

## Research Article

# Analysis and Prediction of Chinese Medium and Long Term Total Demand of Grain and Economic Structure

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**Abstract:** With the advance of China's urbanization, industrialization accelerated and extensions of agricultural, our grain demand changes, then it has a important sense for the forecast of total food demanded during 2014 to 2030 involves China's food security, social stability and rapid development. In this study, we use time series model to forecast the rural and urban residents' per capita food consumption in China during 2020 to 2030, then we combines it with population growth and urbanization-related data of the total food demanded to forecast Chinese total demands in 2030. The results showed that the total demand of food has an increasing trend, as it in 2030, the total grain demands was 627.5 million t, food consumption will be reduced and fodder grain consumption will continue to increase. According to this study, we have analyzed the factors affecting changes in demand for food and it came the result that the food demand is influenced interaction with China's economic structure.

**Keywords:** Changes in the structure of demand, economic structure, food demand forecast

## INTRODUCTION

Since the 21<sup>st</sup> century, China's economic development is sustained and rapid increase and urban and rural incomes continuous improved, meanwhile people's living standards rises and the demand for food is increasing. At the same time, economic restructuring, demographic change and climate change but also on factors such as food security presents new challenges. To have a long-term forecast in China's total demand and having a strategic response according to the demand for food is an important measure to ensure national food security, food is the people's livelihood and national economic security of important strategic materials, but also the people's basic subsistence, because China has many people but less region, basically stable yield of agriculture production and modernization are not too high, so food security and social harmony, political stability, sustained economic development is even more closely.

Food consumption structure (Yan *et al.*, 2013; Li, 2014) of China showing the transformation of food and lothing to the overall well clear trend, total food consumption continue to grow, the proportion of high-quality food consumption is rising rapidly. With the improvement of people's income level, the income elasticity of demand for high-quality progressive increase in the number of agricultural consumption. This stage is not only high-quality production and having an increase in the consumption of rice and wheat, but also having a substantial increase in the consumption of animal foods and meat, eggs, milk and other rapid rise to the scientific transformation of grain

and other foods to the development of safe, high quality, nutrition direction. Chinese per capita calorie, protein and per capita daily intake of fat has been close to the level of moderately developed countries and regions, some cities even has reaches an average level of developed countries and regions. Changes in food consumption volume and structure marks diet of Chinese residents has entered a critical period of transition to a well-off society.

The proportion of Chinese population accounts for close to one-fifth of the world's total population, while the continuous progress of China's urbanization (Lin *et al.*, 2013), the total demand for food is bound to gradually increase, which requires the total demand for grain to make timely and reasonable prediction, which guarantee our food security (Hu and Liu, 2013) and promote stable economic development has more important practical significance.

## MATERIALS AND METHODS

So far, there are two types (Mi *et al.*, 2013; Sun, 2012) of the prediction method of total food demand, one is classified according to the demand for food, that is food rations, fodder grain, seed industry and the industrial use of grain by grain, etc., forecast for each food demand, finally summing the predicted value of total food demand; Second, by building interal relations of per capita income and per capita food consumption, taking into accout demographic changes and changes in the total level of per capita income and then calculate the amount of future food demands. According to composition of Chinese demand for food, forage grain

Table 1: Rural residents' per capita food consumption and year regression equation

	Food	Poultry	Pork	Eggs	Aquatic products	Beef and mutton
Year square	-0.166*** (-17.09)	0.0022*** (7.53)	-	-0.0008* (-1.77)	0.0007* (1.73)	-
Year	3.94*** (11.2)	0.041*** (3.62)	0.249*** (13.365)	0.178*** (10.278)	0.125*** (8.469)	0.033*** (15.221)
The constant	239.395*** (90.431)	0.338*** (3.969)	6.752*** (18.101)	0.403*** (3.068)	0.522*** (4.651)	0.399*** (9.32)
R*R	0.961	0.985	0.8995	0.9756	0.983	0.8785

Table 2: The year of urban residents' per capita food consumption and the regression equation

	Food	Poultry	Pork	Eggs	Aquatic products	Beef and mutton
Year square	0.0865*** (4.68)	0.008*** (3.46)	0.0084*** (2.83)	-	-	-
Year	-5.517*** (-9.14)	0.0155 (0.21)	-0.1784*** (-1.911)	0.1723*** (9.15)	0.2684*** (12.608)	0.0541*** (7.371)
The constant	239.395*** (39.15)	0.338*** (4.931)	6.752*** (26.358)	0.403*** (18.49)	0.522*** (15.62)	0.399*** (17.15)
R*R	0.934	0.8904	0.454	0.7442	0.8549	0.6513

In the above two tables, the t value in ( ), \*\*\*, \*\*, \* represent 1%, 5%, 10% level

demand continues to grow, the demand for food rations declining, while the seed industry and the industrial use of grain for the change is not obvious. Therefore, this study uses time series methods to make the first analysis of the total demand for grain in year period 2014 to 2020, combined it with per capita food consumption, verify the intrinsic link in per capita food consumption of rural and urban residents and time series. By predicting short-term food demand in 2014-2020, to ensure steady growth in 2020-2030 urbanization rate and the demand for food rations at a constant rate of grain amount in accordance with a constant rate of rise of the premise, to further analysis and forecast of Chinese total demands from 2020 to 2030 (Li *et al.*, 2012; Wu and Zou, 2011).

**Materials:** The data materials from this study mainly chosen from Per capita consumption data in urban and rural in <Chinese Rural Statistical Yearbook> and <Chinese statistical yearbook> Rural residents per capita food consumption data selection is 1978-2012 data while urban per capita residential food consumption data selection is 1981-2012 data.

**Methods:** For food consumption forecast of our country is mainly based on the time series of rural and urban residents' per capita food consumption. In order to analysis of rural and urban per capita food consumption results, firstly, establish the per capita food consumption and year regression model of rural and urban residents, then consider the significant level fitting degree of various models and the corresponding time variables at the same time and choose the appropriate regression equation finally.

## RESULTS AND DISCUSSION

Rural residents' per capita food consumption and year regression equation results in Table 1 and shown in Table 2.

We can analyze and forecast in per capita food consumption of rural residents during 2014-2020 according to the results of regression analysis of

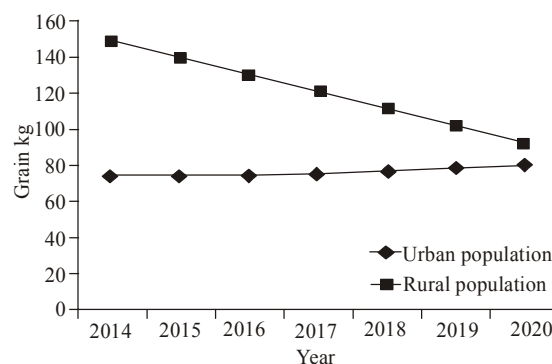


Fig. 1: The prediction of per capita grain consumption of rural and urban residents from 2014 to 2020

Table 1. The result is shown in Fig. 1. The result shows that rural residents' per capita food consumption levels will drop but animal consumption will rise during 2014-2020 years. And by 2020, per capita grain demand of rural residents is 93.12 kg while aquatic products, eggs and poultry consumptions will increase to 7.38, 6.65, 6.55 kg, respectively and price changes of pork, beef and mutton will not be obvious. According to the results of regression analysis of Table 2, urban residents' per capita food consumption results during 2014-2020 years show that food demand will increase. The reason probably is that there will be substantial increase in the level of urbanization in our country and the transformation of the rural population to the urban population leads to leads to the urban population increase. By 2020, urban residents per capita grain demand will be up to 80.89 kg compared to other consumer goods consumption of poultry growths highest which will be up to 16.10 kg. Pork and aquatic products in 2020 will respectively increase to 24.59 kg and 16.53 kg and price changes of beef and mutton will not be obvious. The analysis above shows the change of residents' food consumption structure during 2014-2020 and the demand for food can be transformed into grain demand.

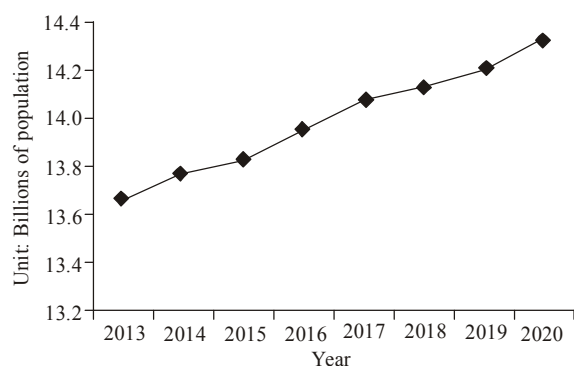


Fig. 2: Population situation in our country from 2014 to 2020

According to China Statistical Yearbook 2013, we can tell Chinese population in 2012 was 1.354 billion and refer to Fig. 2 and relevant literatures; we can predict our urbanization rate would be 65% by 2020. So, if we consider the population increments are the same in each year and the urbanization level stays stable, the annual population increment during 2013 to 2020, is 9.25 million and the urbanization rate increase by 1.45% annually; in 2012, the rural population and urban population of our country were 642 million and 718 million respectively, the urbanization rate was 52.57%. On the basis of the content above, we can predict that our total population, by 2020, will be 1.433 billion and thus by 2030 China's population will be expected to reach 1.596 billion. The urbanization rate will reach 70%, the rural population will decrease and the urban population will increase provided that China's urbanization is at a moderate rate of growth. We can make such an assumption: The growth of Industrial use of grain is at an annual average rate of 0.4 percentage points and the growth of feed grain demand is at an average annual growth of 0.3 percentage points during 2014-2020. However, the growth of Industrial use of grain is at an annual average rate of 0.25 percentage points and the growth of feed grain demand is at an average annual growth of 0.15 percentage points during 2020-2030. We can make such a predict according to the assumption that by 2020, food gross domestic demand is 6,030,400,000 tons and the average annual growth rate of 7,000,000 tons from 2014-2020. Ration consumption will decrease 670,000 tons per year, declining 0.68 percentage points a year. Feed grain will grow with an average annual growth rate of 4,280,000 tons and the industrial use will grows at an average annual growth rate of 3,360,000 tons. We can make a conclusion according to the assumption above that in 2030 the total domestic food demand in China will reach 627,500,000 tons among which ration proportion will decline to 37.33%, feed grain proportion will rise to 39.98%, Industrial grain proportion reached 21.22% and Industrial use of grain will reach 128,000,000 tons. The per capita grain demand in 2020 will reach 409 kg

and in 2030, the per capita grain demand will reach 419 kg.

All in all, the total demand of grain in China will continue to increase and per capita food consumption will tend to be stable. Ration consumption will decrease but feed grain consumption will increase. Urban residents' rations and forage grain demand will be increased but rural residents rations and fodder grain will decrease.

### ANALYSIS OF THE FACTORS INFLUENCING GRAIN DEMAND

Population growth and industrialization, urbanization promotes the development of the consumption structure improvement. Agricultural function extension and grain price relations are the main key influence factors of grain consumption in China (Zhou and Li, 2010). Food demand changes by the impact of economic factors in the price and China's economic structure system has decided our country urban and rural binary food demand system. Concrete analysis is as follows.

**The population increase leads to food demand expand:** Provided that in 2020 China's population is 1,425,000,000 and in 2030 China's population is 1,596,000,000. So ten years of China's population increases by 170000000 and the increase of population will lead to increased food demand (Xiang and Zhong, 2013).

**The food consumption structure improvement will make the feed grain demand increase:** China's economic structure between urban and rural areas is binary structure model and China's food demand is also showing the urban and rural binary characteristics. The concrete performance is as follows: The first is rural residents per capita consumption of grain ration of grain is significantly higher than that of city residents while ration consumption trend of change lags behind the city residents. The second is rural residents animals consumption is lower than that of city residents. The third is urban and rural residents' consumption behavior is different. Urban residents buy food mainly in markets while rural residents often provide food for themselves and changes in their food consumption don't affect the grain market and other consumers. Binary food consumption structure of urban and rural areas leads to the grain supply and demand in the market. According to "Chinese Statistical Yearbook", over the past ten years, pork, beef and mutton, poultry, eggs, aquatic products consumption have been increased every year which shows that China's food consumption in food meat conversion, grain growth rate against the meat, eggs and so on growth rate. So the grain structure will be improved and feed grain demand will increase, too.

**The development of urbanization will reduce the grain ration consumption:** Along with our country to vigorously promote the process of Urbanization, the income levels of residents' increases continuously, the income elasticity of food consumption begin to decline and the react from consumption of food to residents' income becomes blunt. Rations consumption reduce, aquatic product consumption increase and pork, beef and mutton, poultry consumption will be gradually stabilized. According to statistics, In China after 2003, Rations consumption is lower than the non food rations consumer demand. Feed grain has exceeded 1/3 and industrial use of grain exceeded more than 1/10. Pushing forward the process of urbanization will affect the food consumption structure. Chinese residents will use non food rations instead of food consumption, so Rations consumption will decrease.

**Extension of agricultural function improves the industrial gain demand:** In recent years, demand of China' industrial grain has a sharp rise and the proportion of consumption has also increased significantly. Industrial grain includes brewing grain, starch grain, soybean crushing and grain for fuel ethanol and so on. Currently, brewing grain has been the largest proportion of industrial grain. Soybean crushing has the constant increasing. Other types of industrial grain also are in with the rising industrial development. With the extension of grain industry chain and development of biomass energy industry, processing food grain demand will increase in the proportion of 3% and is expected to reach 50 million t in 2030.

**Interaction between grain demand and market price:** Under the market mechanism, changes in grain demand will affect the changes of grain price. Consumption of food and non-food alternatives will also affect grain demand. Long-term demand of grain ration has low sensitivity to changes in market price. Emergencies may have short-term effects on grain demand of residents. In China, changed in grain price will be amplified on account of the convergence behavior of dispersed farmers and price psychology in grain merchants and consumer. When in short supply, grain price will go up. But in the long run, grain price will not have large floating.

## CONCLUSION

This study was based on the per capita food consumption data of rural residents in 1978-2012 and per capita food consumption data of urban residents in 1981-2012. Then, use time sequence model to calculate the per capita food consumption data of both rural

residents and urban residents in 2011-2020. After that, combine with the population growth and development process of urbanization in China to get the further analysis of residents' total grain demand in 2020-2030. Results showed that China's total grain demand in 2030 would reach to 627.5 million t. Grain demand structure will change, demand of grain ration will go down, demand of feed grain will rise, changed of seed grain will not be too obvious and industrial grain will have a sharp rise. At the end of this study, use the principle of economics to analyze the impact factors of China's food demand changes. Population growth, industrialization and urbanization will promote the improvement of consumption structure, extend of agricultural function and perfect the grain price. Hence, China' grain demand will affect the economic structure changes, changes of economic structure also react on grain demand.

## REFERENCES

- Hu, Y.M. and Y.S. Liu, 2013. Food security in China: Dimensions of value and strategic choices. *Economist*, 5: 50-57.
- Li, X.L., 2014. The development trend of China's food consumption. *Heilongjiang Food*, 5: 35-36.
- Li, Z.Q., J.Z. Wu and D.J. Wang, 2012. Change analysis and demand forecast of grain consumption in China. *Food Nutr. China*, 18(3): 38-42.
- Lin, X.Q., D. Wang, W.B. Ren and Y.F. Liu, 2013. The mode of action of urbanization to economic development in China. *Geogr. Res.*, 32(4): 691-700.
- Mi, J., Q.Y. Luo and M.J. Gao, 2013. A review on food demand forecast methods. *J. China Agric. Resour. Regional Planning*, 34(3): 28-33.
- Sun, B.M., 2012. System and model design of predictive index on grain supply and demand in China. *Econ. Prob.*, 3: 39-43.
- Wu, L. and W.T. Zou, 2011. Current situation, trends and countermeasures about China's grain consumption. *Res. Agric. Moderniz.*, 32(2): 129-133.
- Xiang, J. and F.N. Zhong, 2013. Influence of population structure changes on future food demand: 2010-2050. *China Popul. Res. Environ.*, 23(6): 117-121.
- Yan, Y., Z.D. Wang and L. Zhuo, 2013. Investigation of current situation, influence factors and trend of China's food consumption. *J. Anhui Agric. Sci.*, 41(35): 13775-13777.
- Zhou, H.Q. and Z.X. Li, 2010. *Economics of Food*. Sci Press, Beijing, 1: 143-144.