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The Research of Urbanization, Industrialization and Agricultural Modernization's Effect on Food Security

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Abstract
Due to its large population, especially with the development of society and economy, China is in growing demand of food even it has long achieved food self-sufficiency. Food security relates to the national security, the problem of food security has been the focus of China. China's industrialization, urbanization, and agricultural modernization process has a certain impact on food security, based on the empirical analysis of the correlation of the industrialization, urbanization and agricultural modernization. It's said the industrialization and agricultural modernization has a positive effect on improving the level of food security, while the urbanization does the contrary. Under this circumstance, we propose to improve the industry nurturing agriculture, to promote agriculture with industry, science, to promote the urbanization level, and to improve the level of agricultural modernization.

Key words: Food security; Industrialization; Urbanization; Agricultural modernization

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INTRODUCTION
The food problem has always been solved by Chinese past dynasties. China has a large population and large grain demanding, with limited land resources. China has to feed 21% of the world's population with 7% of the world's arable land. Food security is always the focus of national attention. Food security defined by The United Nations is that anyone can get enough food to live by and to have health in any place. With the increasing use of science and technology in agriculture and national policy which support to agricultural production, despite fluctuations, food production in China is a increasing trend on the whole, especially in 2004 when the abolition of agricultural tax and food subsidy policy was implemented, Chinese grain production increases year by year, which ensures national food security in large extent. But along with our country industrialization, urbanization process accelerating, Food security is facing new challenges. Development of industrialization and urbanization needs relevant industry support. In the process of industrialization, rural areas provide sufficient labor and resource guarantee for its development. In the early stage of China's industrialization, it has implemented the policy that agriculture nurturing industrial, to ensure the rapid development of industrial economy. In the process of urbanization, the rural population migrates to cities, the agricultural lands trend to be urban construction lands. At present the world's major developed countries have realized industrialization and city changing. The very important reason is the coordinated development of agriculture and industry, coordination of industrialization and development of the cities. The rational allocation of production factors in the urban and rural location between workers and peasants, inter industry. Therefore the development of industrialization and urbanization did not cause the agricultural recession and the decline of countryside. The industrialization of Chinese country is now in development, the urbanization level is also rising. It still needs support from related industries including agriculture. But it does not mean that it will impact the food security in China. Through analyzing the

relationships between industrialization, urbanization and food security, problems can still be found and got solved.

1. LITERATURE REVIEW

By reading the relevant literature, the literature will be divided into two aspects. The first is a study of industrialization, urbanization, modernization of agriculture and food security relationship, the second is to set the safety evaluation index of food security.

There have been studies on the research of relationship between industrialization, urbanization, agricultural modernization and food security. Li Yueyun thinks that the development of industrialization and urbanization, relevant to the needs of industry support, results in a large number of cultivated land. Attracting a large number of high-quality labor force to enhance the ability of food consumption. Zhu Zhonggui analyzed that the rural land industrialization, urbanization and agricultural structure adjustment results from non-grain oriented, proposed by protecting arable land to ensure food security proposal. Zhang Yongen and Zhu Qingquan argue that increased food demand of urban population, will become the main reason for growth in China's demand for food. They put forward the strict protection of arable land, which is expanding the scale of agricultural operation, strengthening the construction of grain storage and circulation system, improving the grain yield, and reducing food postpartum link loss and waste. Chen Zhuo and Jian Xiaofeng, through empirical analysis, finds out that there is a long-run equilibrium relationship between China's urbanization rate and food security. Although the process of urbanization results in reduced agricultural land, it greatly improves the efficiency of the use of land agricultural scale, and it also causes the continuous increase of grain. Zeng Jing presented the process of industrialization has changed the dietary structure, causing the urban population increases and an increase in demand for food bio-energy. All these threaten food security. Wang Yongpei, and Li Fengchun found that along with the strengthening of industry nurturing agriculture, through the elements redistribution, industrialization has a positive effect on the efficiency of agricultural production.

There are also many studies on the evaluation of food security. Zhu Zeshan used four indictors, which are the grain yield fluctuation rate, rate of grain reserves, grain self-sufficiency rate and per capita grain to explain variables. These four indicators have the same measurements. The coefficient of food security formula is $\lambda=\sum\lambda_i/4$, λ closer to 1, higher the level of food security gets. On Zhu Zeshan's index basis, Xu Fengxian added a new "security level of food security for low-income class". The calculation method is the same with Zhu Zeshan's index method. Ma Jiujie uses food and dietary energy supply and demand balance index, volatility in food production index, the ratio of grain reserves, grain coefficient dependence on international trade, food and food market price stability as indicators to measure food security. He uses the weighted average method. He sets different measurements of different indicators, as following: 0.3, 0.2, 0.2, 0.1, 0.1.The coefficient of food security formula is $\lambda=\sum\lambda_i\alpha_i$. λ is the evaluation index, α is the measurement of its corresponding. Liu Xiaomei also uses the weighted average method. She used the per capita grain, grain total output volatility, grain reserve rate and grain import rate as indicators. The weights are: 0.4, 0.3, 0.2, 0.1. In summary of above methods and others, Gao Fan sets 8 evaluation indexes from four aspects of food production, consumption, trade, and distribution. They are coefficient of fluctuation, per capita grain rate, the angel coefficient, poverty population, grain price rising rate, rate of grain reserves, grain self-sufficiency rate, food imports accounted for the proportion of the total import. The measurements are: 0.1, 0.2, 0.1, 0.1, 0.2, 0.1, 0.1, 0.1.

Although there are many studies of industrialization, urbanization and agricultural modernization and food security relations, most are relatively simple comparisons. Few studies compare their overalls. Therefore they can not accurately grasp the relationships between the four. And theoretical research is rich, the lack of empirical research is difficult to explain the interaction between the four elements accurately. In this paper, the research on the relationships between industrialization, urbanization, modernization of agriculture and food security, puts forward the policy to ensure food security alongside some policy suggestions.

2. THE EMPIRICAL ANALYSIS

2.1 Model Selection

In this paper, via multiple regression analysis, it analyzes the relationship between China's industrialization, urbanization, modernization of agriculture and food security. The regression model more than two explanatory variables is called the multivariate regression model.

$$y=b_0+b_1x_1+b_2x_2+\ldots+b_kx_k+u\ ,$$

y is the dependent variable, (j=0, 1, 2, …, k) as a model parameter, u is the random error term.

2.2 Select Indicators and Data Sources

In order to facilitate the data, we define the industrialization level of industrial value accounts for the proportion of GDP increased and note for IT. The level of urbanization is the urban population to total population, denoted as UT. Agricultural modernization level is represented by per capita agricultural machinery, denoted as AT.

Food safety (GT) is a comprehensive index. This paper selects four indicators, i.e. per capita grain, grain output fluctuation coefficient, grain reserve rate and grain import rate. The weighted average method is used after assigning the measured data. The weight of each index was 0.4,

0.3, 0.2, 0.1. Per capita grain (A) = total grain yield / total population. Grain yield fluctuation coefficient (B). X is the grain yield, x' is grain yield (five year cycle).Grain reserve ratio (C) reflects the ability of state regulation on food security. But there is no accurate data to be found. According to expert estimates the rate of our existing food reserves 1990s is an average of 34.8% annually since mid-1997, more than 40%. Food self-sufficiency ratio (D) = 1 - food imports / (grain production - grain net imports). The above data is resourced from "China Statistical Yearbook".

2.3 Correlation Analysis

Table 1 shows the relationship between the coefficient of food security and variables.

Table 1
Results of Regression Coefficient of Food Security and the Variables

Variable	Estimated parameters	*T* statistics	*P* value
C	-2.13	-2.66	0.017
UT	-2.64	-2.70	0.015
IT	0.40	2.39	0.029
AT	0.99	2.30	0.035
R^2=0.43 adjusted R^2=0.33		*F* value=3.8918	

As shown, the urbanization parameter estimation is -2.64, T value is -2.70, P value is 0.017. It is described in the urbanization at the 5% level is significantly negatively correlated with food security costs. Industrial parameter estimation value is 0.40, T value is 2.39, P value is 0.015, explained that the urbanization in the 5% level is positively related with food security. Parameters of agricultural modernization estimate is 0.99, T value is 2.30, P value is 0.035, explained in the urbanization in the 5% level was positively related with food security. The adjusted R^2 is 0.33, indicating that the general goodness of fit. The F value is 3.8918. At the 5% significance level, F value is greater than the critical value, indicating that the overall linear relationship between food security and the variables passed the test of significance.

2.4 The Empirical Results Analysis

From the empirical results, for Chinese food security, urbanization, industrialization and agricultural modernization not only promotes it but also inhibited it. Urbanization has a negative effect on food safety. Firstly, the process of urbanization is the process of rural population to urban. A large agricultural population changed to be non-agricultural population, attracting a large number of rural labor to urban employment population. It reduces the number of agricultural population. Secondly, the process of urbanization consumes water resource, land resource, and labor resource, therefore it occupies the resources needed for food production inevitably. Thirdly, the rapid development of urbanization causes a growing gap between urban and rural economies. Agricultural income growth rates are much lower than that of the urban residents, which result the farmers' enthusiasm lower than expectation. It makes the grain yield lower accordingly. Finally, for agricultural investment is insufficient, agricultural infrastructure is not guaranteed, so as to affect food production.

From the data shown, industrialization has a positive effect on food safety although a lot of people think otherwise. Cui (2011) and Li Yueyun believe that the development of industrialization, and urbanization increased the rigid demand of grain. The reduction of arable land, the lack of water resources and other reasons impacts the food production. Ceng (2012) thinks that industrialization promotes urbanization, and it increases the industrial use of grain. The industrialization level of China has been leading up the level of urbanization, and agricultural modernization. But with the development of industrialization, the balanced development between industrialization and agricultural modernization strongly becomes the focus of attention. The loss caused by the process of industrialization of rural labor on some level limited the labor needed for the production of food, but from another perspective, it improves the quality of labor, and changes the production concept. Meanwhile industrialization has changed the traditional mode of agricultural production. Investment in technology, mechanization, and intensive production greatly increased food production. With the increase of the intensity of industry nurturing agriculture, and tilt policy to agriculture, industry's role in promoting agriculture is gradually revealed. Food security has been a corresponding increase in the promotion of industrial development.

Raise the level of agricultural modernization is an important factor in ensuring food security. Firstly, raising the level of agricultural modernization liberates the labor. Mechanized operation largely replaced manual labor, improving production efficiency. The use of science and technology in agriculture has greatly increased food production, promoting food production intensification and scale levels. Secondly, in the industrialization, the urbanization of the rural labor forces dilution conditions and the level of agricultural modernization to make up for the shortage of agricultural labor force. It can be concluded that the level of agricultural modernization is directly related to food security, under the circumstances of less arable land, it is a key factor to improve the level food production.

3. POLICY RECOMMENDATIONS

3.1 Increase the Intensity of Industry Nurturing Agriculture

China's industrialization process has been running above the level of modernization of agriculture, which is the universal law of the industrialization process of all nations in the world. According to the development experience of developed countries, during the middle stage of industrialization, it begins the implementation

of industry nurturing agriculture in order to promote industrial development in agricultural development. China entered the mid-industrialization around 2005, the level of industrial development is enough to support agricultural development. To increase the intensity of industry nurturing agriculture, firstly the government led to raise funding, personnel and other resources for agricultural development investment to improve agricultural production capacity. Secondly, reduce the production cost. It is important to make full use of mechanical industrial development to promote the level of mechanization of agricultural production, popularize of agricultural machinery products and increase government subsidies for agricultural machinery carried. China uses the industrial development to improve the agricultural human capital of employees, guiding the human resource flowing to agricultural sector, increasing agricultural investment and employee training. To realize the agricultural production technology, China uses industrial development and technological progress to improve the technological content of agricultural production, and encourages technological innovation in agricultural production and promotes agricultural science and technology. On the other hand, it raises the food price subsidies, enhances food producing agriculture practitioners' enthusiasm for growing grain. Low agricultural income is one of the leading practitioners of the population decline of agricultural and low food production. Income gap between urban and rural areas increased the outflow of rural population. Ensuring food security, to a certain extent, must guarantee increasing agricultural income and reducing the gap between agricultural workers and other industrial workers' income.

3.2 To Promote Scientific Development of Urbanization

China's urbanization rates rapidly. Development of urbanization affects food security. But urbanization is inevitable. China has a large population, especially the rural population. Urbanization will still maintain a certain growth rate. Promoting scientific development of Urbanization and reducing the threat of urbanization on food security is the problems to be solved. First, make scientific plans to strictly protect arable land. We must intensify land using, improve land utilization levels and protect arable land. Second, strengthen the construction of small towns. It can attract urban rural reflux to raise the level of employment, income and living standard in small towns. The increased gap between urban and rural income levels is the root cause of the rural population to urban influx. Guiding the population back hand can protect agricultural population and alleviate the pressure of urban sustainability. Third, improve the social security system in rural areas, so that rural and urban can both enjoy the same social security. Guarantee the basic livelihood of the rural so that farmers can grow grain without pressure.

3.3 Raise the Level of Agricultural Modernization

Compared with industrialization, urbanization level, modernization of agriculture and food production is most closely associated. The traditional mode of agricultural production is far from meeting the food needs of China's development. Agricultural modernization level influences the efficiency of agricultural production directly, and it is the key factor that impacts food security. Frist, to improve the level of agricultural modernization, China must strengthens the agricultural infrastructure investment, and realizes the mechanization of agricultural production using the profit of industrialization and improving agricultural equipment's to promote the production efficiency. Second, increase investment in science and technology in agricultural production, for example, use scientific methods in production, improve varieties of crops to improve crop yield, in order to increase the agricultural human capital investment. Because of the agricultural workers' essentiality to agricultural development, China must makes the urbanization of agricultural personnel transfer opportunities to improve the quality of labor and increase the investment of agricultural workers, scientific training, and technical guidance, so that it can meets the requirements of agricultural modernization on labor quality. Finally, China must raise the income level of farmers. To improve the level of agricultural modernization, it depends not only on the state of this policy or industry nurturing. It falls on the farmers themselves to enhance the level of agricultural modernization. Only with increased income, can they have enough capital to implement renewal, execute mechanization, increase the use of fertilizer, and bring in advanced technologies and methods. Thus, increasing the income of farmers, narrowing the income gap between urban and rural areas are both very important.

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