

## Article

# Status of Sino–Russian Trade in Agricultural Products: Dual Consideration Based on Characteristics and Growth

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**Abstract:** The security of agricultural product supply is crucial for social development. For populous and resource-rich countries like China and Russia, strengthening their bilateral trade in agricultural products is essential to ensure stability and security in the global food market. However, current research on their agricultural product trade lacks sufficient detail. This article aims to analyze the overall trend of agricultural product trading between China and Russia based on trade data from 2007 to 2021. Different trade indexes will be used to examine the four aspects of the agricultural product trade characteristics of both countries. The constant market share model will be employed to analyze the growth factors of agricultural product trade between the two nations, providing insights into the driving force behind changes in agricultural exports. The findings of this study demonstrate that bilateral agricultural trade between China and Russia shows complementarity and high trade intensity. Intra-industry trade represents the primary form of agricultural product exchange, while inter-industry trade serves as a supplemental form of trade. In terms of trade growth impact, the bilateral agricultural trade between China and Russia is primarily influenced by the effect of product structure, followed by competitiveness. Therefore, in the face of uncertain situations, such as counter-globalization and localized trade frictions, specific recommendations will be provided to optimize the trade structure of agricultural products between the two nations.

**Keywords:** trade of agricultural products; characteristics; growth; China and Russia



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## 1. Introduction

### 1.1. Background of the Study

As the fundamental source of sustenance for our survival, ensuring the security of agricultural production and supply is crucial for the well-being of the population and the progress of society. It serves as the bedrock for human social development. However, with the rapid advancement of globalization, the increasing occurrences of geographical conflicts and extreme weather events have disrupted the global agricultural market's industrial and supply chains. These recurring events present numerous challenges to agricultural production and supply systems. The security of the agricultural product supply is crucial for the social development of humanity. In the current scenario of deep integration in the international agricultural products market, expanding and strengthening international cooperation is essential to address the challenges faced by China, such as the increasing food demand, imbalanced agricultural product structure, rising costs, concerns about environmental capacity, and heavy reliance on imports. China, with its small-scale agricultural operations, has normalized a tight balance between supply and demand of agricultural products, leading to a situation of 'large import and small export'. In the face of unprecedented changes in the world, our times, and history, the Chinese government has emphasized the need to implement policies like 'implementing the diversified strategy of agricultural product import' and 'promoting high-level opening up' to deepen international

agricultural cooperation. China and Russia, being populous and resource-rich countries, also have a significant agricultural production capacity and their agriculture sectors are highly complementary. Agricultural cooperation between the two countries aligns with their development goals and has a strong convergence of interests, playing a vital role in ensuring stability and security in the global agricultural product market. However, the long-standing asymmetric nature of political, diplomatic, economic, and trade relations between China and Russia has hindered the progress of agricultural cooperation. At the beginning of 2022, Putin's visit to China emphasized the enduring friendship and limitless cooperation between the two countries in a joint statement. President Xi Jinping chose Russia as his first foreign visit destination after being reelected as president, and the two heads of state cosigned the Joint Declaration on Deepening China–Russia Comprehensive Strategic Collaborative Partnership in the New Era. They also signed several bilateral cooperation documents, including ones related to agriculture, which provide momentum for enhancing bilateral economic and trade relations as well as agricultural cooperation. In this context, analyzing the characteristics of Sino–Russian agricultural trade using the trade index can help clarify the bilateral agricultural trade structure. Meanwhile, by employing a structural equation model to analyze the growth factors of bilateral agricultural trade, we can effectively understand the development trend of such trade. Through an extensive analysis of 66 agricultural product groups, our study addresses the gaps in existing research by providing a comprehensive and meticulous examination. This approach enhances the practicality of our study, and this analysis holds great significance for upgrading bilateral agricultural trade cooperation and further deepening economic and trade cooperation between the two countries.

### *1.2. Review of Relevant Studies*

The trade of agricultural products plays a crucial role in balancing the world's food supply and bridging national disparities in agricultural production [1]. This trade not only expands farmers' markets but also contributes to the modernization of agriculture, improvement of product quality, and diversification [2–4]. However, recent extreme weather events and geopolitical tensions have resulted in unpredictable crop yields and increased price volatility [5–7]. The imposition of trade restrictions has further intensified uncertainty and limited market access, leading to increased scrutiny of agricultural trade. Given that China and Russia are the leading agricultural nations globally, the stability of their agricultural supply holds significant importance for the global agricultural market. Firstly, relevant studies on the effects of trade on economic growth have been conducted by various scholars. While many scholars have found evidence supporting the idea that trade openness can promote economic growth [8–10], there are also some who question this relationship, particularly with regard to the measurement of trade openness [11,12]. It is important to note that trade growth can have various effects, including economic growth, environmental effects, and social effects [13–16]. Secondly, scholars have extensively studied the characteristics of agricultural product trading between China and Russia. According to Wu Xuejun (2010), the main agricultural products exported by both countries are those that have their own comparative advantages, indicating a strong trade complementarity [17]. Zhang Guohua (2010) found that the high concentration of trade in agricultural products is an important feature of agricultural trade between China and Russia, and the complementary characteristics of the agricultural trade between the two countries are significant [18]. Tang Bi (2012) pointed out that, regarding the Sino–Russian trade in agricultural products, Chinese exports to Russia are complementary to eight kinds of agricultural products, while Russian exports to China are complementary to only one kind. China has more advantages in terms of land-intensive agricultural products, while Russia's natural environment factors make it more suitable for the development of forestry and animal husbandry [19]. According to Tong Guangji (2016), China has a comparative advantage in aquatic products, horticultural products, tobacco, and beverages [20]. Some researchers found that the trade of agricultural products between China and Russia is dominated by the inter-industry trade of

complementary resources, and the intra-industry trade shows an increasing trend [21–23]. Gusev (2007) found that, relative to other countries and regions, Russia has the highest level of intra-industry trade with China and CIS countries [24]. Natalia (2014) found that Russia's agricultural trade with Asian countries is large in terms of the mutual trade in aquatic products, while the scale of trade of other agricultural products is smaller. The intra-industry trade level of agricultural products between Russia and Asia decreased from 36.59% in 1996 to 21.4% in 2012, due to the sharp decline in horizontal intra-industry trade. Compared with the end of the 1990s, Russia significantly reduced the import of dairy products, meat products, and other agricultural products from Asia (mainly China) [25]. Thirdly, with regard to the factors of influence on China–Russia agricultural trade, Sun Yuxin (2016) believes that the Sino–Russian trade in agricultural products is closely linked to inter-industry trade and not well-formed economies of scale and differentiated production. Market demand is the primary affecting factor of the growth in Sino–Russian agricultural product trading, while the export structure effect restricts the growth of the agricultural products trade in China, and export competitiveness has hindered the effect of the Russian agricultural products' trade [26]. Yang Fengmin et al. believe that the quality and safety of agricultural products, backward infrastructure, green trade barriers, trade costs, and other factors have adverse effects on Sino–Russian agricultural trade [27–31]. Xu Zhenbao et al. believe that the “Belt and Road” strategy, the construction of the China–Mongolian–Russia Economic Corridor, and Sino–US trade frictions have brought good development opportunities for bilateral agricultural trade [32–34]. Of the many influences, the agricultural ban has had the greatest impact. Cheptea's (2020) study found that the ban on agricultural products resulted in welfare losses of approximately 0.2–0.6% in Russia [35]. Meanwhile, Smutka (2016) analyzed the impact of Russia's agricultural import ban and found that the ban effectively reduced its external dependence, enhanced the competitiveness of Russia's agricultural trade, and also accelerated the improvement of Russia's agricultural trade with the Asia Pacific region [36]. In addition, there are forecasts on the direction of future trade in agricultural products between Russia and China. Yang Guihua (2015) and Cui Ningbo (2015) studied the trade of agricultural products in Ukraine before and after the crisis. They showed a possible direction of future growth in the Sino–Russian trade in agricultural products, including bulk agricultural products and animal products [37,38]. Benesova (2017) believes that the structure of Russia's agricultural export trade should be adjusted, and the export products should be adjusted and concentrated, among which cereals, fish, and vegetable oils need to increase in the status of Russia's agricultural exports [39]. When Ren and YF (2020) evaluated the self-sufficiency rate and potential index of food security cooperation, they found that the potential for food cooperation between China and Russia will reach USD 72.842 billion by 2030 [40].

Regarding the existing literature on the subject, we mention the following points: Firstly, the majority of scholars only studied the trade of agricultural products from the perspective of the characteristics of one or two products; a comprehensive consideration is lacking, and the characteristics of internal relations between products have not been well-reflected. Secondly, the existing research tried to evaluate the trade characteristics more than the growth factors, but the growth factors cannot be ignored. Thirdly, whether SITC or HS product classification was used was mostly presented regarding the category of agricultural products or chapter; no research has been conducted focusing specifically on the agricultural product group level, reducing its pertinence and maneuverability. Thus, it is very important that, in the case of the international agricultural market, research must be conducted to reflect the true state of Sino–Russian trade in agricultural products to make better use of this practice in reality. In view of this, this study uses the SITC Rev.4 agricultural statistical standard. Then, we use a variety of agricultural products featured in the Russia Index of Trade, focusing on the four aspects of comparative advantage and complementarity and intra-industry trade intensity. We use the constant market share model (CMS) to analyze growth drivers from the two aspects of structure and competitiveness. This study refined

66 groups of agricultural products to conduct a more accurate and more conducive analysis to solve practical problems.

## 2. Research Methods and Data Sources

### 2.1. Selection of Trade Characteristic Indicators

This paper employs the normalized revealed comparative advantage index (NRCA) and trade complementarity index (TCI) to examine the trade complementarity between China and Russia. Additionally, the intra-industry trade index (GHM) is utilized to analyze the intra-industry trade and export market structure between the two countries, specifically focusing on Sino–Russian trade. Furthermore, the trade intensity index (TII) is employed to investigate the growth factors and development potential of agricultural products trade between China and Russia. This comprehensive approach aims to provide a more thorough understanding of the sample characteristics.

#### 2.1.1. The Normalized Revealed Comparative Advantage Index

The normalized revealed comparative advantage index was introduced by Yu et al. (2009) [41]. This index measures how much a country's actual exports differ from comparative advantage neutrality and can be compared across commodities, countries, and time. A positive  $NRCA_{ij}^k$  value suggests that the product has a comparative advantage, a negative value suggests a comparative disadvantage and a zero value suggests neither a comparative advantage nor a comparative disadvantage for the product. The formula is shown below:

$$NRCA_{ij}^k = \frac{X_{ij}^k}{X_w} - \frac{X_{wj}^k}{X_w} \times \frac{X_{ij}}{X_w} \quad (1)$$

In Equation (1),  $X_{ij}^k$  denotes the value of product  $k$  exported by country  $i$  to the export market  $j$ .  $X_{wj}^k$  denotes the world's total exports of product  $k$  to that  $j$  market, and  $X_w$  denotes the world's total exports to that export market.  $X_{ij}$  represents the total exports of all products from country  $i$  to country  $j$ .

#### 2.1.2. The Trade Complementarity Index

The trade complementarity index examines the connection between a country's export specialization and another country's import specialization at the product level of trade. It determines the extent to which a country's advantage in exporting a specific product sector aligns with another country's disadvantage in importing the same sector. Understanding this level of complementarity is essential for analyzing international trade patterns. Enhancing trade complementarity can effectively improve the efficiency of bilateral resource utilization, facilitate exchanges between trading partners, foster a more robust, flexible, and sustainable bilateral trade system, and create more opportunities and benefits for the development of cooperation between the two sides. The TCI index is a comprehensive measure that uses a trade-weighted approach to evaluate how well sectors' exports in exporting countries match sectors' imports in importing countries. The formula is shown below:

$$RXS_i^k = \frac{X_{iw}^k / X_{iw}^s}{X_w^k / X_w^s} \quad (2)$$

$$RMS_j^k = \frac{M_{jw}^k / M_{jw}^s}{M_w^k / M_w^s} \quad (3)$$

$$CI_{ij}^k = RXS_i^k \times RMS_j^k \quad (4)$$

$$TCI_{ij}^s = \sum_k \left( \theta^k \times RXS_i^k \times RMS_j^k \right) \quad (5)$$

In Equation (2),  $RXS_i^k$  represents the comparative advantage that country  $i$  has in exporting products of type  $k$ , while  $RMS_j^k$  represents the comparative disadvantage of country  $j$  in regard to importing agricultural products of type  $k$ .  $X_{iw}^k$  and  $X_{iw}^s$  denote the total trade in  $k$  types of agricultural products exported by country  $i$  to the world and the total trade in all agricultural products exported by country  $i$  to the world, respectively.  $X_w^k$  and  $X_{iw}^s$  denote world trade in  $k$  exported agricultural products and total world agricultural exports, respectively. In Equation (3),  $M_{jw}^k$  and  $M_{jw}^s$  denote country  $j$ 's imports of the world's agricultural products in category  $k$  and the value of country  $j$ 's total trade in agricultural products with the world, respectively.  $M_w^k$  and  $M_w^s$  denote world imports of category  $k$  agricultural products and total world agricultural imports.

In Equation (4),  $CI_{ij}^k$  reflects the compatibility between country  $i$ 's export of category  $k$  agricultural products and country  $j$ 's import of category  $k$  agricultural products.  $CI_{ij}^k$  is considered complementary if the value exceeds 1 and vice versa if the value is less than 1.

In Equation (5),  $TCI_{ij}^s$  indicates the level of agricultural trade complementarity between countries  $i$  and  $j$ . The  $k$  product weights are denoted by  $\theta^k$ . A value greater than 1 for  $TCI_{ij}^s$  signifies a high level of trade complementarity between country  $i$ 's agricultural exports and country  $j$ 's agricultural imports, while a value less than 1 indicates a low level of trade complementarity.

### 2.1.3. The Trade Intensity Index

The trade intensity index, initially introduced by Brown [42] and further enhanced by Qing Kojima [43] and other researchers, is commonly utilized to indicate the proximity of trade ties between two nations. If the TII value is greater than 1, it indicates that the two countries have substantial trade connections, surpassing the level of links with other countries. Conversely, if the value is lower than 1, it suggests that the trade links between the two countries are not high. The formula is shown below:

$$TII_{ij} = \frac{X_{ij} / X_{iw}}{M_{jw} / (M_w - M_{iw})} \quad (6)$$

In Equation (6),  $X_{ij}$  and  $X_{iw}$  represent country  $i$ 's agricultural product exports to country  $j$  and the world, respectively. Meanwhile,  $M_{jw}$ ,  $M_w$ , and  $M_{iw}$  represent country  $j$ 's total agricultural product imports from the world, the world's total agricultural product imports, and country  $i$ 's total agricultural product imports from the world, respectively.

### 2.1.4. The Intra-Industry Trade Index

The GHM index was proposed by Greenaway, Hine, and Milner (1994) [44] using the unit price method, which reflects differences in resource endowment and the degree of integration and fusion of industries between countries. This index is crucial in analyzing the trade level and structure among countries. When  $0 < GHM < 0.75$  or  $GHM > 1.25$ , it is vertical intra-industry trade, and it is vice versa for horizontal intra-industry trade.

$$GHM_{ij}^p = \frac{\sum_k \left[ \left( X_{ijk}^p + M_{ijk}^p \right) - \left| X_{ijk}^p - M_{ijk}^p \right| \right]}{\sum_k \left( X_{ijk} + M_{ijk} \right)} \quad (7)$$

In Equation (7),  $X$  and  $M$  denote imports and exports of products. Horizontal intra-industry trade (HIT) refers to the two-way flow of products within the same category or type in international trade. In this type of trade, a country acts as both an exporter and an importer of a specific product. On the other hand, vertical intra-industry trade (VIT) involves the two-way flow of different categories or types of products in international trade. In this case, a country primarily exports certain products while mainly importing other types of products;  $p$  denotes whether trade in the product is HIT or VIIT,  $k$  is the ordinal number for the number of all agricultural product groups (integers 1–66) or for the



number of groups in the agricultural product categories of 0, 1, 2, and 4, and  $j$  denotes the trading partner.

## 2.2. Modeling of Trade Growth Effects

The constant market share (CMS) model, proposed by Tyszynski (1951) and improved by many scholars, is widely used for examining the effect of trade growth in the international trade market and policy research [45]. In recent years, the CMS model has been utilized by researchers to analyze growth factors for the trade of agricultural products in China [46–50]. The basic assumption of the CMS model is that a country's share of exports in the target market will remain unchanged if its competitiveness remains unchanged. Therefore, the change in actual export growth can reveal the export competitiveness of a country's agricultural products in the target market and its changing trend. The formulas, as presented by Liu Zhixiong in 2013 [51], are as follows:

First-level decomposition:

$$\Delta Q = \sum_i S_i^0 \Delta Q_i + \sum_i Q_i^0 \Delta S_i + \sum_i \Delta S_i \Delta Q_i \quad (8)$$

In the Equation (8), the three items to the right of the equal sign are the structural effect, the competitive effect, and the crossover effect, respectively.

Second level decomposition:

$$\Delta Q = S^0 \Delta Q + \left( \sum_k S_k^0 \Delta Q_k - S^0 \Delta Q \right) + Q^0 \Delta S + \left( \sum_k Q_k^0 \Delta S_k - Q^0 \Delta S \right) + \sum_k \Delta S_k \Delta Q_k \quad (9)$$

In Equation (9), the four terms to the right of the equal sign represent the growth effect, the product structure effect, the comprehensive competitiveness effect, and the product competitiveness effect.

$Q$  represents the total imports of the target market,  $Q_k$  represents the target market demand for product  $k$ ,  $S$  represents a country's share in the target market,  $S_k$  represents the share of a country's product  $k$  in the target market for all imports of product  $k$ ,  $\Delta$  represents the amount of change between the two periods, and superscript 0 indicates the first period (starting year). In Equation (8), trade growth decomposes into structural effects, competitive effects, and cross effects. Structural effect reflects the degree of match between a country's exports and a country's needs (including market structure and product mix). Competitive effect reflects the competitiveness of a country's agricultural products in the market of the trading country (including comprehensive competitiveness and product competitiveness). In Equation (9), structural effects are decomposed into growth effects and product structure effects. The former measures the extent to which a country's export growth depends on the general growth in the target market imports, and the latter measures the matching degree between a country's export products and fast-growing import products of the target market. A positive value indicates that a country's export products mainly concentrate on the products for which the other country's import demand is fast-growing. Competitive effect can be divided into comprehensive competitiveness and product competitiveness. The former measures the contribution of growth in overall agricultural export share to export growth. The latter measures the contribution of growth in the export share of specific agricultural products to export growth. In the two formulas, the crossover effects measure whether the change in a country's export share is consistent with the change in the import level of products in the target market. A positive value indicates that a country's share of products, which are among the products for which the target market has increased its import volume, has also increased.

## 2.3. Data Sources and Description

The information in this paper was sourced from the United Nations Commodity Trade Statistics Database (UNCOMTRADE) data on China–Russia trade in agricultural products

for the fifteen-year period 2007–2021. The scope of agricultural products is determined by the United Nations Standard International Trade Classification (SITC Rev.4). This classification comprises 4 categories, 22 chapters, and 66 groups of agricultural products. The agricultural products can be classified into four categories: Category 0, Category 1, Category 2, and Category 4. Category 0 encompasses food and activities, including 36 groups of agricultural products across 10 chapters. Category 1 includes beverages and tobacco, featuring 4 groups of agricultural products in 2 chapters. Category 2 covers non-edible raw materials (excluding fuels), with 22 groups of agricultural products spanning 7 chapters, as well as Chapters 27 and 28. Lastly, Category 4 pertains to animal and vegetable oils, fats, and waxes, containing 4 groups of agricultural products comprising 3 chapters. The details are shown in Table 1 below.

**Table 1.** Classification table for agricultural products.

Number	Product Category	Customs Code
Category: 0	Food and live animals	001, 011, 012, 016, 017, 022, 023, 024, 025, 034, 035, 036, 037, 041, 042, 043044, 045, 046, 047, 048, 054, 056, 057, 058, 059, 061, 062, 071, 072, 073, 074, 075, 081, 091, 098
Category: 1	Beverages and cigarettes	111, 112, 121, 122
Category: 2	Non-edible raw materials (except fuel)	211, 212, 222, 223, 231, 232, 244, 245, 246, 247, 248, 251, 261, 263, 264, 265, 266, 267, 268, 269, 291, 292
Category: 4	Animal and vegetable oils, fats, and waxes	411, 421, 422, 431

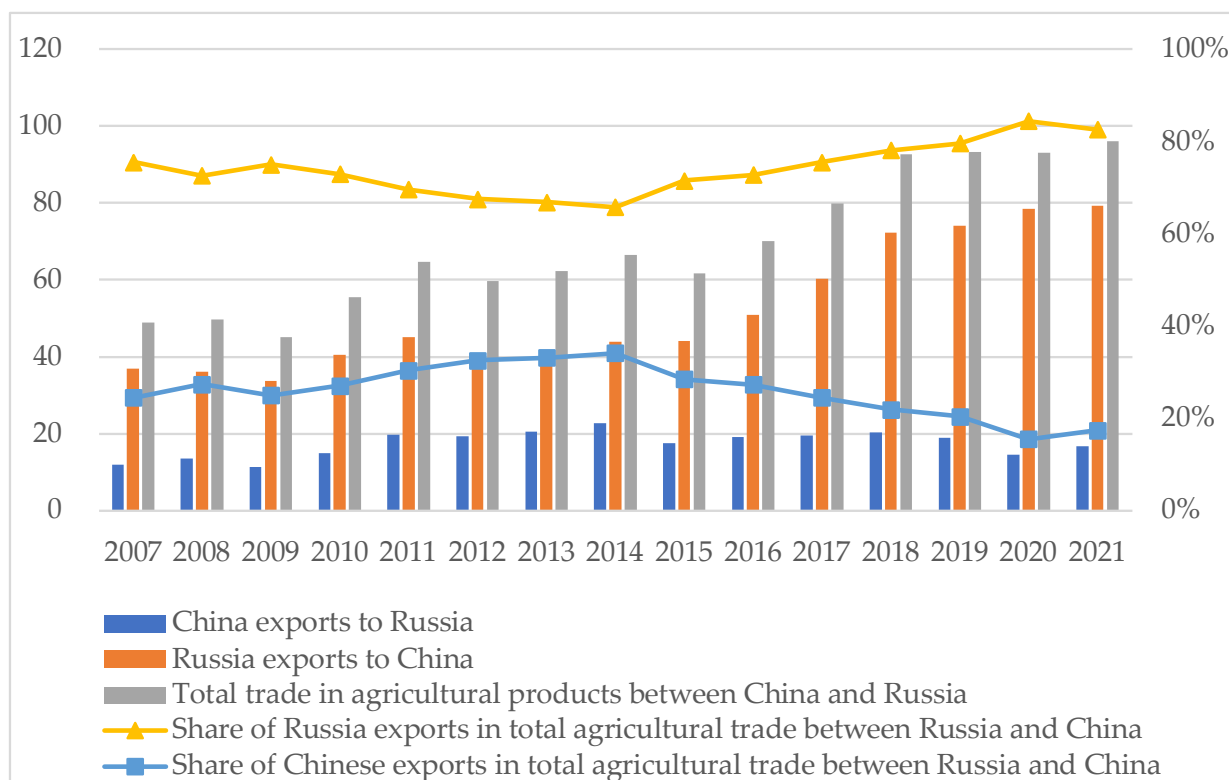
### 3. Scale and Characterization of China–Russia Agricultural Trade

#### 3.1. Status of Russian Agriculture and China–Russia Agricultural Trade

After the collapse of the Soviet Union, significant transformations occurred in Russian agriculture. The collective farms were dismantled, and the process of privatization gained momentum. However, these changes posed challenges to the agricultural sector, as efficiency declined. The shift towards a market-oriented approach resulted in increased volatility, lower yields, and an aging agricultural infrastructure. Moreover, government support for agriculture decreased, leaving farmers in a constant struggle to sustain their livelihoods. The Russian government implemented a systematic policy to improve the agricultural situation until the beginning of the century. In July 2012, the Russian Duma approved the State Program for Development of Agriculture and Regulation of Agricultural Products, Raw Materials, and Food Markets in the Russian Federation for the period 2013–2020. This program established policies to support agriculture and proposed the use of WTO rules to strengthen “Green Box” subsidies, aiming to change the upward trend of the “Amber Box”. By 2014, Russia’s indicators for arable land and certain agricultural equipment had surpassed or matched the levels seen in 1990. Moreover, there was a significant increase of RUB 47.5 trillion in fixed investment in agriculture compared to the year 2000. The improvement in agricultural conditions in Russia has not only resulted in increased yields but also a significant growth trend. From 2013 to 2021, Russia’s total grain crop output increased from 92.4 million tons to 120.7 million tons, representing a growth rate of 30.6%. In 2017, it reached a record high of 135 million tons. In September 2022, Putin predicted that Russia’s grain output would reach a new record of 150 million tons. Today, Russian agriculture stands out as the sole sector in the national economy that has experienced positive growth in recent years. It plays a crucial role in reducing Russia’s reliance on the energy economy and enhancing the country’s industrial structure.

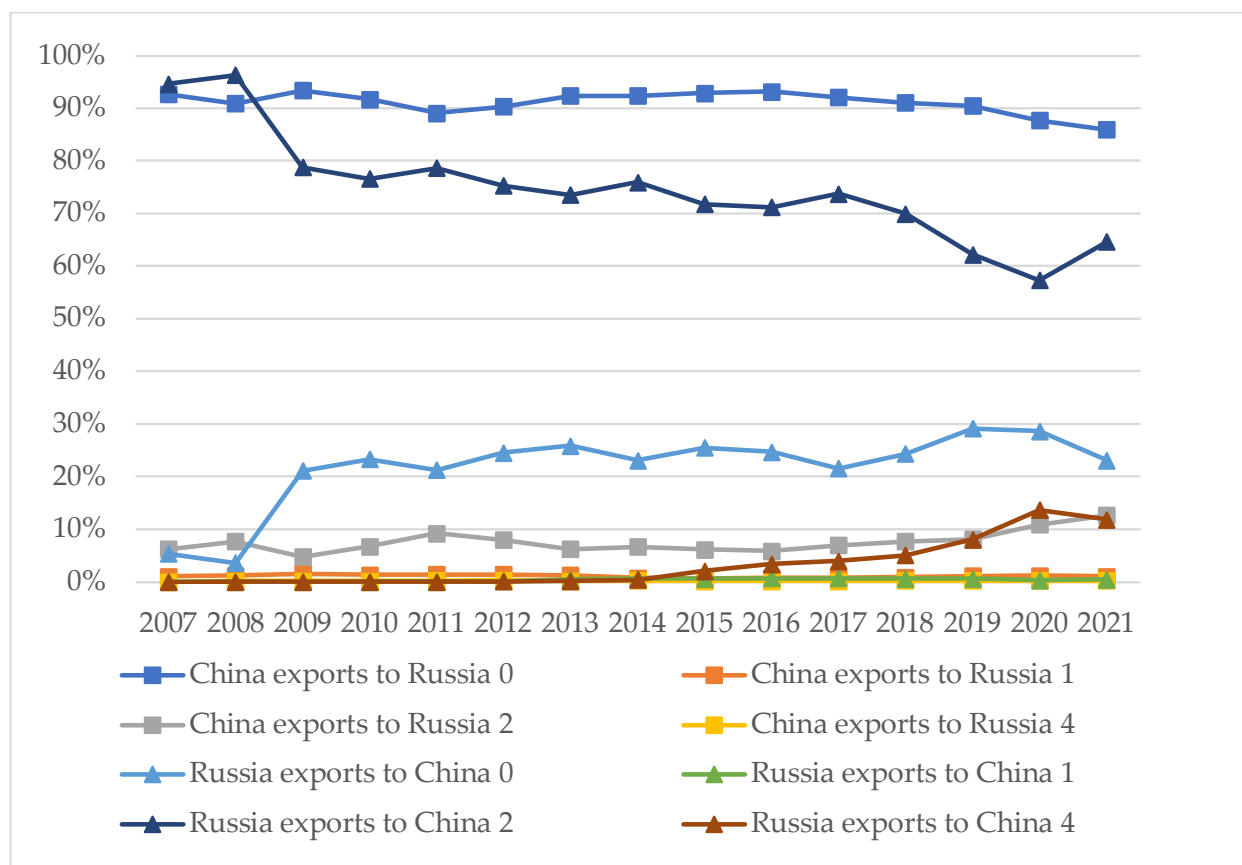
Despite some improvements in Russian agriculture, there are inherent limitations in its production structure due to factors such as geographic location, climate, and labor force. Consequently, certain agricultural products in Russia still need to depend on international markets. After the 2014 crisis in Ukraine, Russia implemented a ban on agricultural imports

from Western countries, which resulted in two consecutive years of decline in Russia's total agricultural imports and a significant change in the pattern of agricultural imports. The Government of the Russian Federation aims to position itself as an agricultural supply base in the Asia-Pacific region and overcome economic development constraints. To achieve this, it has increased capital investment and policy support and has sought cooperation with China and other Asia-Pacific countries. As a major agricultural country, China possesses ample arable land and water resources. However, its large population creates a significant demand for agricultural products, leading to a substantial gap in the domestic market. To meet this demand, China often relies on imports, which presents a significant market potential for agricultural imports. The geographical proximity of China and Russia further enhances bilateral agricultural cooperation. Nowadays, China jumped from seventh to fourth place in the Russian agricultural import market, as traditional agricultural importers' trade with Russia declined. In addition to the import market, China is also an important export market of agricultural products for Russia. According to Figure 1, the total agricultural trade between China and Russia in 2021 was USD 9.60 billion, out of which Russia's exports accounted for 82.60%. China has become the second largest export market of agricultural products for Russia, while, for overall trade, it is in first place. According to Figure 2, as Russian agricultural products are resource-intensive and Chinese agricultural products are labor-intensive, both countries possess complementary advantages and can achieve mutually beneficial trade, creating a win-win situation. Therefore, it is crucial to focus not only on expanding the overall trade volume, but also on improving the trade structure, enhancing coordination, and ensuring effective fulfillment of agricultural product demands between the two nations. The close communication between the leaders of both countries and the cooperation agreements among government agencies have contributed to the strengthening of agricultural trade cooperation. A plan has been devised to enhance the compatibility of agricultural cooperation between Russia and China.



**Figure 1.** Scale of agricultural trade between China and Russia, 2007–2021. Note: Data are from the UN Trade Database.





**Figure 2.** Structure of agricultural trade between Russia and China, 2007–2021. Note: Data are from the UN Trade Database.

### 3.2. Characteristics of Agricultural Trade between China and Russia

#### 3.2.1. Characteristics of the General Agricultural Trade Situation between China and Russia

Table 2 presents the overall characteristic index values of agricultural product trade between China and Russia. The data obtained from the normalized revealed comparative advantage index (NRCA) indicate that China's agricultural product exports to Russia experienced significant fluctuations during the sampling period but showed an overall upward trend. Starting from 2016, the NRCA value of China's agricultural exports to Russia has consistently increased and became positive for the first time in 2020. This indicates a gradual improvement in China's comparative advantage in exporting agricultural products to Russia, demonstrating enhanced competitiveness. The two leaders met several times in 2016, and the two governments signed more than 20 important cooperation documents, laying a solid foundation for bilateral practical cooperation. Enhanced bilateral ties have contributed to the growth of China's agricultural exports to Russia. On the other hand, the NRCA index values for Russian agricultural exports to China generally exhibited a declining trend throughout the sample period. In 2020, the NRCA value turned negative, and in 2021, the downward trend continued with an increased rate of decline. These findings suggest that the degree of comparative advantage of Russian agricultural products in the Chinese market is diminishing, leading to a decline in competitiveness.

The complementarity index (TCI) measurement data reveals that China's agricultural exports to Russia are complementary. The overall TCI value increased from 0.94 in 2007 to 1.14 in 2021, indicating a growth of 21.28%. On the other hand, the TCI index value for Russian agricultural exports to China decreased to 0.99 in 2021, which is a significant drop of 0.96 or 49.23% compared to 2007. This decline can be attributed to the impact of the epidemic, which hindered Russian exports. Prior to 2021, the TCI index value for Russia's agricultural exports to China exceeded the Sino-Russian TCI index value,

indicating a stronger complementarity with China's exports. However, since 2010, the complementarity index of Russia's agricultural exports to China has generally exhibited a fluctuating downward trend. Although there was a slight recovery in 2014, it declined again in 2017. This suggests that the structure of Russia's agricultural exports is more evidently complementary to China's agricultural imports, but it is unstable, which is closely linked to the changes in the TCI indices of different groups of agricultural products between the two countries.

**Table 2.** Characteristics of the agricultural trade situation between China and Russia as a whole.

Year	NRCA Index		TCI Index		GHM Index			TII Index	
	China–Russia NRCA	Russia–China NRCA	China–Russia TCI	Russia–China TCI	GHM	GHM <sup>H</sup>	GHM <sup>V</sup>	China–Russia TII	Russia–China TII
2007	−10.89	4.32	0.94	1.95	3.81	0.07	3.74	1.23	3.43
2008	−11.58	3.35	1.00	1.78	3.80	3.26	0.55	1.19	3.03
2009	−15.91	2.83	1.03	1.59	6.82	0.79	6.02	1.03	3.15
2010	−19.70	2.38	1.07	1.66	4.92	0.15	4.78	1.04	3.10
2011	−14.96	1.89	1.11	1.49	5.39	1.18	4.21	1.13	2.35
2012	−16.43	1.02	1.05	1.19	8.70	1.92	6.79	1.01	1.55
2013	−18.30	1.00	1.06	1.25	8.11	1.6	6.51	0.99	1.60
2014	−18.46	1.05	1.08	1.21	8.21	0.12	8.09	1.14	1.54
2015	−20.14	1.59	1.11	1.28	8.24	1.89	6.35	1.16	1.71
2016	−18.68	1.45	1.08	1.42	9.03	0.05	8.99	1.14	2.04
2017	−16.17	1.25	1.06	1.45	10.17	1.12	9.05	1.16	1.73
2018	−17.22	0.99	1.03	1.20	10.78	2.08	8.70	1.27	1.89
2019	−17.51	0.92	1.02	1.14	10.99	0.90	10.09	1.14	1.87
2020	15.66	−0.03	1.11	1.14	9.59	2.50	7.08	1.05	1.22
2021	13.66	−1.51	1.14	0.99	10.33	1.32	9.01	1.38	0.98
Mean	−12.44	1.50	1.06	1.38	7.93	1.26	6.66	1.14	2.08

Note: Data are from the UN Trade Database.

The intra-industry trade index (GHM) measurement indicates that agricultural trade between China and Russia is primarily inter-industry trade, with a low level of bilateral intra-industry trade, averaging an annual GHM index value of 7.93%. Specifically, the annual average GHMH and GHMV indices for agricultural trade between China and Russia are 1.26% and 6.66%, respectively. Vertical intra-industry trade accounts for 83.98% of this trade. The dominance of vertical intra-industry trade in agricultural products between the two countries indicates a minimal share of horizontal intra-industry trade. Furthermore, the intra-industry trade of agricultural products between the two countries has been increasing significantly. Since Russia's accession to the WTO in 2012 and the signing of various cooperation agreements with China in areas such as agricultural trade, investment, and animal and plant quarantine, the agricultural trade relationship between the two countries has strengthened. In 2021, due to the impact of the epidemic, Russia's most lucrative fresh products were subjected to quarantine control, and Russia's exports to China decreased significantly.

The trade intensity index (TII) measurements reveal that the trade intensity index value for Chinese exports of agricultural products to Russia consistently remains above one, indicating a robust connection between China's exports of agricultural products to Russia. However, the trade intensity index values for agricultural exports from Russia to China have consistently been higher than those for exports from China to Russia in all years, except for 2021. This suggests that the link between agricultural exports from Russia to China is stronger than that from China to Russia.

While both countries have TCI and TII values greater than one, the low level of intra-industry trade and the comparative disadvantages of Chinese agricultural products in the Russian market do not align with the other index values. This suggests that both countries have not fully capitalized on their respective market advantages and there is a need for further adjustment and strengthening in agricultural trade between them.

### 3.2.2. Analysis of Trade Characteristics of 66 Groups of Agricultural Products Analysis of the NCRA Index, CI, and TII

China and Russia have established robust trade relations across various agricultural product groups. The normalized revealed comparative advantage index and the trade intensity index provide further evidence of the strong complementarity in agricultural trade between the two nations. The specific results are shown in Table 3.

**Table 3.** Summary table of data on the three types of trade characteristics of 66 groups of agricultural products in 2021 \*\*.

NRCA Index				CI Index				TII Index			
China–Russia		Russia–China		China–Russia		Russia–China		China–Russia		Russia–China	
Group	Number	Group	Number	Group	Number	Group	Number	Group	Number	Group	Number
261	−0.00 *	248	1.04	057	15.44	248	14.06	231	16.73	073	5.54
247	−0.00 *	034	0.34	054	11.55	247	10.11	059	3.55	046	4.67
244	−0.00 *	421	0.30	074	10.64	232	9.20	248	2.34	223	4.46
043	−0.00 *	037	0.22	056	9.09	421	8.69	061	2.30	248	3.31
264	−0.00 *	247	0.18	037	8.13	251	8.23	071	2.16	011	3.01
016	−0.00 *	251	0.15	034	7.73	041	7.68	062	1.99	037	2.38
268	−0.00 *	223	0.07	098	7.44	222	6.19	044	1.96	034	2.37
246	−0.00 *	073	0.03	292	6.36	043	5.98	054	1.68	251	1.89
211	−0.01	232	0.00 *	058	4.93	037	3.93	056	1.60	421	1.80
045	−0.01	046	0.00 *	036	3.80	012	3.64	058	1.55	422	1.74
. . . . . ***											

Note: The data were obtained from the United Nations Trade Database. \* indicates that the value exists but is very small. \*\* indicates that the data are arranged according to the index value from the largest to the smallest. \*\*\* indicates that the index data of only some agricultural product groups are displayed in the table. More results have been omitted from the table. If necessary, please contact the author directly.

In the context of comparative advantages, Russian agricultural products have a clear edge in the Chinese market. Over the sample period, the normalized revealed comparative advantage (NRCA) of 66 groups of agricultural products exported from Russia to China increased in 10 groups. Notably, group 421 experienced the largest increase in advantage, with its NRCA value changing from negative to positive starting in 2014 and reaching 0.30 in 2021. When it comes to specific products, Russia's comparative advantage in the Chinese market lies primarily in resource-intensive agricultural products like fish and grain. The range of agricultural goods exhibiting export comparative advantages differs significantly between China and Russia, highlighting the extensive complementarity in agricultural trade between the two nations.

As can be seen from Table 3, China exports a greater quantity and intensity of agricultural products with complementary characteristics to Russia compared to Russia's exports to China. In terms of complementarity, there are 20 groups of Chinese farm products that complement the Russian market, but none of them have a competitive edge. This indicates that both Chinese and Russian farm products are not fully utilized in trade and need to be prioritized for future agricultural trade progress between the two countries. On the other hand, there are 17 groups of Russian agricultural products that are complementary to the Chinese market, and out of these, 7 groups have comparative advantages. The remaining seven groups, whose advantages have not been demonstrated yet, could be the focus of the development of Russian–Chinese farm trade. When considering the complementarity index values of agricultural products exported from China to Russia, the majority fall between 3 and 15. Only three groups have values exceeding 10, with the maximum being 15.44. In contrast, there are two groups of agricultural products with complementary CI values greater than 10 for Russian exports to China, with a maximum value of 14.06. Overall, China's agricultural exports to Russia outperform those of other countries, demonstrating a higher quantity and intensity of complementarities.

According to Table 3, there were 18 groups of Chinese agricultural exports to Russia with a trade intensity greater than one in 2021. The highest recorded trade intensity value was 16.73. Similarly, Russia had 16 agricultural exports to China with a trade intensity greater than 1, and the highest value was 5.54. In terms of both volume and trade intensity, China's agricultural exports to Russia outperform those of Russian exports to China. It is evident that most of China's agricultural products, which have complementary characteristics in the Russian market, also have trade intensities higher than one. Likewise, Russia's agricultural products, which have comparative advantages and complementarities in the Chinese market, also exhibit trade intensities higher than one.

#### Analysis of Intra-Industry Trade Index (GHM)

The trade pattern of agricultural products can be divided into inter-industry and intra-industry trade. Generally, inter-industry trade emphasizes comparative advantage while intra-industry trade pays attention to the difference in product quality or the difference in product type. Intra-industry trade structure can be divided into horizontal intra-industry trade and vertical intra-industry trade. Horizontal intra-industry trade (HIIT) is easy to establish between countries with similar resource endowments, and vertical intra-industry trade (VIIT) is easy to establish in countries with large differences in resource endowments. The higher the level of intra-industry trade, the higher the degree of economic integration among countries. The development of an intra-industry trade of agricultural products between China and Russia could optimize the structure of the trade of agricultural products between the two countries and increase the close relationship regarding the trade of agricultural products. Table 4 shows that, in 2021, there was a total of six groups of agricultural products belonging to the intra-industry trade model, of which two groups belonged to vertical-type agricultural products and four groups belonged to horizontal-row-type agricultural products. This shows that, even in the intra-industry trade, the difference in resource endowments between the two countries is still large. In the future, China and Russia could focus more on intra-industry trade in agricultural products that appear to improve the level of trade in agricultural products.

**Table 4.** Intra-industry trade of agricultural products (groups) for China and Russia (<sup>V</sup> indicates vertical and <sup>H</sup> indicates horizontal).

Group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
112	0.88 <sup>H</sup>	0.85 <sup>H</sup>	0.65 <sup>V</sup>	0.57 <sup>V</sup>	0.53 <sup>V</sup>		0.85 <sup>H</sup>	0.83 <sup>H</sup>	0.65 <sup>V</sup>		0.72 <sup>V</sup>		0.51 <sup>V</sup>	0.69 <sup>V</sup>	
022			0.75 <sup>H</sup>		0.68 <sup>V</sup>	0.96 <sup>H</sup>	0.98 <sup>H</sup>	0.74 <sup>V</sup>	0.50 <sup>V</sup>						
036			0.63 <sup>V</sup>		0.72 <sup>V</sup>	0.82 <sup>H</sup>	0.58 <sup>V</sup>		0.90 <sup>H</sup>	0.98 <sup>V</sup>	0.69 <sup>V</sup>	0.86 <sup>H</sup>	0.68 <sup>V</sup>	0.95 <sup>H</sup>	0.68 <sup>V</sup>
081					0.55 <sup>V</sup>	0.64 <sup>V</sup>	0.64 <sup>V</sup>	0.77 <sup>V</sup>	0.58 <sup>V</sup>	0.61 <sup>V</sup>	0.79 <sup>V</sup>	0.72 <sup>V</sup>	0.66 <sup>V</sup>	0.51 <sup>V</sup>	
245					0.97 <sup>V</sup>			0.65 <sup>V</sup>	0.53 <sup>V</sup>						0.94 <sup>H</sup>
012	0.61 <sup>V</sup>		0.79 <sup>H</sup>												
035				0.54 <sup>V</sup>		0.51 <sup>V</sup>	0.54 <sup>V</sup>							0.42 <sup>V</sup>	
121							0.92 <sup>H</sup>	0.83 <sup>H</sup>	0.75 <sup>H</sup>	0.66 <sup>V</sup>	0.57 <sup>V</sup>	0.96 <sup>H</sup>	0.79 <sup>H</sup>	0.81 <sup>H</sup>	
268	0.68 <sup>V</sup>	0.50 <sup>V</sup>	0.63 <sup>V</sup>										0.68 <sup>V</sup>		
223				0.98 <sup>H</sup>				0.74 <sup>V</sup>							
291			0.65 <sup>V</sup>	0.69 <sup>V</sup>											
042									0.56 <sup>V</sup>	0.68 <sup>V</sup>					
048									0.86 <sup>H</sup>	0.65 <sup>V</sup>	0.69 <sup>V</sup>	0.58 <sup>V</sup>	0.98 <sup>H</sup>	0.99 <sup>H</sup>	0.53 <sup>V</sup>
111									0.87 <sup>H</sup>	0.96 <sup>H</sup>	0.75 <sup>H</sup>	0.90 <sup>H</sup>	0.75 <sup>H</sup>	0.92 <sup>H</sup>	0.95 <sup>H</sup>
246									0.89 <sup>H</sup>						
263				0.98 <sup>H</sup>											
411		0.52 <sup>V</sup>													0.99 <sup>H</sup>
421					0.61 <sup>V</sup>										
091										0.54 <sup>V</sup>	0.75 <sup>H</sup>		0.72 <sup>V</sup>		0.78 <sup>H</sup>
037											0.71 <sup>V</sup>	0.89 <sup>H</sup>	0.69 <sup>V</sup>		

Note: Data are from the UN Trade Database.

The analysis of the above characteristics shows that the two countries have many groups of agricultural products with comparative advantages in each other's markets and more agricultural products with complementary characteristics, but the comparative advantages of many groups have not yet been reflected. Furthermore, as intra-industry trade in agricultural products grows and trade relationships between Russia and China

become stronger, there is an expectation of realizing the potential for agricultural product trade and further strengthening trade ties.

#### 4. Analysis of Growth Factors of Agricultural Trade between Russia and China

##### 4.1. Growth Factor Analysis of Russian Imports of Chinese Agricultural Products

Tables 5 and 6 show that, for 15 years, Russian imports of Chinese agricultural products experienced growth five times and experienced a decline twice. First-layer decomposition indicates that structural effect and competitive effect play a decisive role in Russian imports of Chinese agricultural products and the demand structure of agricultural products in the Russian market is significantly affected by the world economy. In 2008–2009, 2014–2015, and 2018–2019, the structural effect of China’s export of agricultural products and the demand for agricultural products in the Russian market was negative, which directly led to the decline in Chinese exports of agricultural products to Russia. The competitive effect of China’s export of agricultural products to the Russian market is not stable, and it showed the greatest value during 2014–2015. This presents a relationship with Russia’s ban on agricultural products from Europe and the United States. Among them, 2008–2009 was mainly affected by the global financial crisis, while 2018–2019 was mainly affected by the dual impact of the China–US trade conflict and the Russia–Ukraine conflict. In the second-layer decomposition, structural effects are most affected by growth effects, which explains why the growth in Chinese agricultural exports to Russia is mainly due to the growth in import demand in the Russian market. Although the growth effect is relatively low, it became positive in 2016–2017, although it was negative in the previous year, which means that there is a certain correlation between increases in the export of Chinese agricultural products and Russia’s increasing demand for imports. This is mainly due to Russia’s continued policy of delayed import bans against the West, which has led to an increase in demand for Russian conversations. Product competitiveness is the second main factor in Chinese exports to Russia, which indicates that China’s exports of specific agricultural products have a smaller impact on the share of overall export growth and agricultural products do not have much competitive advantage, showing a deteriorating trend.

**Table 5.** Growth factors regarding Chinese agricultural exports to Russia (2006–2013) (unit: M USD, %).

Growth Factor Decomposition	2006–2007		2008–2009		2010–2011		2012–2013	
	The Absolute Value	%	The Absolute Value	%	The Absolute Value	%	The Absolute Value	The Absolute Value
Year-on-year export growth	310.67	100	−196.8	100	415.13	100	100.33	100
First-level decomposition								
Structure effect	235.3	76	−173.18	88	277.64	67	168.69	168
Competitive effect	48.59	16	−11.35	6	102.35	25	−61.66	−61
Cross effect	26.78	9	−12.28	6	35.13	8	−6.69	−7
Second-level decomposition								
Growth effect	223.51	72	−208.02	106	240.21	58	107.91	108
Product structure effect	11.79	4	34.84	−18	37.43	9	60.77	61
Comprehensive competitiveness	68.17	22	13.22	−7	149.04	36	−0.06	0.06
Product competitiveness	−19.58	−6	−24.57	12	−46.69	−11	−61.61	−61
Cross effect	26.78	9	−12.28	6	35.13	0.08	−6.69	−7

Note: Data are from the UN Trade Database.



**Table 6.** Growth factors regarding Chinese agricultural exports to Russia (2014–2021) (unit: M USD, %).

Growth Factor Decomposition	2014–2015		2016–2017		2018–2019		2020–2021	
	The Absolute Value	%	The Absolute Value	%	The Absolute Value	%	The Absolute Value	The Absolute Value
Year-on-year export growth	−401.89	100	179.28	100	9.72	100	848.05	100
First-level decomposition								
structure effect	−668.55	166	289.23	161	−14.89	−153.19	203.96	473.8
Competitive effect	403.53	−100	−87.82	−49	26.33	270.88	−139.37	−323.74
Cross effect	−136.87	34	−22.13	−12	−1.72	−17.69	−21.55	−50.06
Second-level decomposition								
Growth effect	−671.34	167	11.62	6	1.97	20.27	251.5	584.2
Product structure effect	2.79	−1	277.61	155	−16.86	−173.46	−47.53	−110.41
Comprehensive competitiveness	269.45	−67	−5.01	−3	7.75	79.73	−157.67	−366.25
Product competitiveness	134.08	−33	−82.81	−46	18.58	191.15	18.29	42.49
Cross effect	−136.87	34	−22.13	−12	−1.72	−17.69	−21.55	−50.06

Note: Data are from the UN Trade Database.

#### 4.2. Growth Factors Regarding Chinese Imports of Russian Agricultural Products

Tables 7 and 8 show that, from 2006 to 2021, Chinese imports of Russian agricultural products also experienced growth five times and experienced a decline three times. Three of these declines were primarily due to the global financial crisis, the Ukraine crisis, and the trade war between China and the United States. The first-layer decomposition shows that the structure and competitive effects are determinants of Chinese imports of Russian agricultural products and the embodiment of this structure effect is obvious. During the period 2016–2021, the structure effect of Russian agricultural products in the Chinese market changed from negative to positive and was much greater than the competitive effect, which indicates the importance of Russian agricultural products in the Chinese market. It can be said that the future growth trend of Russian agricultural products in the Chinese market will be determined by the structure of Russian agricultural products, and this is almost consistent with Russia's import of Chinese agricultural products. The second-level decomposition shows that the determinant for the structure effect changes from the absolute effect of the growth effect to the combined effect of the growth effect and product structure effect. In 2016–2017, the growth effect and product structure effect of Russian agricultural products in the Chinese market were both positive and the value of the product structure effect was considerable, which indicates that Russian exports of Chinese agricultural products closely match China's import demand growth and the rapid import growth of agricultural products. The comprehensive competitiveness effect and product competitiveness effect play equally important roles in the structure effect. From 2016 to 2021, the comprehensive competitiveness effect and product competitiveness effect of Russian agricultural products were negative. However, the growth effect and product structure effect have positive values and Russian exports of agricultural products to China are still positive, which indicates that the comprehensive competitiveness and product competitiveness of Russian agricultural products in the Chinese market have significantly declined. However, the product matching degree is high, which has a significant impact on the growth in agricultural imports in the Chinese market. In short, the determinant for the growth in Russian agricultural products that are exported to China is changing from the effect of increases in China's import demand to the effect of Russia's product structure in the Chinese market. This is also consistent with the characteristics analysis of Russian agricultural products for the Chinese market and explains why the status of Russian agricultural products in the Chinese market is improving.

**Table 7.** Growth factors of Russian agricultural exports to China (2006–2013) (unit: M USD, %).

Growth Factor Decomposition	2006–2007		2008–2009		2010–2011		2012–2013	
	The Absolute Value	%	The Absolute Value	%	The Absolute Value	%	The Absolute Value	The Absolute Value
Year-on-year export growth	1199.58	100	−1156.23	100	1318.63	100	−331.95	100
First-level decomposition								
structure effect	1095.93	91	−644.13	56	1731.63	131	763.03	−230
Competitive effect	102.07	9	−655.17	57	−308.31	−23	−917.98	277
Cross effect	1.58	0.1	143.07	−12	−104.7	−8	−177	53
Second-level decomposition								
Growth effect	1135.62	95	−659.71	57	1796.02	136	311.35	−94
Product structure effect	−39.69	−3	15.58	−1	−64.39	−5	451.68	−136
Comprehensive competitiveness	50.54	4	−562.57	49	−357.11	−27	−609.72	184
Product competitiveness	51.53	4	−92.61	8	252.41	19	−308.26	93
Cross effect	1.58	0.1	143.07	−12	−104.7	−8	−177	53

Note: Data are from the UN Trade Database.

**Table 8.** Growth factors of Russian agricultural exports to China (2014–2021) (unit: M USD, %).

Growth Factor Decomposition	2014–2015		2016–2017		2018–2019		2020–2021	
	The Absolute Value	%	The Absolute Value	%	The Absolute Value	%	The Absolute Value	The Absolute Value
Year-on-year export growth	152.15	100	1125.91	100	−527.16	100	1271.66	100
First-level decomposition								
structure effect	−711.7	−468	1365.91	121	1002.94	−190.25	4671.44	325.45
Competitive effect	1013.08	666	−283.22	−25	−1302.66	247.11	−2337.43	−162.85
Cross effect	−149.24	−98	43.21	4	−227.44	43.14	−898.65	−62.61
Second-level decomposition								
Growth effect	−345.78	−227	8.19	1	157.89	−29.95	4614.48	321.49
Product structure effect	−365.92	−240	1357.73	121	845.05	−160.3	56.95	3.97
Comprehensive competitiveness	530.27	349	−6.88	−1	−685.05	−129.95	−1108.76	−77.25
Product competitiveness	482.81	317	−276.34	25	−617.61	117.16	−1228.66	−85.6
Cross effect	−149.24	−98	43.21	4	−227.44	43.14	−898.65	−62.61

## 5. Conclusions and Policy Implications

### 5.1. Conclusions

First of all, the general normalized revealed comparative advantage of agricultural products from China in the Russian market is initially negative, but it gradually becomes positive after 2020, indicating an improvement in comparative advantage. On the other hand, the comparative advantage of Russian agricultural products in the Chinese market is basically positive, and although it has been declining in recent years, the advantages of Russian agricultural exports compared to Chinese agricultural exports are now more pronounced. The trade complementarity between the two countries is greater than one, and this trend increased over the last four years, so the complementarity has been strengthened. Before 2017, the intra-industry trade of agricultural products between the two countries was below 10%. However, in recent years, it has shown a positive trend and increased to 10.33% in 2021, indicating increasingly close ties. The intra-industry trade structure is primarily based on vertical intra-industry trade, reflecting significant differences in the product qualities of both countries. The intensity of agricultural trade between the two countries is above one. Specifically, the trade intensity of China's agricultural exports to Russia has been increasing recently, while the trade intensity of Russia's agricultural exports to China has been decreasing.

Secondly, we take a specific look at each of the 66 categories of agricultural products. From the perspective of the trade comparative advantage, the normalized revealed comparative advantage in terms of Chinese agricultural products has no normalized revealed comparative advantage in the Russian market, while Russia has 10 groups in the Chinese

market. From the perspective of trade complementarity, we observed that there are 20 and 17 complementary agricultural product groups between China and Russia, respectively. These numbers are higher than the groups of agricultural products with a comparative advantage. From the perspective of intra-industry trade, there were six types of agricultural products that were subject to intra-industry trade between the two countries in 2021, with the horizontal type of intra-industry trade mode dominating. From the perspective of trade intensity, the number of agricultural products with a trade intensity greater than one between the two countries is 18 for Chinese agricultural products in Russia and 16 for Russian agricultural products in China. Among the aforementioned groups of agricultural products, Russia primarily exhibits resource-intensive characteristics, while China is mainly labor-intensive. This observation essentially reflects the agricultural resource endowment of both countries.

Thirdly, an analysis of growth factors shows that Chinese agricultural exports to the Russian market are most influenced by the product structure effect among the structural effects and second most influenced by the product competitiveness effect compared to all competitiveness effects. On the other hand, Russian agricultural exports to the Chinese market are primarily influenced by the structural effect, with the product structure effect being the most significant. Furthermore, the competitiveness effect also plays a significant role, with the product competitiveness effect being larger.

## 5.2. Policy Implications

In order to further expand and deepen Sino–Russian agricultural trade cooperation, bilateral governments and enterprises need to grasp trade development trends, improve cooperation mechanisms, optimize the structure of the agricultural industry, and build a comprehensive support and guarantee system. The specific actions are as follows.

### 5.2.1. Grasp the Development Trend of Sino–Russian Trade in Agricultural Products

First, it is necessary to grasp the rare historical opportunity provided by the current cooperation between the two countries. The comprehensive strategic partnership of cooperation between China and Russia is currently experiencing significant growth, with deepened exchanges and cooperation in various fields. It is important to continue building on the achievements in agricultural trade between the two countries, especially considering the market gaps created by the sanctions and counter-sanctions resulting from the Russia–Ukraine war and the uncertainty surrounding the Black Sea grain deal. Efforts should be made to expand the trading volume of agricultural products, improve the trade structure, and strengthen the agricultural trade relationship between China and Russia. We should also aim to improve the market position of the two countries' import and export of agricultural products. China and Russia are important export markets of agricultural products for each other, but the import trade is relatively low. This should be continually strengthened and consolidated so that the complementary agricultural products of China and Russia can also have comparative advantages in each other's markets and the types and quantities of agricultural products from the two countries entering each other's markets will increase. Finally, efforts should be made to improve the trade of agricultural products that have a comparative advantage and complementarity between the two countries to optimize the trade structure. China must focus on developing the trade of horticultural products, aquatic products, and other agricultural exports from Russia. China's comparative advantages regarding these types of agricultural products should be consolidated, and focus should be placed on individual products that do not have comparative advantages, such as bulk agricultural products, animal products, tobacco, and beverages, to cultivate their comparative advantages. Imports of Russian aquatic products should be maintained and, at the same time, the number of imports of other agricultural products should be increased so as to increase the competitiveness of Russian agricultural products in the Chinese market. Joint efforts are required to implement the trade of complementary agricultural products; this

could be achieved on the market by developing Chinese horticulture, aquatic and other agricultural products, and Russian aquatic products and bulk agricultural products.

#### 5.2.2. Strengthening the Mechanism of Sino–Russian Agricultural Trade Cooperation

The international market of agricultural products is variable, unpredictable, and has frequent price fluctuations. Coupled with political, diplomatic, epidemic, and other factors, it is difficult for any country to prevent and deal with this market alone. In this scenario, looking for a strong trade partner and establishing good trade cooperation mechanisms has become the norm. At present, this should be carried out under the guidance of the Prime Minister’s regular meeting committee and the sub-committee on the agricultural cooperation of the two countries. The strategic situation of the construction of the Eurasian Economic Union and “The Belt and Road Initiative” suggests the need to improve and reconstruct cooperation mechanisms by focusing on improving trade rules, improving their implementation capacity, and settling trade frictions and disputes. First, it is necessary to improve the Sino–Russian agricultural trade rules, reduce or eliminate trade and policy barriers for agricultural products from the two countries, and increase the opportunities for agricultural products to circulate. This can be achieved by gradually opening up access to sensitive areas of agriculture, expanding the breadth and scale of investment in agriculture, carrying out various forms of agricultural cooperation, especially in technology research and development, streamlining the labor force, and establishing transnational agribusiness management, as well as through extensive exchanges and cooperation in the field of food culture and promoting trade by cooperation. Additionally, the execution of agricultural trade should be improved. This can be achieved by the construction of key trade ports between China and Russia, using areas such as Harbin, Manzhouli, Heihe, Suifenhe, and Dongning as key trade ports for the pilot projects. The promotion of regulation is also suggested, as well as the mutual recognition of inspection and quarantine certification, establishment of a barrier-free transport or “green channel” for agricultural products, and further promotion of the free market regarding agricultural production factors. It is also necessary to establish an effective trade consultation mechanism and solve problems through dialogue. After all, the two countries have different cultural environments, the levels of political and economic development are different, and there are differences in the definition of agricultural trade standards; therefore, agricultural trade friction is inevitable and can only be reduced by improving the sense of cooperation and strengthening the communication channels between the governments and agricultural sector. This will help to solve problems effectively and reduce the frequency of problems.

#### 5.2.3. Promote the Interaction and Progress of Sino–Russian Agricultural Trade, China’s Supply-Side Structural Reform, and Russia’s Industrial Restructuring

Agricultural supply-side structural reform is not only the endogenous driving force when building a strong agricultural and trade country but also an inevitable choice when promoting the Chinese path to modernization. This reform is not simply a change in the relationship between total amount and quantity, but, more importantly, it allows the market demand to be understood and can transform a production advantage into a market advantage by improving the quality and working on the supply side. In recent years, Russia has taken the development of agriculture as an important form of industrial structure adjustment, which is in line with the promotion of Sino–Russian agricultural trade. Agricultural trade, reform, and adjustment between the two countries can have a co-progressive effect. In order to realize the co-progressive effect in the formulation and implementation of trade activities and policies regarding agricultural products, the two countries need to support China’s labor-intensive and Russia’s resource-intensive agricultural products based on resource endowments, focusing on comparative costs, technological progress, domestic support, and trade policies to enhance the international competitiveness of the agricultural products of both countries and promote agricultural supply-side structural reform and industrial structure adjustments. Both countries need to actively and proactively under-

stand each other's markets and the corresponding international trade dynamics of their agricultural products, enrich product types, and meet each other's needs while relying on the market to guide agricultural supply-side structural reform and industrial restructuring. Both governments and enterprises need to increase their investment in the capital and technology of agricultural products, introduce new varieties and advanced production and processing technology, improve product quality, and expand and improve the scale and level of deep processing. An integrated development of the whole industrial chain should be undertaken to improve the level of intra-industry trade in agricultural products. In addition, the value-added capacity of agricultural cooperation between the two countries on the global value chain should be strengthened, the competitiveness level of bilateral agricultural trade should be increased, the two countries' agriculture status in the global value chain should be jointly upgraded, and the high-quality development of the two countries' agriculture should be promoted.

#### 5.2.4. Build a Comprehensive Support and Guarantee System for China–Russia Agricultural Trade

To increase the level of opening-up to the outside world and build a large-scale, wide-ranging, and deep-seated pattern of opening-up, it is necessary to have a systematic support and guarantee system. A linkage support system that integrates platform support, enterprise guidance, financial support, and logistics support is supposed to be built to promote the in-depth integrated development of the trade in agricultural products between China and Russia. First, an agricultural trade platform construction ought to be solidly promoted. Adhering to the cooperation concept of “joint consultation, joint construction, and shared benefits” and in accordance with the principle of “mutual benefit and win–win cooperation for common development”, high-quality development bases should be built for agricultural international trade, as well as cross-border economic and trade cooperation zones and other carrier platforms, to form industrial clusters, platform effects, and synergy effects. The industrial chain should be optimized and Sino–Russian agricultural cooperation should be improved. Second, international grain merchants and traders ought to be cultivated. Based on the basic national conditions of a populous nation with small-scale agricultural operations, we should cultivate international grain merchants, support and strengthen leading enterprises, and strive to have more say in the international market. Enterprises should be encouraged to promote the agglomeration of cooperative resources and strengthen the resilience of China's agricultural product supply chain through acquisitions, mergers, alliances, and other measures. Additionally, the financial support system should be improved. The existing policy support and financial subsidies should be strengthened; banks, trusts, and other financial institutions should be strengthened to provide more credit enhancement support for foreign trade enterprises; and insurance agencies should be encouraged to design special risk management products to provide practical support for bilateral cooperation projects. The construction of trade channels should be sped up. The trade network needs to be unblocked so that a safe and efficient trade channel with internal and external connectivity can be built. The construction of maritime, land, and air transport channels that are in cooperation with Russia should be strengthened, a three-dimensional trade logistics network should be built, and an open channel should be maintained among agricultural materials, agricultural tools, agricultural products, and other elements to help improve the quality and efficiency of Sino–Russian trade.

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