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Recognition on the Food Security Strategy in China from the Perspective of Industrial Chain

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Abstract: Chinese agricultural production is facing with “ceiling” effect of high price and “floor” effect of high cost. The new food security strategy is an important principle to firmly grasp the initiative of food security in “China’s New Normal”. From the industrial chain perspective, the food security in our country is facing with overproduction, inefficient supply, serious consumption and other problems, which is also a concentration of structural contradictions in the supply-side. Therefore, in order to deal with “elements constraint”, “quality constraint”, “benefit constraint”, and “right constraint” faced by China's food security in the current and future periods, China should strive to strengthen the expansion of potential and innovation-driven, optimize the structure and regional distribution, stock adjustment and incremental optimization and take the initiative to participate in food industry international cooperation. With building food security industry chain development model, the grain industry can be effectively promoted and a higher level of national food security system can be established.

Keywords: Industry Chain, Food Security Strategy, Policy Optimization

1. Introduction

Food security is an important cornerstone for national survival and development, and is the indispensable part of protecting national security. Since 2013, China implemented the new national food security strategy which clearly put forward to ensuring that the basic self-sufficiency and absolute food security, the new goal of national food security. The main content is to coordinate the contradiction between the grain as private property and safety as the public property, which distinctly appears in the fields of production, consumption, circulation, and trade [1]. With global warming, international grain price's fluctuation and other multi-dimensional environmental changes as well as the deep-seated contradictions accumulated by extensive management of long term grain production, the situation with highly grain purchase and stocks is in a certain period of time. China's grain production is facing with major challenge of higher prices and subsidies, the ecological environment and resources, which will not only endanger the current and future national food security, but also endanger the quality of agricultural products and safety of ecological security. Therefore, it’s urgent to actively promote the structural reform of the supply of the food industry, actively construct the whole industry chain development model, make up obvious short board influenced the development of grain industry, in order to promote the optimization and upgrading of grain industry structure, and enhance the competitiveness of industrial market.

At present, the development of the whole industry chain has become the most competitive industrial model in the process of agricultural modernization. In the pattern of the international grain market, United States ADM (Archer Daniels Midland), United States Bunge (Bunge), United States Cargill (Cargill) and France Louis Dreyfus (Louis Dreyfus) as the four largest representatives of grain dealers in the world, actively develop the whole industry chain. They try to create an operation mode of "planting + circulation+ trade", so that the downstream chain can be closely docking, and complement advantages in different aspects, which to show synergistic effect, and realize the supervision and management of the whole industry chain, thereby they can continuously impact the domestic grain market. As to domestic aspect, the study on the grain industry chain can be traced back to the industrial division, the horizontal appreciation and the connotation

development. For example, Li [2] analyzed the influence of grain industry chain on security of grain circulation in China from three aspects, such as separation of food production and consumption, separation of production and circulation, separation of circulation and consumption. He also advised to promote mergers and acquisitions of grain enterprises, and develop large grain enterprise groups and modern grain circulation industry, to develop grain industry chain in China and to ensure the safety of grain circulation by strengthening the food industry chain from two aspects. Ma [3] quantitatively analyzed the significant differences in the efficiency of labor division in food industry chain, and pointed out that Henan, Liaoning, Inner Mongolia and Tianjin had the highest comprehensive efficiency in the food process. Sun [4] put forward the opinion from the perspective of industry chain of China's grain price vertical transmission effect, and suggested that market structure, government intervention and the imbalance of supply and demand can effectively explain the phenomenon of asymmetric transmission in short and long term. Therefore, in the new national food security strategy framework, how to coordinate with grain production and consumption, purchasing and storage, product structure and regional differentiation, circulation management and international trade and other aspects, as well as the deep-seated contradictions in different areas, and establish a unified, complete industry chain development model including food production, consumption, circulation and trade, is urgent to solve the problem of agricultural supply-side structural reform, and it's long-term policy to ensure the country's food security from global and strategic consideration.

2. Analysis on the Present Situation of Grain Industry Chain in China

2.1. Impacts on Crop Yield and Production

From 2004 to 2015, China crop yield has increased for the 12th year in a row, while the total yield appears in negative growth for the first time in 2016. Specifically, China's grain output in 2003 was only 430,695,000 tons, increased to 621,435,000 tons in 2015, which increased by 190,738,000 tons in twelve years, with an average annual increase by 15,895,000 tons, and an increase by 2.6%. In 2016, the total crop yield was 616,239,000 tons, decreased by 5,196,000 tons, 0.81% compared with in 2015. Among them, rice, wheat and maize as the representative of grain production had 374,287,000 tons in 2003, increased to 572,253,000 tons in 2015, an average annual increase of 3.0%. Cereal production in 2016 showed negative growth for the first time, reaching 565,165,000 tons, decreased by 708,800 tons, a decrease of 1.22% compared with 2015 (Figure 1). Especially in the context of the new economy, this slowdown will exist for a long time, in addition to the rigid demand by the population, but also by resources, climate, technology, efficiency and other factors. Among them, the impact of climate change has become increasingly prominent, and in the absence of extreme climate disasters, the impact of climate change on China's grain production has both positive effect and negative effect (Table 1).

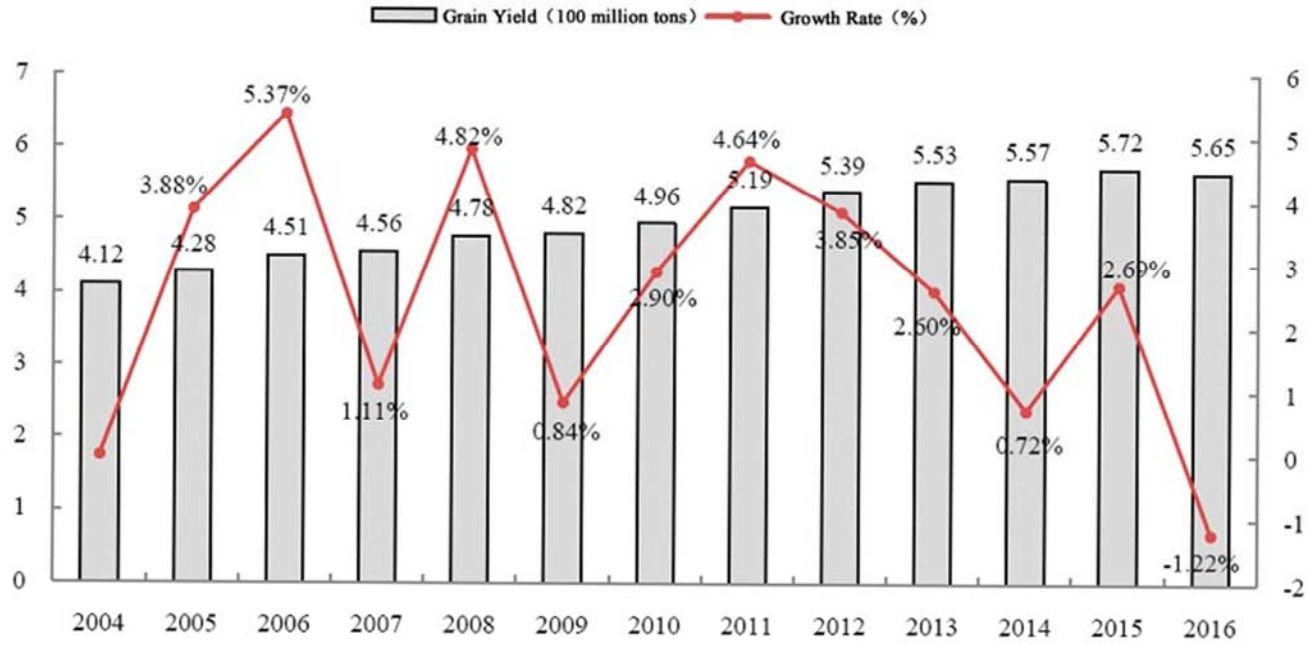

Figure 1. *The crop yield (100 million tons)in 2004-2016 in China.*

Table 1. *Summary on impacts of climate change on crop yield in China.*

Study area	Crop	Period	Impacts on yield	References
Positive impacts				
China	Wheat	1990-1999	Climate→Yield(↑)	Xu et al.[5]
Henan	Wheat	1971-2004	Temperature(↑)→Yield(↑)	Chen et al.[6]
Tianjing	Wheat	1979-2002	Temperature↑(1°C)→Yield↑(4.2-12.0%)	Tao et al.[7]
China	Rice	1951-2002	Climate→Yield(↑)	Tao et al.[7]
Ningxia, Heilongjiang, Liaoning, Anhui, Jiangsu, Henan, Zhejiang, Fujian, Guangxi, Guangdong, Hubei	Rice	1981-2005	Temperature(↑)→Yield(↑)	Zhang et al.[8]
China	Maize	1980-2008	Precipitation(↑)→Yield(↑)	Zhang and Huang [9]
Heilongjiang	Maize	1981-2000	Temperature(↑)→Yield↑(271.1Kg per hectare per year)	Tao et al.[10]
Negativeimpacts				
China	Wheat	1979-2002	Climate change→Yield(↓)	Tao et al.[7]
Jiangsu	Wheat	1979-2002	Precipitation(↑)→Yield(↓)	Tao et al.[7]
China	Rice	1990-1999	Climate→Yield(↓)	Xu et al.[5]
Anhui, Tianjing, Shandong, Henan, shanxi, Shaanxi, Sichuan, Guizhou	Rice	1981-2000	Temperature(↑)→Yield(↓)	Zhang et al.[8]Tao et al.[10]
Hebei, Jiangxi, Sichuan, Shaanxi	Rice	1980-2008	Max temperature(↑)→Yield(↓)	Zhang and Huang [9]
China	Maize	1979-2002	Temperature(↑)→Yield(↑)	Tao et al.[7]
China	Maize	1980-2008	Temperature(↑)→Yield(↓)in half provinces in China	Zhang and Huang [9]

2.2. Impacts on Grain Consumption

From 2004 to 2015, China's grain self-sufficiency rate has been maintained at more than 95%, basically achieved self-sufficiency. Take three main grains as an example, the self-sufficiency rate of rice was more than 99%, and the self-sufficiency rate of wheat was more than 98%, and the self-sufficiency rate of maize was more than 101% (Figure 2). However, with the development of economic society and the proportion of middle-income people, the food products are being more diverse, which made demand for processed food and other high value-added products constantly increased. The more expensive and high added value of the high-end consumer level of agricultural products will further replace the low consumption level of primary agricultural products. The consumption of meat, eggs, milk and aquatic products has grown steadily in urban and rural areas, partly replacing traditional grains such as wheat and rice. At the same time, feed and food processing and other non edible agricultural products consumption will continue to maintain growth momentum in a very long period with livestock products and advanced agricultural products demand growth. At the same time, the non Chinese traditional food also increased with the rise of their living standards, the demand elasticity of such products is larger, but the growth trend is obvious.

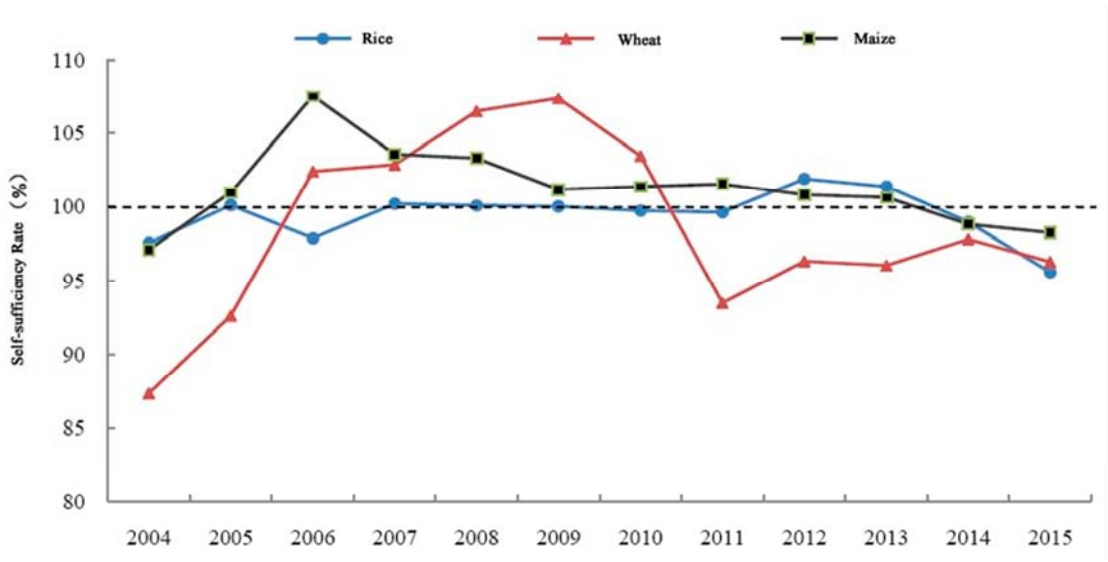

Figure 2. *The rice, wheat and maize self-sufficiency rates in 2004-2015 in China (%).*

2.3. Impacts on Grain Circulation

Since the 1980s, with the development of industrialization and urbanization, the pattern of grain production and consumption has been adapted to the requirement of efficient use of resources, and there has been a situation in which production is more concentrated, production and marketing are

more differentiated regional and structural contradictions of grain supply and demand are more highlighted. Due to a substantial reduction in grain sown area in some developed coastal provinces, the rapid development of aquaculture, and the influx of labor, the surplus or self-sufficiency state gradually becomes the main grain sales area. The nationwide grain production presents a trend of "constant northward" and "central concentration". From the provincial grain production, Heilongjiang province is the largest, followed by Henan, Shandong, Jiangsu, Sichuan, Anhui, Hebei, Hunan, Jilin; etc. From the market turnover, Shandong province is the largest, followed by Zhejiang, Henan, Jiangsu, Guangdong, Shanghai, Tianjin, Jiangxi, Beijing, Hebei; etc. From the production area and trade structure, the main grain production provinces are basically concentrated in the north of China, and the grain trade is mainly in Shanghai, Guangdong, Jiangsu, Zhejiang, Jiangxi and other southeast coastal provinces, in addition to Shandong Province, Henan Province, Beijing, and Tianjin city. The phenomenon that "shipping grains from the North to the South" has become the main channel of grain circulation in China (Figure 3). However, because of the lag of China's grain market and logistics system construction, humble grain storage facilities, various circulation and removal links, the grain circulation efficiency needs to be improved. In 2014, the country has 165 million tons of inter-provincial transport grains, provincial bulk grain only accounted for 25%.

2.4. Impacts on Grain Trade

Since joining the WTO in 2001, China has gradually opened up the market of some agricultural products on the basis of insisting on the self-sufficiency of important food products, which made the amount of trade in agricultural products increased significantly, the total import and export of agricultural products increased from $51.60 billion in 2004 to $186.100 billion in 2015, an average annual growth rate of up to 13.2%. And since 2004, China's agricultural products began to appear a net trade deficit, and showed an increasing trend year by year, the trade deficit expanded from $4.880 billion to $45.740 billion in 2015. Moreover, with the increase of domestic production resource constraints and the strong growth of domestic consumer demand, the import volume of some major agricultural products has increased significantly in recent years, the import dependency increased from 7.8% in 2004 to 13.5% (Figure 4). At the same time, the net exports of rice, wheat and maize, respectively changed from of 2.348 million tons, 2.67 million tons, 16.4million tons, into a net import of 3.9 million tons, 2.885 million tons and 4.719 million tons; net imports of soybean expanded from 20.474 million tons to 81.694 million tons, an increase by 300%. And in 2015 self-sufficiency rate of soybean was only 11.9%.

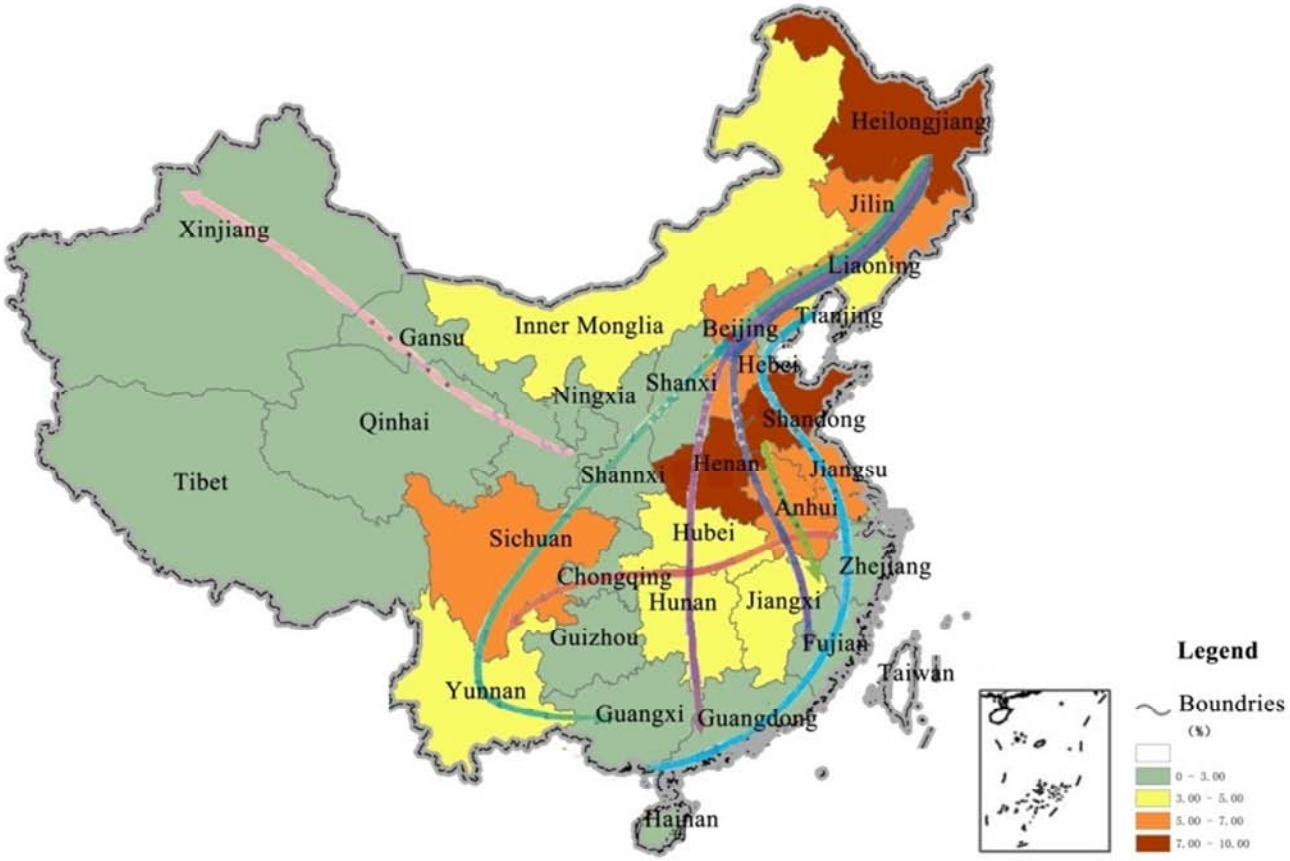

Figure 3. *The logistics channels of grain circulation and provincial crop yield proportion (%) in 2016 in China.*

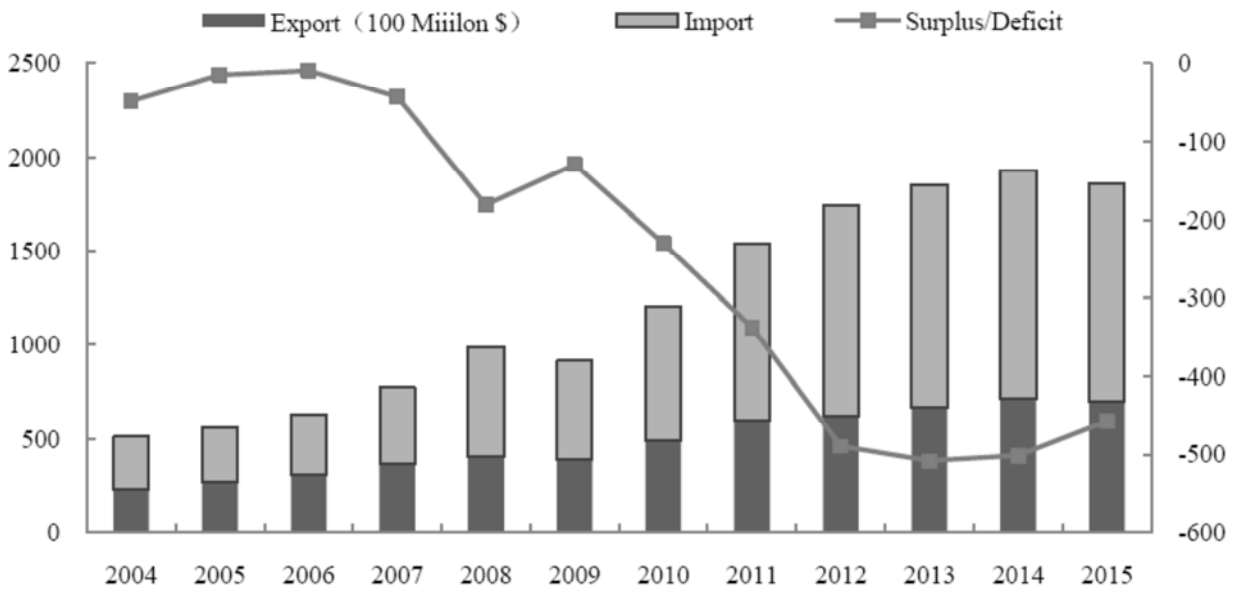

Figure 4. *The agriculture trades in 2004-2015 in China (100 million $).*

3. Multiple Constraints That China's Food Security Faced from the Perspective of Industry Chain

3.1. The Constraint of Agriculture Production Inputs

Crop production is closely related to land resources, fertilizer inputs, irrigation, economic-social capital and technical progress [11]. On the one hand, with the increase of input of productive factors, such as chemical fertilizers, pesticides, and so on, it has led to the rapid depletion of a large number of productive resources, and even overdraft. China has 22% of the world's population, but only account of about 7% of the world's land, and the cost of food production at the expense of the use of accounting for about 35% of the global nitrogen resources and about 70% of the world's available water resources. In addition, the amount of fertilizer is 2 times much than upper limit that applied by Food and Agriculture Organization of the United Nations (FAO), which is about 2.5 times as much as the global average per unit. As such extensive way led by huge input of energy and resources not only increased the cost of energy, resources and other elements, which made the economic benefit reduced in the grain growth process, but also seriously damaged the long-term survival and development of agricultural resources and environmental support, which had a great threat to crop production in the long term. On the other hand, driven by economic interests, rural labors are being out flowed, and the weakness of agriculture is highlighted. The weakness of agriculture, not only determines the background that market profit decides allocation of resources, the existing conditions of agricultural production continued to actively attract external quality factors of production scale of investment, but also is difficult to take measures that prevent the rural labor force, agricultural capital, rural land and other basic factors out flowed [12]. Therefore, it is difficult to select qualified agricultural manager, and to achieve with the development of labor productivity.

3.2. The Constraint of Agriculture Production Quality

With the improvement of people's living standard and the acceleration of new urbanization, the consumption demand of agricultural products is changing rapid significantly. Food security is not only reflected in the quantity, but also in the quality. In recent years, food security incidents in China came into multiple phase, drainage oil, tonyred, tainted milk, cadmium rice and other food security problems emerged in a wide range of areas, related to all aspects of agriculture, agricultural products and food processing and distribution. The food security crisis has become increasingly prominent, partly because of the improvement of living standards, gradual strengthening of food security consciousness, requirement on food quality and increase of public concern, as well as the pursuit of high quality, green and healthy food. On the other hand, the rapid growth of consumer demand has driven the rapid development of agricultural products, food production and processing industry. However, due to the restriction of production conditions, the lag of detection technology, the imperfect of supervision system, and the avail of punishment mechanism, especially with the increasing threat of agricultural ecological security, agriculture and rural areas are facing increasingly serious ecological problems, agricultural pollution accounted for about 1/3 of the country's total pollution, about 1/6 of the land is contaminated by heavy metals, which made heavy metal pollution up to 12 million tons each year, resulting in direct economic losses up to 20 billion. In addition, some for the pursuit of high yield, used excessive of chemical fertilizers and pesticides in agricultural production, which caused serious pollution and residues problems. Thus the quality of agricultural products declined, fundamentally threatened food security, as well as endangered our health.

3.3. The Constraint of Agriculture Production Benefit

Firstly, the agricultural comparative benefits continued to decline. Although in recent years in order to encourage farmers to grow the grain crop, the government has issued a package of preferential agricultural policies and the central document focus on the development of agriculture for the thirteen consecutive years. With the acceleration of the process of urbanization and the frequent occurrence of "labor shortage" phenomenon, the income of migrant workers is increasing, especially the prices of chemical fertilizer, pesticide and other production materials are rising, which greatly led to rising food prices and promoting dividend policy. Thus it resulted in agricultural comparative benefit continued to decline. Similarly, for many major grain producing counties, they are also facing a very embarrassing situation, which put a lot of manpower and material resources, but the profit obtained from production was very low. Secondly, the existing rural social governance structure will face a profound transformation. With the decline of population birth rate and the acceleration of the aging population, the traditional demographic dividend will gradually disappear. What's more, in the current situation, the transfer of rural labor force is capable of rural labor, not the so-called surplus labor. It is precisely the current rural labor resources needed. Therefore, it is faced with labor shortage, rural hollowing, rural aging; and children, women, and elderly left behind in rural areas which is to a large extent exacerbated the difficulty of protecting national food security, realizing agricultural progress, increasing incomes and building rural beauty. At the same time, due to the impact of China's traditional farming culture and imperfect of rural social security system, it's difficult to carry out rural land circulation, and develop appropriate management, especially in under development agricultural areas. Thirdly, the subject of the grain market is not standardized, the reform and development of state-owned enterprises is lagging behind. State owned grain enterprises occupy a relatively monopoly position in the grain circulation, and the reform is sluggish, so they can't effectively respond to market signals and even take decisions. However, the private enterprise which can react sensitively to the market signal and even the government decisions is still immature, and is still in the stage of constant adjustment.

3.4. The Constraint of Agriculture Production Rights

On the one hand, foreign capital involved of the food industry chain, making the existing food industry received the shock to a certain extent, resulting in a change in the current competitive landscape. As early in 2008, the World Trade Organization regulated foreign capital involved in the field of China's grain circulation has ended. Therefore, for foreign capital, they can legally participate in the domestic food enterprises for crop production, sales and processing, food circulation and foreign trade industry chain operations. Transnational food management institutions not only had a solid foundation of funds, but also had built a global trade marketing network, and accumulated the world's well-known brand effect for many years, for example, the United States ADM, the United States Cargill, the United States Bunge and France Louis Dreyfus as the representative of four famous multinational grain merchants, who controlled about 80% of the global share of international food trade. In this way, to a large extent, they exacerbated the domestic food processing and circulation of the fierce competition. What's more, in the background of the trend of financialization, the grain has connected with the oil and the dollar, which had the dual attributes of commodity and financial, and became investment products that foreign capital vied for the profit of. Foreign companies with strong capital, advanced management mode, marketing network and other competitive advantages developed into the domestic food processing field, which will result more foreign markets continued to be occupied, and the formation of grain industry monopoly, that will cause serious threat to Chinese food security. On the other hand, the international grain price is high and volatile, and to steady the domestic grain price is more difficult. FAO and the Organization for Economic Cooperation and Development (OECD) pointed out that in the next ten years, world food prices showed rising trend as a whole. Comprehensive consideration of the world's food supply and demand, energy price fluctuations, such as the superposition of multiple factors, as well as enhancing of China's ability to participate in the international labor division, the international and domestic market is more closely linked, the volatility of international food prices not only directly affect China's grain trade surplus, but also produce linkage effect on the domestic food price volatility. Since 1996, the trend of international food price fluctuations is basically the same as the domestic. Therefore, in the effect of high international grain price and price violent fluctuation, it's more difficult to reach the goals that keep that grain price steady.

4. Conclusion

The food security in the new period in China is facing many challenges, including lack of grain market operation power, imbalance of supply and demand structure of grain varieties, the needed improvement in grain storage system, and the gradual appearance in multiple attribute of grain. So promoting the food supply-side structural reform has become an important point for the future of China's grain security strategy. Therefore, from the perspective of industry chain, actively promoting the whole food industry chain including crop production, warehousing, logistics, processing and trade is helpful to further promote the reform in supply-side structural and to increase the green quality supply of agricultural products.

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