

Exploring the Path of China's Grain Import Security under RCEP Framework -Analysis Based on HHI Herfindahl Index

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Abstract. At present, China's agricultural imports are highly concentrated and international relations are complicated. In order to further exploit the important role of imports in China's food security, stabilizing market supply, reducing resource and environmental pressure, and promoting agricultural industry reform. Based on the Asia-Pacific region, this paper analyzes the feasibility of forming a diversified pattern of agricultural imports between China and RCEP member countries. The Herfindahl index is used to analyze the concentration of China's agricultural imports, and the trade basis and actual data of China's agricultural trade with RCEP member countries are combined to assign scores to the recommended degree of agricultural products of RCEP member countries. This paper further empowers China's agricultural imports to RCEP member countries with the help of tariff reduction, negative list management and regional logistics in the context of RCEP policy, and reduces China's import dependence on a single country for agricultural products. It is expected that China gradually travels a good trend of diversification of agricultural imports among RCEP member countries, continues to adhere to China's good trade relations in the Asia-Pacific region, and provides a guarantee for China's import food security and healthy growth of international trade in the long term.

Keywords: Food security; HHI Herfindahl Index; import diversification; RCEP

1 INTRODUCTION

In 1996, the Food and Agriculture Organization of the United Nations (FAO) raised the issue of "food security" for the first time when it sounded the alarm at the first World Food Summit. The academic community is divided into two categories: one focuses on the dynamic balance of food supply and demand. Huang Jikun (2013) predicts that China's future food security is a feed security issue.^[1] ; Sun Dongsheng and Liang Shiyong (2010) analyze the historical fluctuation of China's grain production using time trend and cycle fluctuation models and point out that China's future grain supply and demand are basically in a self-sufficient state.^[2] ; Jiang and Ping (2020) propose to build a positive view of grain security based on the background and perspective of deepening rural economic reform. security.^[3] . Another category focuses on the weak links of China's food security system, such as transportation logistics and grain reserves. Xie, Hualing and Yang, Yanping (2020) analyzed the international hot issues of food security based on "TI=OR=AK" as a search strategy and suggested that China should achieve all-round food security in terms of nutritional security and environmental sustainability at an early date.^[4] ;

Zhang, Zhi-Xin et al. (2022) used the variety-based input method and the total reduction method to (2022) used the combination of the variety-based input method and the aggregate reduction method to measure the consumption of food for different purposes in each province, and proposed a "us-based" strategy to grasp the initiative of food security based on the change of food consumption structure^[5]. Zhao, Xia et al. (2022) proposed the idea of self-improvement and opening up to the outside world in the context of the double-cycle pattern, and the international community for food security.^[6]

The research innovation of this paper is mainly reflected in the following aspects: firstly shifting the center of diversification to the Asia-Pacific region in the international form, from unstable regions to relatively stable regions. Secondly, by constructing a utility recommendation model to recommend the import of agricultural products categories in the Asia-Pacific region, we promote the construction of a food security community in the Asia-Pacific region.

2 CHINA'S AGRICULTURAL IMPORTS CONCENTRATION ANALYSIS

2.1 Status of China's agricultural imports

The types of imported agricultural products are concentrated. China's imports of agricultural products are mainly concentrated in edible oilseeds, grains and livestock products. China's main grain imports "three giants" are rice, corn and wheat. China's main edible vegetable oil consumption varieties, palm oil in the past five years the average import dependence of up to 99%, including three years of imports even more than the domestic consumption. The average import dependence of canola oil is 14%. For sugar crops, sugar has an average of 29% over the past 5 years. In terms of meat, beef import dependence is high, with an average value of nearly 20%. With the expanding supply-demand gap for beef and pork, the external dependence is increasing faster, from 11% and 7% in 2016 to 29% and 13% in 2020, respectively.

In summary, this paper selects palm oil for edible oilseeds, corn and wheat for cereals, sugar for sugar crops, and beef for livestock products, which are five more representative agricultural products, as the samples for HHI analysis.

2.2 Calculation of import concentration based on Herfindahl index

2.2.1 Model and variable meanings

The HHI, also known as the Hirschman-Herfindahl index, is a composite index that measures industry concentration to reflect the dispersion of market size and relative market concentration, and is mainly used to measure changes in market share. In this paper, it is the sum of the squares of the respective market shares of each sample agricultural import source country, which can reflect the degree of influence of each sample agricultural import source country on each sample agricultural import in China. The calculation formula is.

$$HHI = \sum_{i=1}^N \left(\frac{x_i}{X} \right)^2 = \sum_{i=1}^N S_i^2 \quad (1)$$

Where X is the total size of each sample agricultural import market in China; X_i is the size of the i -th largest import source country for each sample agricultural product in China. S_i is the share of import size ranked in the i th position among the import source countries of each sample agricultural products in China; N is the total number of countries in the import source countries of each sample agricultural products in China.

2.2.2 Sample countries and data sources

In selecting trading partners to construct the sample countries, the author gave priority to the main sources of China's imports of each sample agricultural product in the last three years. The countries selected for this purpose are: Malaysia, Ecuador, Indonesia, the United States, Australia, New Zealand and thirty-six other countries.

2.2.3 Model data

This paper first uses the HHI index to measure the market structure of imported palm oil in China in 2019-2021.

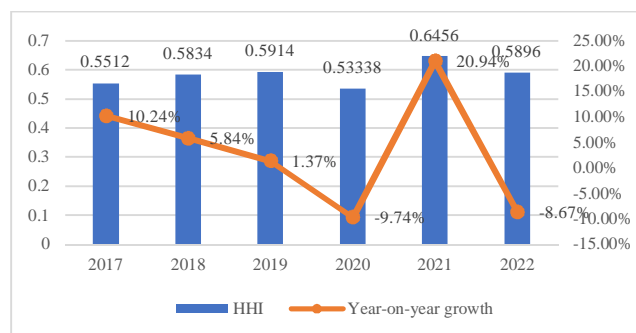


Figure 1 Trends in China's Palm Oil Import Market Concentration(2017-2022)

From Figure 1, the HHI values are all greater than 0.5 and reach a maximum value of 0.6456 in 2021, indicating that China's palm oil import market is concentrated in very few countries during this period. 2020 has a minimum value of 0.5338, indicating a greater range of countries selected for import in this year compared to other years, and an initial move towards import country diversification. 2017 The HHI values show an overall fluctuating downward trend, which reflects that the concentration of China's palm oil import market is in an unstable but slowly declining state. Although there is an upward trend from 2020 to 2021, overall China's palm oil import dependence is still unstable, and there is still a threat to the security of China's food supply.

The average HHI index value from 2017 to 2022 is 0.5825 (higher than 0.3), which is in the extremely high oligopoly stage of high oligopoly type I. The import market for palm oil in China, which is an example of an oligopoly market, is highly concentrated and has a high degree of monopoly, as shown by the HHI index.

The aforementioned analysis' findings indicate that, in the context of economic globalization and as a result of the new crown epidemic, although imports of palm oil can temporarily satisfy domestic demand, trade frictions, a loss of pricing power, and a reduced capacity to withstand

changes in international prices are all made more likely by the import market's high concentration, degree of monopolization, and single channel.

The market concentration of imported beef and corn from 2019 to 2020 can be compared to this way. Figure 2 shows that while the HHI of corn moves upward, with a considerable decrease from 2019 to 2020 and an even more significant increase from 2020 to 2021, the HHI of beef fluctuates downward, comparable to that of palm oil. This demonstrates that corn market concentration and dependency on imports are both significant and on the rise. The average HHI index values for corn and beef are 0.5916 and 0.4489, respectively (both larger than 0.3), remaining in the high oligopoly I type.

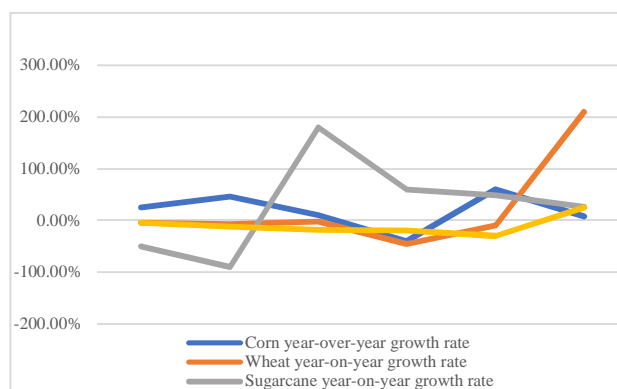


Figure 2 2019-2021 China's corn, beef imports market concentration trends

2.2.4 The trend of import diversification has initially appeared

It is clear from the research above that several of China's agricultural products have steadily diversified development trends in their import sources. While trade policies for some products have decreased imports from the original major sources for some products, such as the imports of "double reverse" sorghum, China has relaxed the inspection and quarantine requirements for some meat imports. The number of sources for beef, mutton, and pork imports has increased from 6, 3 and 14 in 2014 to 19, 6 and 19 in 2019 respectively. For instance, sugar safeguards have decreased the concentration of sugar imports from 87.9% to 49.8%, while sorghum imports from the U.S. have declined from 93.8% in 2014 to 88.1% in 2020. Nonetheless, a small number of countries continue to hold a disproportionately large share of the world's goods (regions).

As for China's grain imports in 2021, data from the General Administration of Customs (Table 1) suggest a rise in cereal imports overall and a fall in soybean imports. The amount of grain imported into China in 2021 nearly tripled from the previous year to 28.35 million tons. Moreover, wheat imports increased to a record high of 9.77 million tons in 2021, exceeding the quota and rising by 16.6% from 8.38 million tons in 2020. 4.96 million tons of rice and soybeans were imported, increasing 68.7% from the previous year.

Table 1 China's grain imports, 2019-2021 (in RMB million)

Product Name	Unit of measurement	December		Current month over the same period last year		Cumulative from January to December		Cumulative over the same period last year	
		Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount
Food	million tons	1,360	4,455,213	3.4	37.4	16,454	48,344,779	18.1	39.1
Wheat	million tons	94	207,182	6.9	22.2	977	1,992,115	16.6	22.1
Corn	million tons	133	263,027	-39.9	-23.2	2,835	5,177,996	152.2	203.1
Rick& Paddy	million tons	58	170,333	-18.7	-27.7	496	1,443,782	68.7	40.8
Soybeans	million tons	887	3,399,835	17.9	57.3	9,652	34,590,693	-3.8	26.1

In general, China's agricultural products import channels show a trend of diversification. However, the situation of high concentration in the import market and high dependence on foreign imports has still not been changed.

2.2.5 Concentration of import source countries

The main source countries of China's agricultural products are Brazil, the United States, Argentina, Canada, Australia, New Zealand, and Indonesia (Figure 3), and the source countries of China's soybean imports are mainly Brazil and the United States. Due to the trade friction between China and the U.S. in 2018, Brazil then became the main source of soybean imports for China. 2021 China remains in the first place as an importer of soybeans from Brazil, with 58,151,000 tons of imports^[7]. Canada is the main supplier of rapeseed to China. In 2021, China's imports of milk powder, liquid milk, butter, cheese, and infant formula from New Zealand ranked first, with import volumes of 88.9, 36.3, 10.8, 9.6, and 61,000 tons, respectively. New Zealand is also China's leading supplier of dairy goods. This shows that China still has many agricultural products of high oligopoly type I. At present, both the categories of imported agricultural products and the countries of origin of imports show relatively concentrated characteristics. China still needs to firmly practice the development strategy of diversification of agricultural imports, and correctly and reasonably use the advantages of China's accession to RCEP to realize the path of broadening the diversification of food imports, so as to provide strong support and guarantee for China's food security.

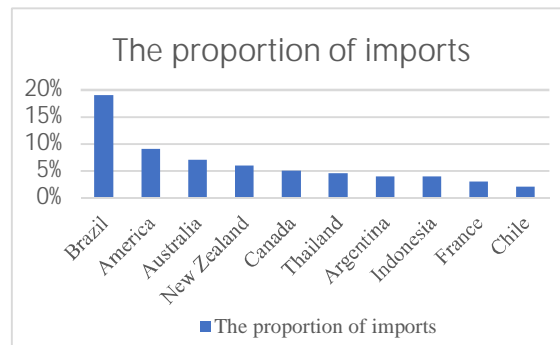


Figure 3 Percentage of import value of major importing countries of agricultural products in China in 2020

3 ANALYSIS OF CHINA'S PATH TO DIVERSIFY GRAIN IMPORTS IN RCEP

3.1 Agricultural exports and advantageous products of RCEP member countries

The agricultural exports of RCEP countries can be roughly divided into three categories. One category is countries with a large share of agricultural exports, including Indonesia, Thailand, Cambodia, Laos, Myanmar and Vietnam; the second category is countries with a relatively small share of agricultural exports, including Malaysia, Singapore, Australia and South Korea; the third category is countries with very small agricultural exports, including Brunei and Japan. Cambodia, Laos, Myanmar and Vietnam have more than half of their own agriculture, so they export more cereals, and rice is among their advantageous products. New Zealand's dairy products are its dominant products, while accounting for the largest share of China's dairy imports^[8]. Australia's beef and lamb and wheat are its dominant products and are important sources of imports of grain, oil and dairy products for China. Indonesia's dominant product is palm oil, which also has significant trade with China. The specific circumstances are shown in Table 2.

Table 2 Share of agricultural export commodities of RCEP countries in 2019

Indonesia	Animal and vegetable oils, fats and waxes; refined edible fats and oils 10.5%; fish and other aquatic invertebrates 2%; coffee, tea, mate tea and flavored spices 1%; tobacco, tobacco and tobacco substitutes 1% of the products
Thailand	Rubber and its products 6.3%; cereals 1.7%; edible fruits and nuts; melons and other fruits rind 1.5%; sugar and sugar food 1.4%
Singapore	Rubber and its products 0.5%
Cambodia	Cereals 46%; edible fruits and nuts 20%
Laos	Cereals 5%; with fruits and nuts, melons or citrus fruits 4%
Myanmar	Grain 13%

Vietnam	Grain 40%; coffee 10%
Australia	Meat and edible miscellaneous 4.2%; cereals 1.3%
New Zealand	Milk; eggs; honey, other food animal products 25.6%; meat and edible miscellaneous 13%;edible fruits and nuts and other fruit peels 9.1%; fish and other aquatic invertebrates 2.9%

3.2 Calculation of import recommendation based on utility value method

3.2.1 Data sources and model settings for the recommended score method

By referring to the requirements of the 14th Five-Year Plan on the construction of food security and the influencing factors system of the "Supervision and Administration of Inbound and Outbound Grain Inspection and Quarantine" and the summary of "China's Food Security" issued by the Central People's Government of the People's Republic of China, we emphasize the direction of agricultural export prices, agricultural quality and safety, agricultural product quality and safety, and agricultural product gross domestic product. The four aspects of exporting countries' trade preferential policies and gross agricultural products are identified as the indicators of the agricultural products import evaluation index system. According to the indicators, different countries are ranked and assigned points to give corresponding scores. The formula for calculating the total recommendation score is as follows

$$W = \sum_{i=1}^n X_i / 11 \quad (2)$$

Where, W denotes the final recommendation score, n denotes the number of indicators, i denotes the starting indicator, and X_i indicates the sum of all indicator scores, and finally the average of the last eleven years of data is calculated, that is, the total recommended score of each country can be found. This method can be applied to other RCEP countries for calculation.

3.2.2 Empirical results of the recommended score method (wheat as an example)

Since RCEP is an agreement made by 15 members in 2012 and entered into force on January 1, 2022. Therefore, this paper selects the data from 2012 to September 2022 as an example. Considering the intuitiveness of the results, four RCEP countries whose wheat is mainly exported to China are selected as examples in this paper, and the first to fourth ranked countries are assigned scores from 4 to 1, respectively (Table3) .

Table 3 Top four countries assignment table

Ranking	1	2	3	4
Assignment of points	4	3	2	1

Calculated by the formula, the scores of the final four countries are shown in Table 4.

Table 4 Recommended scores for four countries in 2021

Country	Indicators	Ranking	Score	Total Score
Australia	Wheat export prices	4	1	13
	Wheat quality and safety	1	4	
	The country's trade preferences	1	4	
	The country's gross wheat product	1	4	
Cambodia	Wheat export prices	2	3	6
	Wheat quality and safety	4	1	
	The country's trade preferences	4	1	
	The country's gross wheat product	4	1	
Vietnam	Wheat export prices	3	2	9
	Wheat quality and safety	3	2	
	The country's trade preferences	2	3	
	The country's gross wheat product	3	2	
Thailand	Wheat export prices	1	4	12
	Wheat quality and safety	2	3	
	The country's trade preferences	3	2	
	The country's gross wheat product	2	3	

3.2.3 Evaluation of results (wheat as an example)

The increase in wheat imports not only reflects China's consideration of food security in the face of a complex and volatile international situation, but also reflects the important complementary role of moderate grain imports to domestic food security. In addition, the U.S. is one of China's traditional major wheat importing countries, and with the escalating trade friction between China and the U.S., China's wheat imports from the U.S. are decreasing year by year and trade uncertainty is increasing^[9]. According to information from the Ministry of Agriculture and Rural Affairs, wheat prices are currently up to a stage high, and domestic wheat prices are expected to stabilize at a high level later. The global wheat supply-demand gap is expanding, while the Russian-Ukrainian conflict continues, affecting global wheat exports, international wheat prices are expected to fluctuate at high levels, and China urgently needs to develop a diversified strategic layout for international wheat imports.

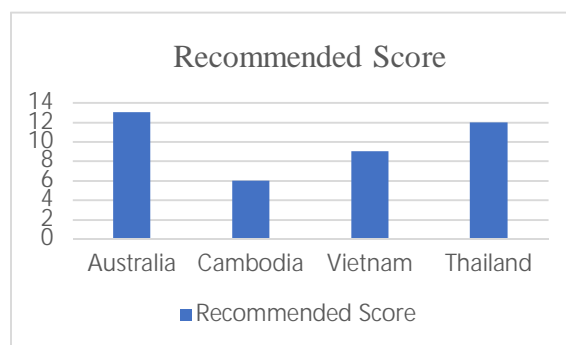


Figure 4 Evaluation results

According to the evaluation results and the value domain ranking in Figure 4, we can see that Australia is in first place. It is in the first place for food prices, food security and food policy. Its total score with ASEAN countries is also above 5. Therefore, considering the tariff preferences and related locational advantages of the RCEP domain trade agreement, China should continue to import wheat from Australia, and gradually spread the wheat share concentrated in the U.S. Canada and other countries to ASEAN countries.

4 SUGGESTIONS FOR CHINA'S STRATEGY TO ACHIEVE DIVERSIFICATION AND GUARANTEE OF AGRICULTURAL IMPORTS

4.1 Use RCEP policy to provide external security

4.1.1 RCEP Reduces Tariffs on Trade Goods of Regional Countries

The proportion of immediate zero tariff between China and ASEAN, Australia and New Zealand is over 65%, and the proportion of mutual immediate zero tariff with Japan reaches 25% and 57%. Certificate of Origin as a necessary document to enjoy preferential tariff treatment in the importing country^[10]. On the day RCEP came into effect, CCPIT and local agencies issued 158 RCEP certificates of origin for 69 enterprises nationwide, which are expected to reduce tariffs by US\$180,000 for enterprises^[11]. Therefore, after the signing of RCEP treaty, the price advantage of domestic and foreign goods is rapidly formed. China will set more eyes on the RCEP member countries, providing suitable target countries for shifting or dispersing the sources of its large-scale imports of agricultural products, which can both reduce import costs and guarantee the safety of agricultural imports.

4.1.2 RCEP further promotes mutually beneficial industrial cooperation among countries

RCEP has carried out deep liberalization in various and all-round areas such as trade in goods, trade in services and international investment. The speed and efficiency of the flow of trade in goods and services, information and capital among member countries has been accelerated, providing ripe external conditions for industrial cooperation between countries^[12]. Taking agriculture as an example, many member countries in the RCEP region will be important destinations for Chinese agriculture to go out, and the negative list management has significantly relaxed market access restrictions, which will facilitate Chinese agricultural enterprises to carry out mutually beneficial cooperation in regional agricultural cultivation and processing.

4.1.3 RCEP promotes the formation of a new pattern of logistics

The description of e-commerce encouragement in Chapter 12 of the Regional Comprehensive Economic Partnership Agreement (RCEP) focuses on the enhancement of cross-border e-commerce and the construction of overseas warehouses.^[13] The RCEP provides for the reduction of customs clearance time for express cargo and perishable goods to 6 hours, bringing prosperous development opportunities to cross-border e-commerce service platforms. The agricultural food supply chain will undergo dramatic changes, mainly in the form of improved shipping service capacity. This promotes a significant increase in trade volume, which will inevitably lead to a significant increase in the volume of container, cold chain and bulk business

in the region, promoting increased investment in intra-regional routes and shipping resources, improving transport time efficiency and reducing shipping costs.

4.2 Using its own characteristics to provide internal security

4.2.1 Promote stable growth of national economy

The stability of the national economy is the basis for social development. If the domestic economy is in recession, it will be difficult to maintain normal production activities, the GDP will decrease, people's income will decrease, the purchasing power of consumption will decrease, and the quantity and variety of agricultural products imported will be affected. Therefore, promoting stable economic growth can deepen China's opening to the outside world and broaden the scope of agricultural imports, demonstrate to the world that it is a great power to build a "community of human destiny", promote the establishment of a free trade zone, and establish cooperation with other countries in the world on an equal and reciprocal basis. ^[14] The government should also take measures to revive the domestic economy. At the same time, the government should take measures to revive the domestic economy, increase the desire of national consumption, and drive the market to turn well through consumption-led production.

4.2.2 Fully exploit the demand gap for domestic agricultural products

China's domestic agricultural products such as soybeans and corn are in short supply, and a large percentage of them are imported from abroad to maintain normal production and living needs. At the same time, China's demand gap is exactly the element that is scarce in the world agricultural market. China should keep looking for suitable agricultural exporting countries, diversify its market selection, promote the flourishing development of the world agricultural market, promote economic and trade cooperation with other countries, and stabilize the global agricultural supply chain.

4.2.3 Establish a monitoring system for imported agricultural products

China should regularly monitor and analyze data on the supply and demand of relevant imported agricultural products, such as types, production and quantity, to forecast changes in foreign agricultural markets as well as domestic demand and stock. This data can also be announced to all countries in the world, and if necessary, assistance can be provided to other countries to jointly resist the agricultural crisis. The establishment of a sound inspection system for imported agricultural products is a key step in China's strategy to diversify its food imports, and China should take into account the healthy development of the global agricultural supply chain while maintaining its own food security.

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