective it can be taken as transatlantic part and Asia-pacific part. These two circuits have the critical influence on global political, economic and security development. China became the second largest economy in the world, right behind US with the future perspective not to catch up US, but to overtake the leadership in the volume of gross domestic product per capita. (Balabán, 2011)

This thesis is focused on the Chinese economy, its agriculture, and the influence of family planning policy on the food security of China.

This thesis is focused on the agriculture production as on the main factor of self-sufficiency of People's Republic of China. As the self-sufficiency belongs to main objective of Chinese government, the Family planning policies were taken as a way to control the rapidly growing population. This step has automatically led to decreasing labour in agriculture.

This thesis deals with issue of the family planning policies, which are often being discussed and are very controversial. In order to find out whether they have positive or negative impacts the quantitative research was concluded. Various data were being processed and finally was found out that family planning policies contribute to increasing of gross domestic product per capita and decreasing of poverty and famine in China.

## 2. THESIS OBJECTIVES AND METHODOLOGY

### 2.1. OBJECTIVES

The purpose of this thesis is to evaluate the effects of family planning program on food self-sufficiency in China, specifically to predict/forecast future development in Chinese agriculture provided expected population growth.

Particular steps in objective fulfilment

- Investigation the dependency of agriculture production on various factors, such as land, labour, machinery and fertilizers
- Comparison of the total demand and total supply
- Prediction of the future development
- Comparison the situation with and without family planning policies

### 2.2.METHODOLOGY

In the practical part of this bachelor thesis has been analyzed the dependency of agriculture production on various factors. To identify and measure the relationship between them was used methods of quantitative analysis. This includes also the regression analysis. Qualitative analysis was used for the explanatory purposes, which were necessary in the analysis section.

#### 1. Multiple regression analysis

Quantitative approach was used for verification, whether thesis hypotheses were right and can be accepted or whether the hypotheses were wrong and have to be rejected. The agriculture production was in this case dependent variable and independent variables were labour, land, fertilizers and machinery. For this purpose the secondary data were used.

#### 2. Linear regression analysis

This regression model was used for prediction of future development. All variables, which were used as independent variables in the previous model were recalculated and then inserted in the new formula.

### 3. LITERATURE REVIEW

#### 3.1. INTRODUCTION OF PEOPLE'S REPUBLIC OF CHINA

People's republic of China is the fourth-largest country in the world, the only bigger states are Russia, Canada and United States. The area of People's republic of China is according to its statements 9,596,960 sq km. In this area is also includes Taiwan, which Chinese government considers to be a Chinese province. If Taiwan and the offshore islands are excluded, the area counts 9,444,292 km<sup>2</sup>. The mainland is 5,774km<sup>2</sup> extended. (Gongheguo, 2007)

China is located in the Easter Asia, and it is bordering with East China Sea, Korea Bay, South China Sea and the Yellow Sea on the west. The coastline measures 14,500km in total. (Gongheguo, 2007)

Between the neighbouring states belong Bhutan, Pakistan, Afghanistan, Burma, Kazakhstan, North Korea, India, Laos, Kyrgyzstan, Pakistan, Nepal, Russia, Tajikistan, Vietnam and Mongolia, which has the longest borders out of all – 4,677 km. The coastline measures 14,500km (Briney, 2011).

##### 3.1.1. HISTORY

China is one of the oldest civilizations in the world. The first notes are dated back to more than 10,000 years. The period from the earliest mentions up to 22<sup>nd</sup> century BC is called the Primitive age. From this century and later, China became unified and the time of dynasties was restored. First Chinese dynasty is called Xia Dynasty, and it is dated back to 1600 B.C. The originate region was near the provinces Henan and Shaanxi. This dynasty was replaced by Shang dynasty. Different dynasties ruled until the year 1911. Last dynasty was Qing Dynasty and it ruled during the years 1616 – 1911. (Culture China, 2010)

Modern history is dated from the year 1912, when the emperor was deposed, and the Republic of China was founded. As the head of revolution was Sun Yat-sen, and the power was held by militarist. The country was weakened and some parts disunited, such as Tibet.

Three civil wars have occurred in China during the 20<sup>th</sup> century. First one is dated 1924 – 1927 and the cause was fight against the militarist, in the head of the army with Chiang Kai-shek, who was a successor after Sun Yat-sen. Chiang Kai-shek represented the Nationalist Party, the Kuomintang(KMT) and the purposes were to unified the country again and take up the government into KMT hands. The opposition was made up by Communist party of China. The result was simple, KMT reached its goals, and the military tyranny was installed. (Eberhard, 2004)

Second civil war was during 1928 – 1936, and the combatants were communists as opposition against Kuomintang. In the South of China Mao Zedong reconstructed the rest of his unit and established the policy “army for people”. This has given the start to Red army. In 1934 they were rounded by the KMT and the famous so-call “Long March” began. The purpose was to get from Jiangki in the South to Shaanxi in the North. This journey was 8,000km long and started in October 1934 and lasted one year. During the Long March the communists reorganized under Mao Zedong, the new leader. Out of 90,000 people, who started this way in Jiangki, only 20,000 reached the goal to get in Shanxii. However, this action proved the ability of peasants to fight, when the proper techniques, arms and motivation are given to them. During this war, two million of people died (Scaruffi, 2009).

Third civil war is started right after the World War II.. The National party, which was supported by landowners year was in first years dominant. But the Chinese Communist party was ready for the waiting game and getting the people’s support. At last the CCP counterattacked the KMT and finally in January 1949 the communists headed by Mao Zedong achieved the victory. (Eberhard, 2004)

In 1949 the People’s Republic of China was established, in the head with Mao Zedong and the communists had finally the power in their hands. They occupied majority of country exclude Taiwan, where Chiang Kai-shek with his army moved. In 1955 the collective farming was introduced and commerce and industry were nationalized.

In May 1966 Mao started with so called Cultural Revolution, what has lead to massive terror. (Eberhard, 2004)

In 1976 Mao was replaced by Deng Xiaping and his economic reforms. He started with economic openness, economic reforms and de-collectivization. During his era the first Family planning policies were introduced. In 1989 became the head of the state Jiang

Zemin. In this time were also returned two very important colonies – Hong Kong and Macau. From the year 2002 is People’s Republic of China led by Hu Jintao. The political status of Taiwan is still not clear as well as discussible position of Tibet. (Beckwith, 2009)

### 3.1.2 POLICY AND ECONOMICS

Political and economic influence of People’s Republic of China on the rest of the world is already given by its area and population.

People’s Republic of China is an atomic power, but undersigned the contract not to use the nuclear power as a first and not to use it against non-atomic state. It is not a member of any military alliance and this is the reason of its asserting of independent foreign policy. It is a member of United Nations Security Council and belongs to group of five permanent members. Chinese influence on the creating of international background is continually more expressive. (Businessinfo, 2009)

As was already said before, since the year 1949 People’s Republic of China was established and the communist era has begun. The policy was very strict in the beginning but with the replacing Mao Zedong by Deng the policy was moderated. Deng Xiaoping’s strategy was to start up with the socialist market economy, which led to opening Chinese market to the world market. His followers continued this strategy and this is why the contemporary policy of People’s Republic of China is relatively opened. (Businessinfo, 2009)

### 3.1.2. ECONOMIC POSITION OF PEOPLE’S REPUBLIC OF CHINA IN THE PRESENT WORLD

People’s republic of China disposes of huge amounts of dollar reserves and concurrently it is the biggest lender of United States. In the year 2010 the dollar reserves were up to 2.85 trillion dollars and the volume of US bonds has overreached 1.2 trillion. Also the trade balance between these two countries is very interesting. The US exports to China were in

the volume of 81.8 billion dollars; on the other hand, the Chinese exports to US were in amount of 344.1 billion dollars. (Balabán, 2011).

US are highly dependent of Chinese financial support and it would have disastrous consequences, if the Chinese government would decide to stop lend money to US (Balabán, 2011).

Next very important factor is the annual percentage growth rate of GDP at market prices. As can be seen on the table 1, the differences between the selected countries are astonishing. China growth rate did not fall under 8 percent during the years 2000 up to 2010, and even exceed 14 percent in the year 2007. On the other hand, US highest rate was only 4.2 percent in 2000 and in the year 2009 it dropped in to the minus 3.5 percent. (Balabán, 2011).

Table 1: Annual Growth Rate

Country	Year										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
<b>China</b>	8.4	8.3	9.1	10.0	10.1	11.3	12.7	14.2	9.6	9.2	10.4
<b>US</b>	4.2	1.1	1.8	2.5	3.6	3.1	2.7	1.9	0.0	-3.5	3.0
<b>Germany</b>	3.1	1.5	0.0	-0.4	1.2	0.7	3.7	3.3	1.1	-5.1	3.7
<b>Czech republic</b>	3.6	2.5	1.9	3.6	4.5	6.3	6.8	6.1	2.5	-4.1	2.3

Source: Worldbank data, own processed

Although this influence on global economy, China still belongs to developing countries. This is the limiting factor to politic, economic and other ambitions. The economic prosperity of population and their living standards are still very low. In the year 2010 the GDP per capita in PPP was 7,599 dollars. In the same year, the PPP in US was 47,199\$, in Germany it is 37,260\$ and Czech Republic has 25,283\$ PPP as can be seen on the table 2, which is placed bellow. (Balabán, 2011).

Table 2: GDP per Capita in PPP

Country	Year										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
China	2,364	2,600	2,863	3,197	3,599	4,115	4,761	5,568	6,204	6,863	7,599
US	35,081	35,898	36,797	38,196	40,309	42,534	44,663	46,406	46,971	45,758	47,199
Germany	25,753	26,714	27,437	28,344	29,690	31,115	33,526	35,565	37,064	35,977	37,260
Czech republic	14,991	16,174	16,866	17,982	19,287	20,362	22,344	24,551	25,858	25,572	25,283

Source: Worldbank data, own processed

On the table 2 can be also seen the development of GDP per capita very clearly. Although China drops behind the other selected countries, the development is very sharp. During the period 2000 up to 2010, the GDP per capita increased by more than 320 percent. The situation in US is absolutely different, the GDP is high, but the progress is quite slow, during the same period it increased by 35 percent. These differences are caused by the economic situation of these countries, China still becomes to developing countries, which was mentioned before, and that is also the cause of such sharp growth of GDP per capita in PPP. On the other hand US is developed country and it is obviously, that the progress is slower. (Balabán, 2011).

### 3.2 NATURAL CONDITIONS OF PEOPLE'S REPUBLIC OF CHINA

Given the size of People's republic of China, the natural conditions varies in temperatures, altitude as well as precipitation and the quality of soil. Surface of this country is mainly formed by mountains, highlands and hills, which in total count 69percent. More accurate, mountains represent 33percent, plateaus 26percent, hills 10percent, basins 19percent and plains only 12percent. One of five main mountain ranges are called Himalaya Mountains and its peak is Mount Everest (Qomolangma in Chinese), which is at 8,844 m. But there are also 6 more mountain peaks, which cross the 8000 height. Although People's republic of China has the world's largest mountains, it has also second lowest place in the world. The only one lower is Dead Sea. Turpan Pendi is situated in Xinjiang Uygur Autonomous Region and it is 154 meters below sea level. Due to altitude it also belongs to one of the hottest place in People's republic of China. (Szczepanski, 2011)

The climate is diversified. Majority of land is in the northern temperature zone. But there is complete range of climate zones, such as the cold-temperature north, with subarctic zones in Himalaya Mountains in comparison with tropical south. Temperatures can be different even in 40°C from north to south. (Szczepanski, 2011)

Thanks to vast territory of People's republic of China the natural resources reserves are abundant. These natural resources are divided into five groups – land resources, mineral resources, natural resources, fauna and flora resources and marine resources. (China facts and figures, 2004)



### 3.3. AGRICULTURE IN PEOPLE'S REPUBLIC OF CHINA

Agriculture plays in People's Republic of China one of the most important role, thanks to the government consideration of food self-sufficiency as a matter of national security. (Hook, 2010)

The share of Agriculture in the national economy, measured by the Agro-added value to GDP has gone through a rapid change. In the year 1978 the Agro-added value to GDP was 28.2percent, in 2008 it was only 11.3. The development of labour employed in agriculture sector is also very interesting. In 1978 the proportion of labour employed in agriculture sector was 70.5percent out of total. In 2008 it was only 39.6percent of total. This drop-off was caused by the continuously urbanization and also the industrialization. (Ministry of Agriculture, 2010)

Cultivated land in People's Republic of China is only 15percent of the total land available. From this amount 75percent is used for producing food crops. The most cultivated food crop is rice, which is cultivated on almost 25percent of the total cultivated land. The second most important crop is wheat, which is followed by potatoes, oil seeds, flex, and jute. Exportation of Tea brings also high revenues to state budget. The most suitable cultivation places are the Yangtze Valley, Huai River, Zhu Jiang Delta, Wei, Fen River, Loess Plateau etc. (Economy watch, 2010)

#### 3.3.1. KEY FACTOR: LABOUR

Labour is one of the most important factors in agriculture production. Chinese agriculture is focused on labour intensive system, which means, that it is preferred to use as many workers as possible, to increase the crop yield per unit rather than focusing on the productivity of each individual worker. (Encyklopedia of the Nations, 2012)

Levels of urbanization are going through a rapid change. In the year 1975, the percentage of population which was living in the urban areas composed only 17.4percent of total, which represents 752 624 thousands of citizens, twenty years later the percentage proportion of urban population was 30.9percent, which represents 836 712 thousands of

citizens. The difference is astonishing - the urbanized population grew for almost one hundred millions of people. In the year 2005 the urban population was up to 42.5percent out of all. (UN, 2012)

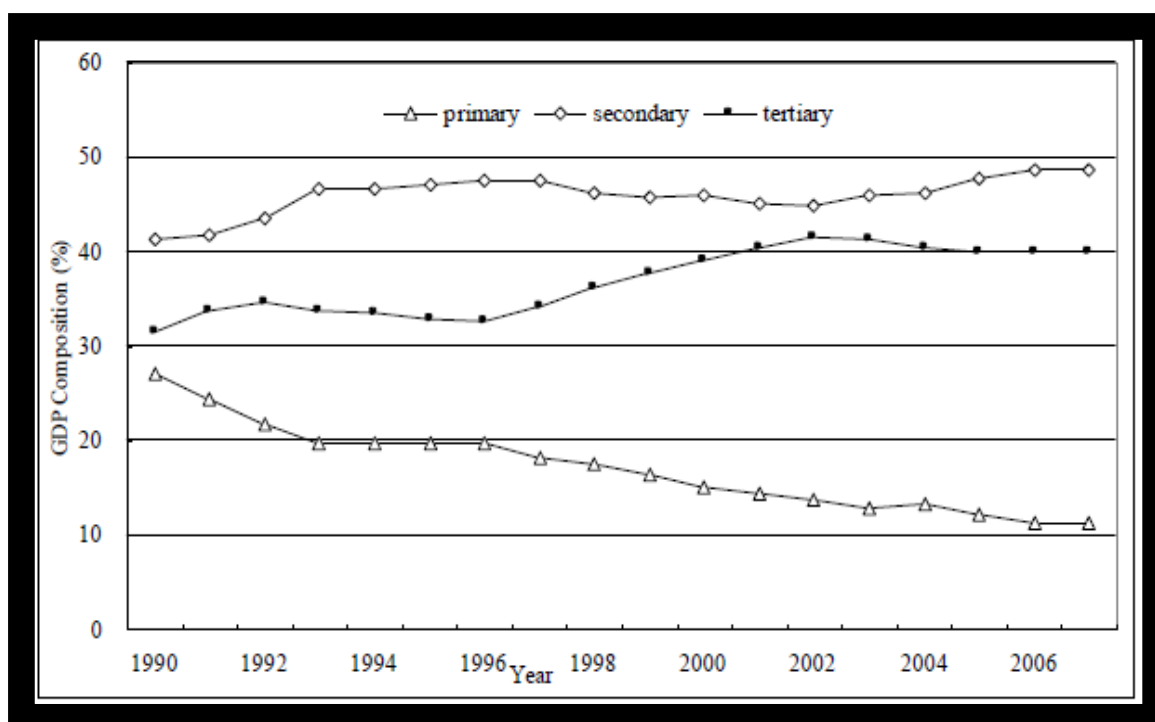
The main cause of such change is the income gap between the rural and urban areas. Despite of all government's attempts, the income gap is still more expressive. According to Chinese Agriculture Ministry statistics, the income on average of people living in urban areas is 3.36 times higher than the income of people living in rural areas. In dollars expressed it means, that in 2008 the average income of worker in rural area was \$690. On the other hand, average income of worker in urban area was \$2,290 on average. (Chen, 2009)

#### 3.3.1.1. ALLOCATION OF LABOUR IN THE MARKET

Before the economic reforms, which started to change the closed market into socialist market economy, the allocation of labour was under a strict scheme. Everything was determined by the government. This means the wages were set by the government, the jobs were assigned by the government and the fussiness between different sectors was highly restricted. After the economic reforms the market began to play an important role in allocating the labour factor. For example the state-owned sector in 1995 was 27.6percent in the comparison with the year 1988, when it was 39.4percent. (Li, Zax, 2009)

As People's Republic of China belongs to the group of developing countries, it follows the grow pattern, which means the continually shrinking the share of primary sector on the total GDP. In 1990 the share of primary sector on the total GDP was 27.1percent, in the year 2007 it counted only 11.3percent of total GDP. This decrease was equalled by the increase in the value-added of the tertiary industry which grew from 31.6percent in 1990 up to 40.1percent of total GDP in 2007. This development can be clearly seen on the table placed below. (Fang, Yang, Meiyan, 2010)

Table 3: Changes of the Content of GDP by Sector



Source: The Statistical Yearbook of 2008, China Statistics Press

### 3.3.1.2. INFLUENCE OF FAMILY-PLANNING POLICIES

Firstly it is necessary to determine the conditions, under which are the family-planning policies implemented. The conditions differs according to area, where are asserted. As the agriculture is connected to the rural area, the conditions for rural area are explained. In rural area couples are supported to have only one child, but several exceptions were accepted. Into these exceptions belongs to have a second child, when the first born is disabled. In some areas it is common to allow having second child when the first born is a girl. The exceptions are valid also for the ethnical minorities. The population in rural areas since the implementing the family-planning policies in 1970s is as following. In 1970 the rural population counted for 673,975 thousands of people. This number was increasing until the year 1990, when it reached 840,095 thousands of people. Since the time the amount of people from rural area is decreasing, the statement from 2010 states, that the current situation is 718,307 thousands of people in rural areas. (UN, 2008)

### 3.3.2. KEY FACTOR: WATER

Water is an extremely important factor for the sustainable development of the country. People's Republic of China is on the fifth position in the amount of renewable water resources in the world, right after Brazil, Russia, Canada and Indonesia. On the other hand, the water renewable resources quantity per capita is much less. It is 2,079m<sup>3</sup> per capita per year, in the comparison with the world average 6,225m<sup>3</sup> per capita per year. The Chinese average should decrease up to 1,890m<sup>3</sup> around the year 2033 due to the population peak, which should reach 1.5 billion of people. (FAO, 2010)

Water is very often used for the irrigation purposes. In People's Republic of China the irrigation plays essential role in food security, 75percent of produced cereals come from the irrigation areas and the similar situation is with the cotton, fruit and vegetables - more than 90percent is dependent on irrigation. As the population will increased, the press on irrigation will be even more significant. (Li, 2006)

#### 3.3.2.1. WATER QUALITY

The quality of water is measured on 409 sections. These sections rate the quality on more than two hundreds rivers and grade the quality according to classification system, which is placed below. (SEPA, 2010)

Category I. - water, that can be used for a public supplies without any purification methods.

Category II – water, that has to undergo a purification method before it can be used as a public supply of water.

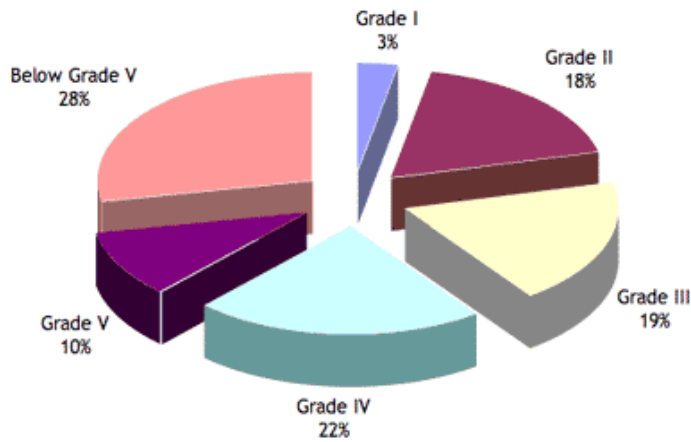
Category III – water, that has to undergo intensive purification procedures to be supplied as public water resource.

Category IV – water, which can be used for the agriculture purposes.

Category V – water, which can be used for farming purposes after purification procedures. (SEPA, 2002)

The water distribution according to the quality grades can be seen on the graph below.

Graph 1: China – Surface Water Quality by Grade (2006)



Source: Ministry of Environmental Protection, 2006

The situation of water quality is worsened each year by the dumping different kind of pollutants into the water bodies. These pollutants come mainly from the industrial and agricultural sector. (WRI, 1999)

The quality of water resources differs according the location and also according to the type of water resource.

### 3.3.2.2. WATER QUANTITY

In general there are two main water resources, surface water resources, which include also glaciers, and groundwater resources. It total there are 9 main river basins and 50,000 rivers, which are divided into two groups, outflowing rivers, which are discharging into seas and second group is inland rivers, which runs into interior basins. The amount of entering water from neighbouring countries is just over 17km<sup>3</sup>. (FAO, 2010)

The groundwater resources are estimated to 828.8km<sup>3</sup>, from this amount 70percent is located in the southern China and only 30percent in the northern part. (Wang, 2005)

The quantity of water varies across the country a lot. The water renewable resources per capita in the southwest part are up to 25,000m<sup>3</sup> annually, in the northern part it is only 500m<sup>3</sup> annually. (FAO, 2010)

The north part of China has only one fifth of the total water resources, which are located in China and every year suffers from the severe water shortages. However there are two-thirds of China's croplands placed in northern part. This fact automatically leads to high irrigation demand. On the other hand, the South is water well-supplied, but every year faces floods. (Burke, 2004)

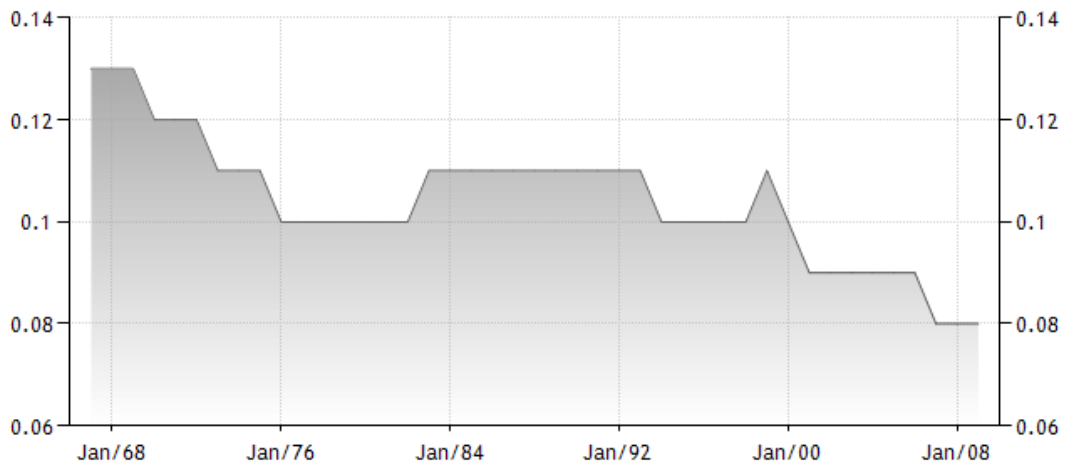
The problem of unequally distribution of water resources is long-term challenge and the Chinese government has to deal with it. The last and greatest project is the South to North Water Transfer Project. This project should be finished until 2050 and should divert 44.8km<sup>3</sup> of water annually. It will transfer the water from the river Yangtze in the south to water poor areas in the north by the three diversion channels. (Wong, 2011)

### 3.3.3. KEY FACTOR: LAND

The types of land resources are variable due to the vast territory of China. Nearly 70percent of the territory is created by hills, plateau and mountains and only 30percent is covered by basins and plains, which are suitable for the agriculture purposes. In 2003 the amount of arable was 118.93 million hectares. And the trend is decreasing. In the year 2007 it was only 109.34 million hectares or arable land. (FAOSTAT, 2011)

The arable land per capita in 2009 was 0.08 hectare. The development of arable land per capita has the decreasing trend as can be seen on the table below.

Graph 2: Arable Land (hectares per capita)



Source: World DataBank, 2010

The world average arable land per capita was 0.22 hectares in 2002 in the contrast with 0.09 hectares in China in the same year. The latest report states the world average arable land per capita was 0.21 hectares in 2009. In China it was 0.08 hectares per capita. (World DataBank, 2010)

### 3.4. FAMILY PLANNING POLICIES

First Family Planning policy was implemented in 1970 and was call “Later, longer and few”. The purpose of this policy was to stop the massive increase in the fertility rate during Mao’s rule. His disaster attempt to population development, which was in the meaning “the more people, the stronger we are” led to unsustainable population growth 2.4percent per year and also it led to series of famines. The policy Later, longer and few represented later marriage, longer pauses between births and few children. (Potts, 2006)

This policy achieved to decrease the fertility rate from 5.51 births per women in 1970 up to 2.9 births per women in 1979. (UN, 2010)

Second implemented, but probably better known is the policy of one child. This policy was introduced by Deng Xiao-Ping in 1979 and its purpose was to decrease the fertility rate

even more. Although it supposed to be only a temporary measure, it is still valid. This policy allowed couples to have only one child. Second pregnancies are usually followed by high fines; women are persuaded to abortion or are forced to sterilization. Permission to have a second child is given to the families, where both parents are only children. The policy is implemented mainly in the urban areas; in the rural areas it is not so strict. There are exceptions for the ethnic minorities, which are allowed to have two children. Another exception is for the rural families, which has first born girl; usually they are allowed to have a second child. Also when the child is mental or physical disabled, parents can applied for the permission to have a second child. (Fitzpatrick, 2009)

The impacts of one child policy are positive, but in some aspects also negative. Between the worse negative impacts belong sex selective abortions and the sex ratio at birth is 118 men to 100 women. The total fertility rate in 2010 was 1.64 births per woman, which is below the replacement level, which state at 2.1 births per woman and according to statistical estimation, the one child policy decreased the growth of population about 300 million of people. (UN, 2010)

#### 4. ANALYSIS OF ONE CHILD POLICY AND ITS EFFECTS UPON AGRICULTURE

To analyze the impacts of family planning policies, especially the one child policy will be used qualitative analysis of the impacts and the quantitative analysis, which will contain the hypothesis testing.

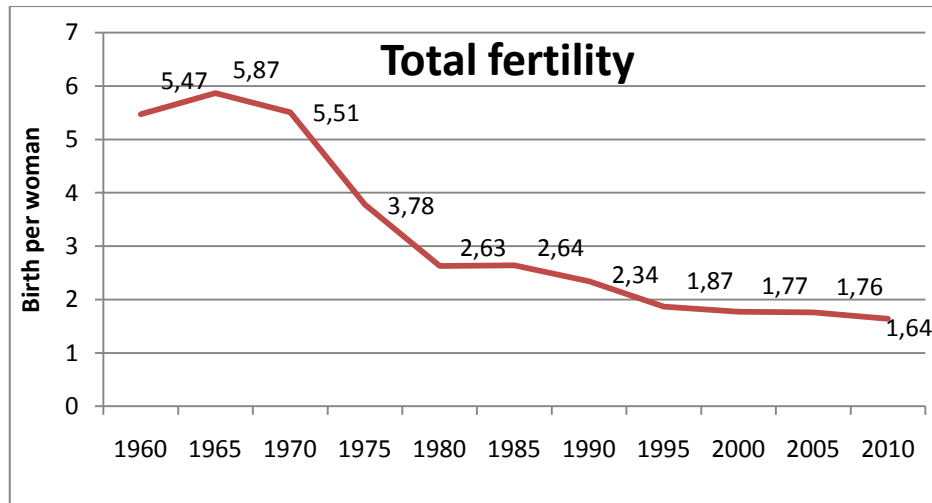
Firstly it is necessary to analyse various factors to detect the present situation in many aspects, such as population development, economic development etc. For this purposes was used the qualitative method of analysing and evaluating the secondary data, which were own processed.



#### 4.1 THE QUALITATIVE ANALYSIS OF THE INFLUENCE OF FAMILY PLANNING POLICIES ON THE DEVELOPMENT OF PEOPLE'S REPUBLIC OF CHINA

- THE DEVELOPMENT OF THE TOTAL FERTILITY RATE MEASURES BY BIRTHS PER WOMAN

Graph 3: Total Fertility

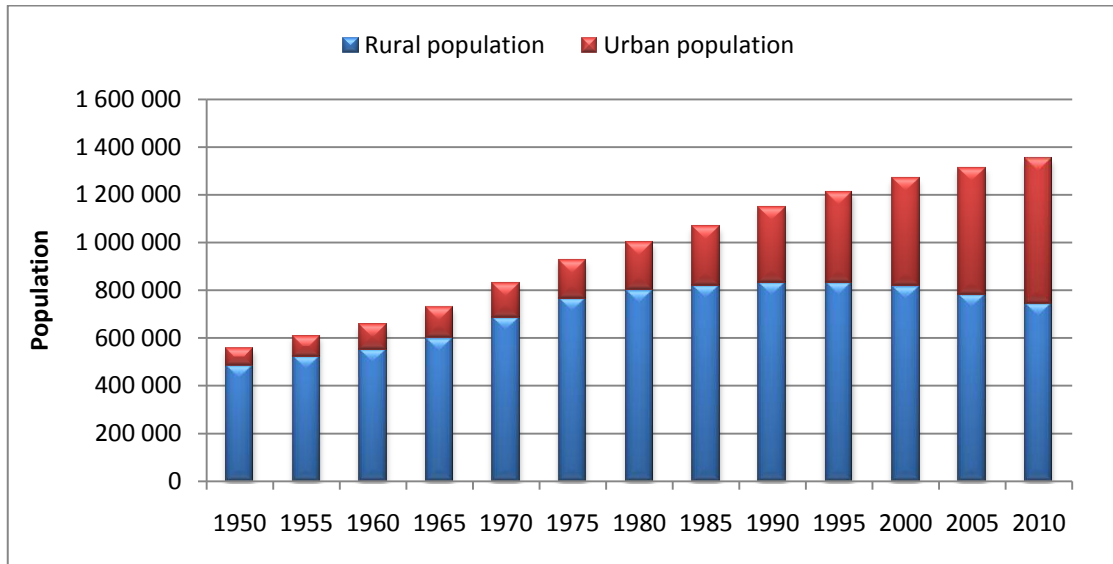


Source: Own processed based on UN database

According to the graph above, the fertility peak was in 1965 and the fertility rate per woman was 5.87 births. By the policy “Late, longer and fewer” was achieved the decrease up to 2.9 in the 1979. After the implementing of one child policy the decreasing trend continued up to 1.64 births per women. The replacement level is 2.1 births per woman so the total fertility rate is below it.

- THE URBANIZATION DEVELOPMENT IN CHINA

Graph 4: Population Divided into Urban and Rural Sections



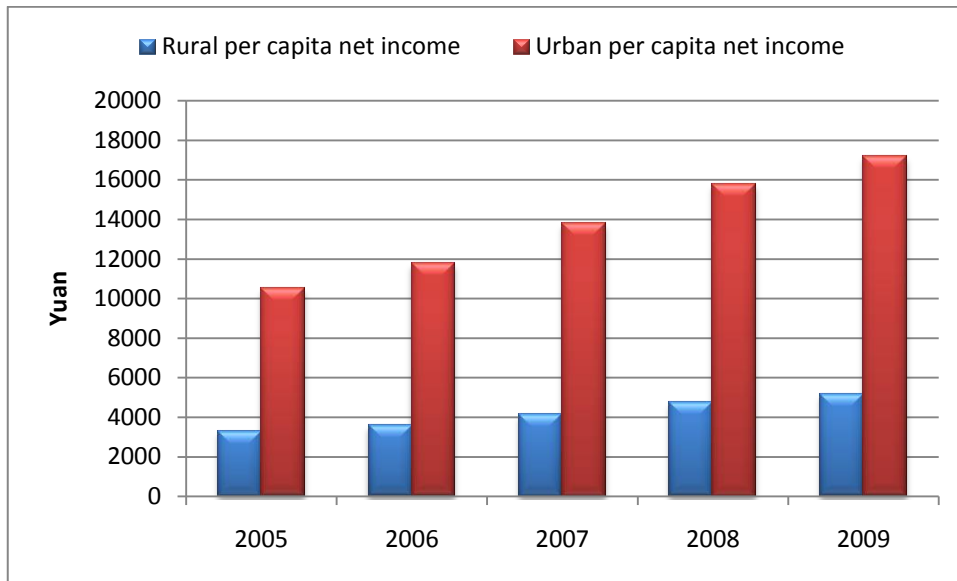
Source: own processed based on UN database

As can be seen, the process of urbanization is rapidly increasing. In the year 1950 the number of people living in the urban areas was 72,119 thousand people what represented only 13percent of total population. In the1985 the urban population crossed the 22percent of total population, in number of people it was 245,322 thousand people. The statement from the year 2010 estimates the urban population on 45percent of the total population, which means 607,230 thousand people. Another important fact is, that in 1995 was a break-point in the rural population development. Until 1995 the population increased, but since this year the trend is reverse, and the rural population decreases.

The main cause of such urbanization is the income gap between rural and urban population. The urban net income per capita was 17,175 Yuan in 2009 in the comparison with the rural net income which was 5,153 Yuan in the same year. The income gap is more than twelve thousand Yuan. (Jing, 2010)

The development of urban – rural net income is perfectly depicted on the graph below, where the net urban income and net rural income are compared.

Graph 5: The Urban – Rural Income Gap

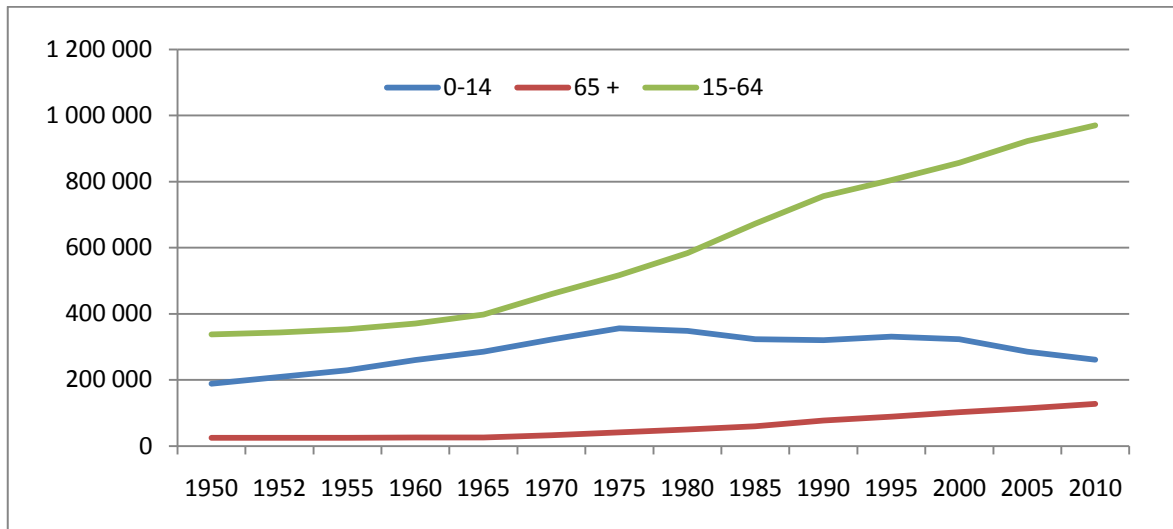


Source: own processed, data National Bureau of Statistics of China

- AGEING OF THE POPULATION IN CHINA

On the graph below can be seen the negative influence of family planning policies which is ageing of the population. Until the year 1975 the population of children, determined by the age till 15, steadily rose, as well as the population of the productive group, which is determinate by age 15 – 64 years. The group of the older 64 years was in stable development but since 1970s the development changed, and this part of population started to rapidly increased.

Graph 6: The Population Development 1950 - 2010



Source: Own processed by usage UN database

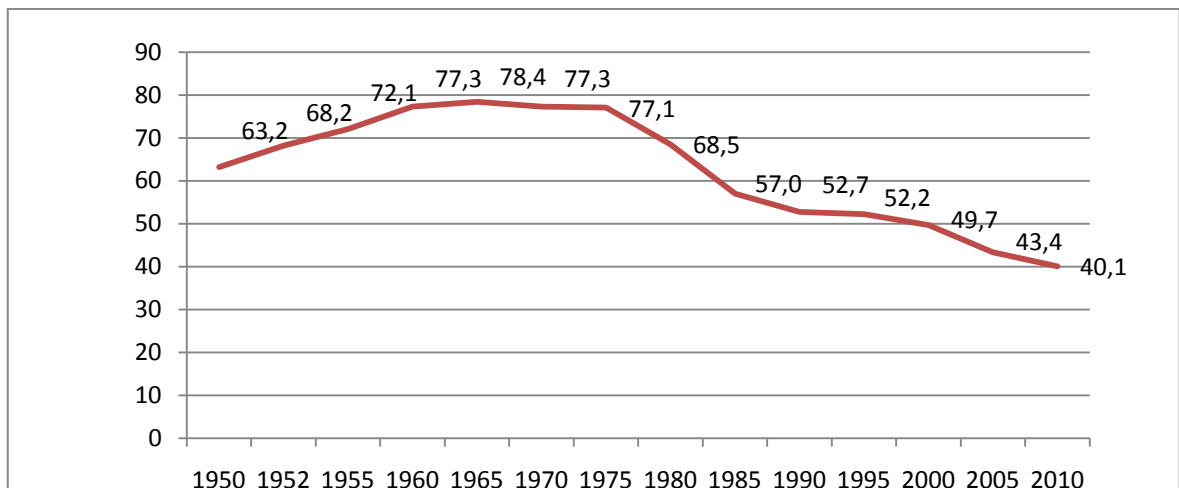
To properly express the population development it is suitable to imply the percentage proportions between the stated groups. In 1950 the population of 65+ was only 4.5percent, the population in the productive age was 61.3percent and the children population was 34.2percent out of total. After implementing the family planning policies in 1980 the situation was as following. Population was formatted by 5.2percent aged 65+, 59.3percent aged 15-64 and 35.5percent younger 15. The family planning consequences were not clear yet. But in 2010 the situation changed. The population was formatted by 8.2percent aged 65+, 72.4percent in productive age and only 19.5percent children. The important is the change between percentage of children and percentage of older ones. The percentage of population in productive is very high, which is caused by the high percentage share of children in 1980s. According to the family planning policies, the proportion of children in 2010 was only 19.5percent, which will unstoppable lead to ageing of population. This assumption is also supported by the increasing proportion of people aged 65+. The increase of proportion of pensioners is partially caused by the prolonging life expectancy at birth. In 1990 the expectancy at birth was 68.8 years. In 2008 it was already 73.0 years.

- THE DEVELOPMENT OF ECONOMIC DEPENDENCY INDEX

The Economic dependency index is a way, how to measure the ratio between the economic dependent population, which is represented by children and pensioners, on the economic active population.

The index is calculated as how many economic dependent people fall to 100 people in the productive age. In practice this means how many people older 65 and younger 15 years fall to 100 people in the age 15-64. Higher the number, the more dependent population, what is a negative factor for the economy.

Graph 7: Economic Dependency Index



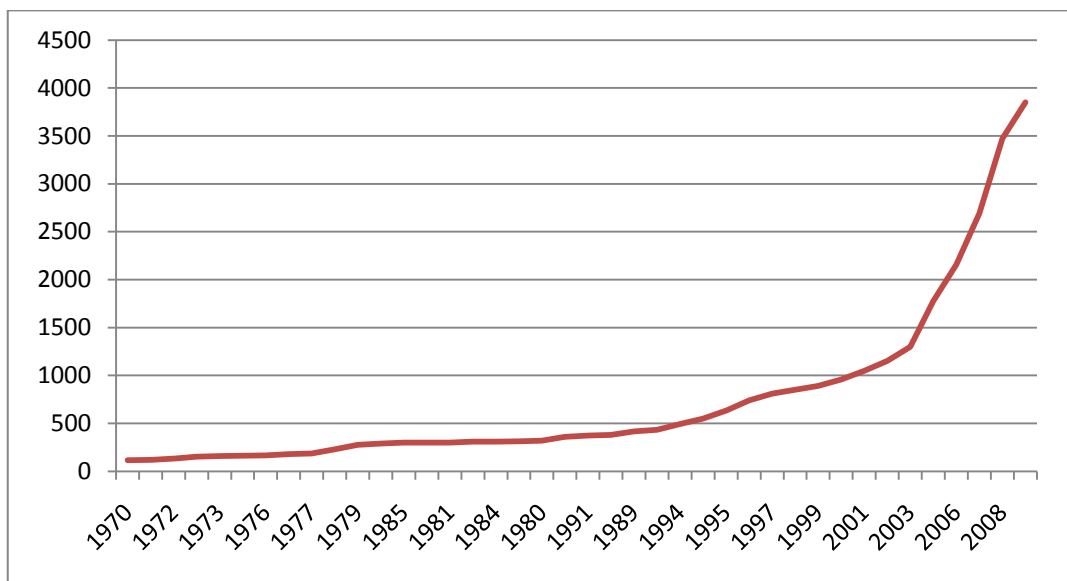
Source: own processed, data from UN databases

According to the graph, the positive trend can be observed since the family planning policies were implemented in 1970s. In 1970 on one hundred people in productive age fall 78,4 people in non-productive age, meant by children and pensioners. In 2010 the dependency has decrease noticeable. On one hundred people in the productive age fall only 40.1 people in non-productive age. This development is caused by the bumper decrease of children population, and relatively small increase of pensioners. The future development will be rather negative, due to the decrease of the population in productive age.

- THE DEVELOPMENT OF THE GDP PER CAPITA IN CURRENT PRICES

The economic development can be also measured by the GDP. In this thesis was used the GDP per capita in current prices in US dollars. The GDP was measured from 1970 up to 2009 and the positive development can be seen. In 1970 the measured GDP was 114 US dollars. The comparison with the development in US is very interesting. In the same year the GDP per capita in current prices was 4,892 US dollars, what more than forty times higher. The comparison of year 1990 looks as follows, in China it was 360 US dollars, in US it was 22,716 US dollars. The difference was even more striking. The situation in 2009 was a bit different, in China the GDP per capita was 3,850 US dollars and in US it was 45,058 US dollars. Although the difference is huge, the ratio between them is decreasing, what is a positive indicator.

Graph 8: GDP per Capita at Current Prices – US Dollars



Source: Own processed, usage of International Monetary Fund

#### 4.2 THE QUANTITATIVE ANALYSIS OF TOTAL DEMAND FOR THE FOOD COMMODITIES, TOTAL FOOD COMMODITIES SUPPLY, COMPARISON

- CALCULATION OF TOTAL DEMAND FOR THE FOOD COMMODITIES AND THE FUTURE DEVELOPMENT

To calculate the total demand for the food commodities it is necessary to define the food demand per capita and the total population. The demand for food commodities such as meat, eggs and other animal products as well as the equivalents for grain were recalculated according to given ratio in to the grain demand. These data were obtained from the National Bureau of Statistics in China.

Table 3: The Total Demand for Grain

Year	2000	2010	2020	2030	2040	2050
<b>Demand for grain per capita (kg) *</b>	400	420	450	465	480	500
<b>Total population (million) **</b>	1282,05	1369,88	1440,87	1460,57	1449,23	1400,23
<b>Total grain demand(Mt) ***</b>	512,82	575,35	648,39	679,17	695,63	700,12

Source: \* National Bureau of Statistics, \*\* UN databases, \*\*\* Own processed

Total grain demand was calculated as a product of demand per capita times the total population. The prediction for population development comes from the UN databases and the variant with lasting one child policy of population development was chosen.

As can be seen from the table above, the demand for the grain will be stationary increasing. The population will increase until 2030s, where will be the population peak and right after it should started to decrease. The total grain demand will stable increase.

- CALCULATION OF TOTAL SUPPLY OF GRAIN

The total grain supply was taken as a dependent variable. Arable land, rural population, machinery and fertilizers were chosen as the independent variables.

$H_0$  = the total output is not dependent on four factors: arable land, rural population, machinery and fertilizers.

$H_A$  = the total output is dependent on four factors: arable land, rural population, machinery and fertilizers.

To testify this hypothesis was used the linear multiple regression function in statistical program. The studied data were since 1970 up to 2010 in the period of one year, which means 40 observations. The four variables were mentioned above. The stated level of significance was 0.01.

It the attained result the R-squared was equal to 0.99317, which means 99.317percent of approximates the real data. The level of significance was 1.27e-06, which is far below the stated limit. And finally the function, which is equal to:

$$y = -2.15936e+08+1241.49x_1+387.799x_2+35.6055x_3+3.71927x_4 \quad (1)$$

Where:  $y$  = total grain output,  $x_1$  = arable land.  $x_2$  = rural population.  $x_3$  = machinery.  $x_4$  = fertilizers

As can be seen from the results, the total grain output is dependent on mentioned variables. The decrease in the variable of rural population is smoothly supplemented by the increase of amount of fertilizers and machinery used in agriculture. The fluctuating of the arable land is only mild.

By this function the total grain output was calculated as well as the supply of grain per capita.

According to results,  $H_0$  is rejected and  $H_A$  was accepted.



Table 4: Total grain output based on linear regression function, selected decades

Year	1970	1980	1990	2000	2010
Arable land (1000ha)*	102.52	100.22	131.41	128.23	113.31
Rural population (1000)**	416.314	807.648	857.291	813.925	725.271
Machinery (No)*	126440	747900	824113	989139	3010658
Fertilizers ... (tonnes)*	4407000	15334700	27273700	34217868	46605367
Total grain supply ... (Mt) ***	180.86	370.47	431.28	462.17	469.18
Supply of grain per ... capita per year (kg) ***	217	348	368	360	342

Source: \* FAOSTAT, \*\* UN databases, \*\*\* Own computation

H<sub>0</sub>: As the rural population decreases, the increase in the consumption of fertilizers and in the mechanization will not compensate this diminution.

H<sub>A</sub>: As the rural population decreases, the increase in the consumption of fertilizers and in the mechanization will compensate this diminution.

To verify H<sub>2</sub> was necessary the prediction of the development of each independent variable on the base of linear regression function. The predicted data were inserted in the foregone formula. The results can be seen in table 5, which is placed below.

Table 5: Prediction of total grain output, selected decades

Year	2020	2030	2040	2050
Arable land (1000ha)	114.15	116.06	117.48	118.98
Rural population (1000)	644.394	557.019	467.893	379.350
Machinery (No)	4578237	5412989	6342512	7132451
Fertilizers (tonnes)*	50201530	55076224	59950895	65431178
Total grain supply ...(Mt)	526.47	585.33	631.09	655.95
Supply of grain per capita per year(kg)	365	401	435	468

Source: own computation

According to results,  $H_0$  is rejected and  $H_A$  was accepted.

- COMPARISON OF THE TOTAL GRAIN SUPPLY AND TOTAL GRAIN DEMAND

The following step is the compare the reached results. In the table can be seen the grain supply in million tones, also the supply of grain equivalents. The data of the supply of grain equivalents were found in the FAOSTAT database. These two variables were summed in to third row, the total grain supply

The total grain supply was compared with the total grain demand and the difference was made. This difference is called balance. The negative balance means imports, the positive one means exports.

Table 5: Comparison of total grain supply and demand

year	2000	2010	2020	2030	2040	2050
<b>Grain supply (Mt)</b>	462.17	469.18	526.47	585.33	631.09	655.95
<b>Supply of grain equivalents(Mt)*</b>	32.89	74.01	88.47	102.93	116.03	129.13
<b>Total grain supply (Mt)</b>	495.06	543.19	614.95	688.27	747.12	785.08
<b>Total grain demand (Mt)</b>	512.82	575.35	648.39	679.17	695.63	700.12
<b>Balance (Mt)</b>	(-17.76)	(-32.16)	(-33.45)	9.10	51.49	84.96
<b>Food self-sufficiency (percent)</b>	96.5	94.4	94.8	101.3	107.4	112.1

Source: \* own processed, FAOSTAT database, others own computation

As can be seen on the last row of the table above, China is dependent on the imports in present. This status should be changed in 2030, when China should become fully self-sufficient and even should start to export the grain.

- COMPARISON THE YEAR 2010 WITH AND WITHOUT ONE CHILD POLICY

To evaluate the one child policy was used the comparison of the situation of 2010 with and without this policy. The population of China would be approximately about 300 million according to National bureau of Statistics. These 300 million people would be mainly from the urban areas, because the family planning policies are in urban areas implemented very strictly. This is the cause, why any increase in rural population is not included in the rural population in 2010 without family planning policies.

As can be seen from the table below, the supply per capita would decrease from 342 kg up to 285 kg without the family planning policies. This would represent significant decrease in self-sufficiency from 94.4percent up to 78.6percent. This decrease would mean massive imports of food commodities, what would automatically lead to rapid increase of world prices of food commodities.

Table 6: Comparison of 2010 with and without one child policy

Factor	2010 actual	2010 without one child policy
Population in thousands	1369.88	1645.72
Demand for grain per capita per year in kg	420	420
Supply of grain per capita	342	285
Total supply of grain in Mt	543.19	543.19
Total grain demand in Mt	575.35	691.21
Balance in Mt	-32.16	-148.02
Food self/sufficiency percent	94.4	78.6

Source: own computation on the base of own computed data, data from UN database

According to this table, the family planning policies were necessary for the sustainable economy development.

## 5 CONCLUSION

China is often perceived as country which limits human rights and restricts freedom. One child policy is often apparent as evil and symbol of Chinese communistic and undemocratic government. But this “evil” is necessary for sustainable development of Chinese economy and agriculture. Quantitative research shows that without child policy the China would have significant problems with poverty and famine. This implementation is strict and very extraordinary, but extremely effective. China is the most populated country and one child policy is the only solution which can solve the possible problem of overcrowding and enable China to be self-sufficient.

On the other side one child policy leads to ageing of population and increasing of emigration of inhabitants. This could be also alarming for the sustainable development in the future, nevertheless it is necessary. This could be solved by increasing the age of retirement as well as reduce the real value of state pension. Chinese government should lead the people to save for their old age to be independent on the state financial support.

Gross domestic product of China is increasing very significantly, even more than gross domestic product of United States. Chinese economy is growing and living standards are being improved as well.

Although China is very often perceived as communistic country with cheap labour and poor quality of products, reality is different. Government of China tries to improve quality of inhabitants’ life and therefore it is forced to implement some controversial policies, such as one child policy. But these policies enable Chinese economy to grow.

## 6 REFERENCES

- Ash, R. F., 2011, Feeding Billions: Food security in PRC <http://www.isn.ethz.ch/isn/Current-Affairs/ISN-Insights/Detail?lng=en&id=128073&contextid734=128073&contextid735=127105&tabid=127105> accessed 11. 8. 2011
- Balabán, M., 2011, Transformace globální moci a vlivu: Politická, ekonomická a bezpečnostní dimenze, [http://ceses.cuni.cz/CESES-65-version1-Transformace\\_globalni\\_moci\\_a\\_vlivu\\_Balaban.pdf](http://ceses.cuni.cz/CESES-65-version1-Transformace_globalni_moci_a_vlivu_Balaban.pdf) accessed 11. 1. 2011
- Beckwith, Ch., 2009, Empires of the Silk Road: A History of Central Eurasia from the Bronze Age to the Present, Princeton University Press, ISBN: 9781400829941
- Briney, A., 2011, The Geography and Modern History of China <http://geography.about.com/od/chinamaps/a/china.htm> accessed 22. 2. 2012
- Burke, M., 2004, Managing China's water resources <http://www.mendeley.com/research/managing-chinas-water-resources/> accessed 10. 11. 2012
- Businessinfo, 2009, Čína: Zahraničně-politická orientace <http://www.businessinfo.cz/cz/sti/cina-zahranicne-politicka-orientace/3/1000539/> accessed 20. 1. 2012
- Chen, S., 2009, China rural-urban wage gap widens, BBC News <http://news.bbc.co.uk/2/hi/7833779.stm> accessed 27. 2. 2012
- China facts and figures, 2004, Natural conditions <http://www.china.org.cn/english/en-shuzi2004/zr/zrzy.htm> accessed 11. 11. 2011
- Cultural China, 2010, History of China <http://www.cultural-china.com/chinaWH/features/chinaoverview/HistoryofChina.html>, accessed 18. 11. 2011
- Eberhard, W., 2004, A history of China, The Project Gutenberg EBook, ISO-8859-1
- Economy watch, 2008, China agriculture <http://www.economywatch.com/agriculture/country-wide/PRC.html> accessed 5.12.2011

- Economy watch, 2010, China agriculture  
<http://www.economywatch.com/agriculture/country-wide/china.html> accessed 1.11.2011
- Encyklopedia of Nations, 2012, China – agriculture  
<http://www.nationsencyclopedia.com/economies/Asia-and-the-Pacific/China-AGRICULTURE.html> accessed 10. 1. 2012
- Food and Agriculture Organization, 2010, Geography, climate and population  
[http://www.fao.org/nr/water/aquastat/countries\\_regions/china/index.stm](http://www.fao.org/nr/water/aquastat/countries_regions/china/index.stm) accessed 29. 2. 2012
- Food and Agriculture Organization Statistics Division, 2011, Arable Land in China  
<http://faostat.fao.org/site/377/DesktopDefault.aspx?PageID=377#ancor> accessed 29. 11. 2011
- Feng, C., Yand, D., & Meiyan, W., 2009, Employment and Inequality outcomes in China, OECD <http://www.oecd.org/dataoecd/54/52/42546043.pdf> accessed 2.1.2011
- Fitzpatrick, L., 2009, China's One-Child Policy  
<http://www.time.com/time/world/article/0,8599,1912861,00.html> accessed 2. 11. 2011
- Gongheguo, R. Z., 2007, China <http://www.encyclopedia.com/topic/China.aspx> accessed 3. 9. 2011
- Hook, L., 2010, Self-sufficient China watches on as wheat production falls  
<http://blogs.ft.com/beyond-brics/2010/08/13/self-sufficient-china-watches-on-as-wheat-production-falls/#axzz1nW4OMPpP> accessed 23.2.2012
- Jing, F., 2010, Urban-rural income gap widest since the reform  
[http://www.chinadaily.com.cn/china/2010-03/02/content\\_9521611.htm](http://www.chinadaily.com.cn/china/2010-03/02/content_9521611.htm) accessed 3. 3. 2012
- Li, H. & Zax, J., 2009, Economic Transition and the Labour Market in China  
<http://www.prism.gatech.edu/~hl45/research/lbmkt.pdf> accessed 27.2.2012
- Li, Y., 2006, Strategies for coping with water scarcity in China  
<http://www.unwater.org/downloads/wwwyuananhua.pdf> accessed 29. 2. 2012
- McColl, R. W., 1999, Understanding the Geographies of China: An Assemblage of Pieces, <http://www.aasianst.org/EAA/mccoll.htm> accessed 15. 8. 2011

- Ministry of Agriculture of The People's Republic of China, 2010, Agriculture in China [http://english.agri.gov.cn/sa/ca/ooa/201003/t20100304\\_1661.htm](http://english.agri.gov.cn/sa/ca/ooa/201003/t20100304_1661.htm) accessed 19.2.2011
- Ministry of Environmental Protection of The People's Republic of China, 2006, Public 2006 Report on Environmental Quality of China [http://english.mep.gov.cn/News\\_service/infocus/200601/t20110120\\_200081.htm](http://english.mep.gov.cn/News_service/infocus/200601/t20110120_200081.htm) accessed 10. 11. 2011
- Ministry of Environmental Protection of The People's Republic of China, 2010, Environmental Quality and Environmental protection in China [http://english.mep.gov.cn/News\\_service/infocus/201002/t20120207\\_223194.htm](http://english.mep.gov.cn/News_service/infocus/201002/t20120207_223194.htm) accessed 10. 11. 2011
- National Bureau of Statistics of China, 2008, China Statistical Yearbook 2008 <http://www.stats.gov.cn/english/statisticaldata/yearlydata/> accessed 11.2.201
- National encyclopedia, 2008, China – location, size, extent <http://www.nationsencyclopedia.com/Asia-and-Oceania/China-LOCATION-SIZE-AND-EXTENT.html> accessed 20. 9. 2011
- Population Division of the Department of Economic and Social Affairs fo the United Nations Secretariat, 2012, World Urbanization Prospects: The 2011 Revision Population database <http://esa.un.org/unpd/wup/unup/p2k0data.asp> accessed 27.2.2012
- Potts, M., 2006, China's one child policy: The policy that changed the world <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1550444/> accessed 1. 2. 2012
- Rosenberg, M., 2011: PRC's One Child Policy, About.com, <http://geography.about.com/od/populationgeography/a/onechild.htm> accessed 10. 8. 2011
- Scaruffi, P., 2009, Wars and Genocides in 20<sup>th</sup> century, <http://www.scaruffi.com/politics/massacre.html>
- State Environmental Protection Administration of China, 2002, Environmental Quality Standards for Surface Water <http://www.china.org.cn/english/features/China2004/1017048.htm> accessed 20. 1. 2012



- Szczepanski, K., 2011, People's republic of China: Facts and History <http://asianhistory.about.com/od/china/p/ChinaProfile.htm> accessed 20. 1. 2012
- UN, 2007, World Urbanization Prospects: The 2007 Revision Population Database <http://esa.un.org/unup/p2k0data.asp> accessed 1. 2. 2012
- UN, 2010, World Population Prospects: The 2010 Revision <http://data.un.org/Data.aspx?q=china&d=PopDiv&f=variableIDpercent3A54percent3BcrIDpercent3A156percent2C948> accessed 5. 1. 2012
- Wang, J., Huang, J., Blake, A., Huang, Q., Rozelle, S., 2005, The development, challenges and management of groundwater in rural China [http://www.iwmi.cgiar.org/publications/CABI\\_Publications/CA\\_CABI\\_Series/Ground\\_Water/protected/Giordano\\_1845931726-Chapter3.pdf](http://www.iwmi.cgiar.org/publications/CABI_Publications/CA_CABI_Series/Ground_Water/protected/Giordano_1845931726-Chapter3.pdf) accessed 19. 12. 2011
- Wong, E., 2011, Plan for China's Water Crisis Spurs Concern [http://www.nytimes.com/2011/06/02/world/asia/02water.html?\\_r=1&pagewanted=all](http://www.nytimes.com/2011/06/02/world/asia/02water.html?_r=1&pagewanted=all) accessed 29. 2. 2012
- World DataBank, 2010, Arable land (hectares per person) <http://search.worldbank.org/data?qterm=arable+land+world+average&language=EN&format=> accessed 1. 3. 2010
- World Resources Institute, 1999, China's Health and Environment: Water scarcity, water pollution, and health <http://www.wri.org/publication/content/8416> accessed 23. 10. 2011