

Article

Research on the Competitiveness and Complementarity of Agricultural Trade between China and the Association of Southeast Asian Nations

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Abstract: Agricultural trade is the foundation of world trade and an important link in economic and trade relations between countries or regions. Exploring the competitiveness and complementarity of the agricultural trade between China and the Association of Southeast Asian Nations, or ASEAN, could provide a theoretical basis for tapping the growth potential of the agricultural trade between China and ASEAN and expanding the trade relationship. According to the theory of comparative advantage, trade complementarity theory, and intra-industry trade theory, and based on UN Comtrade data from 2013 to 2022, this study uses the Regional Revealed Comparative Advantage Index, the Trade Complementarity Index, and the Intra-Industry Trade Index to measure the competitiveness, complementarity, and intra-industry trade level of China–ASEAN agricultural trade, including HS01–24 commodities. The results show that the agricultural trade between China and ASEAN is both competitive and complementary. The competitiveness of China's agricultural exports to ASEAN is greater than that of ASEAN's agricultural exports to China, and the complementarity of the former is less than that of the latter. Both sides have their own comparative advantage products, and there is also a strong competitive relationship in some agricultural product fields. The bilateral agricultural trade is mainly intra-industry trade, and the level is relatively high, while some strongly competitive agricultural products urgently need to transform from inter-industry to intra-industry trade. China and ASEAN should participate in bilateral trade based on the comparative advantages of their own agricultural products; ASEAN should improve the quality of agricultural products to enhance international competitiveness; China should tap into the market demand for ASEAN agricultural products to enhance the complementarity of its agricultural exports to ASEAN; and the two sides should formulate different policies for different types of agricultural products.

Keywords: agricultural trade relationship; competitiveness; complementarity; intra-industry trade; cooperation; potential; China; ASEAN



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1. Introduction

Agricultural trade plays an important role in global food security and resource sustainability [1]. It is the foundation of world trade and an important link in economic and trade relations between countries or regions. Promoting the stable development of agricultural trade is of great significance to maintaining international food security, ensuring the supply of agricultural products, and promoting sustainable economic and social development. China and ASEAN have unique geographical and cultural ties. Driven by specific framework agreements such as the China–ASEAN Free Trade Area (CAFTA) and the Regional Comprehensive Economic Partnership (RCEP), bilateral agricultural trade has grown rapidly. China's agricultural exports and imports to the ASEAN increased from USD 26.144 billion to USD 59.775 billion, an increase of 128.64%, from 2013 to 2022. This

sector accounted for over 15% of China's total foreign trade in agricultural products, reaching a peak of 18.69% in 2022 (Figure 1). Currently, ASEAN stands as China's largest agricultural export market, second-largest agricultural import market, and primary agricultural trading partner [2]. Despite this, the development of the agricultural trade between China and ASEAN still has considerable volatility; in particular, the growth rate of China's agricultural exports to ASEAN fluctuated from 16.82% in 2013 to 9.87% in 2022 (Figure 2). Against the backdrop of increasingly fierce competition in global agricultural trade, how to tap the growth potential of the agricultural trade between China and ASEAN and expand bilateral agricultural trade relations requires a more in-depth analysis of the competitiveness and complementarity of bilateral agricultural trade.

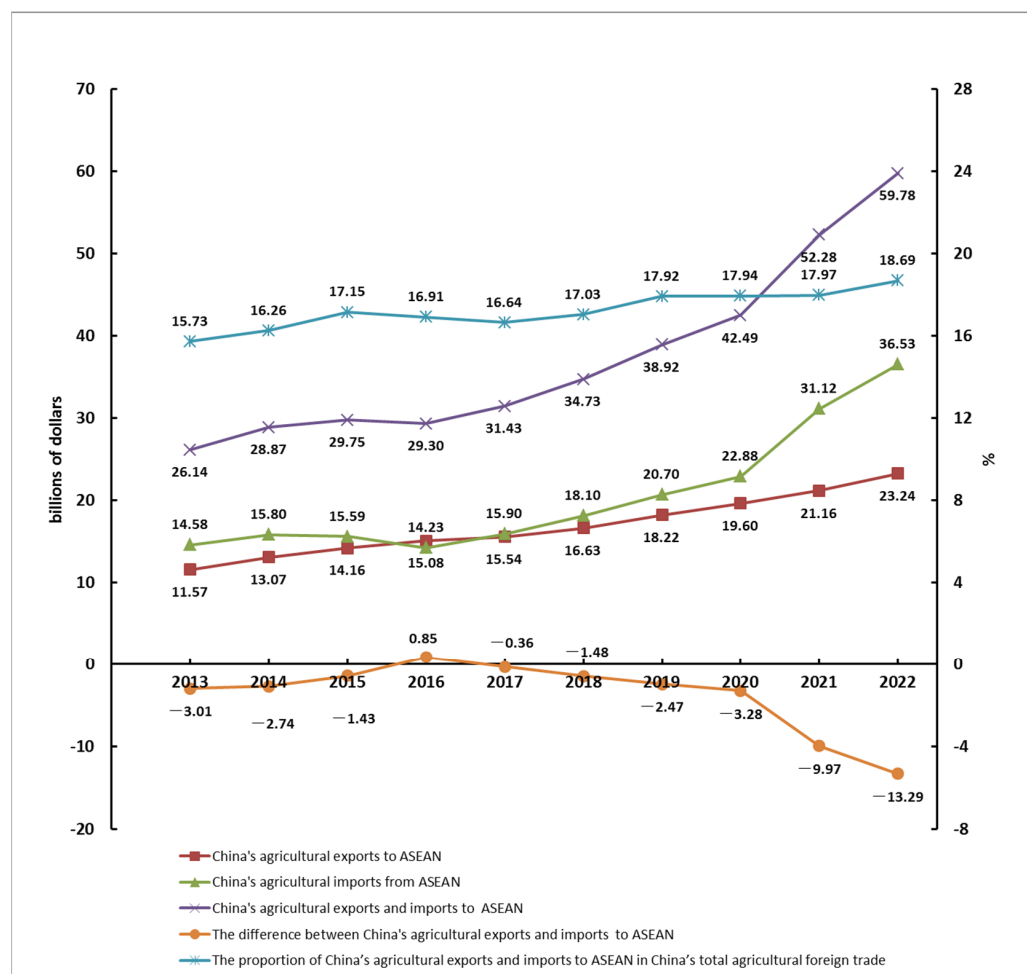


Figure 1. Scale and status of China's agricultural exports and imports to ASEAN from 2013 to 2022. Notes: 1. The difference between China's agricultural exports and imports to ASEAN indicates whether China and ASEAN are in a surplus or deficit position in bilateral agricultural trade, or whether China or ASEAN is in a favorable position or has a competitive advantage. 2. The proportion of China's agricultural exports and imports to ASEAN in China's total agricultural foreign trade in the 2013–2022 period represents the status of bilateral agricultural trade in China's foreign trade of agricultural products. Source: Calculated based on United Nations Commodity Trade Statistics Database.

Mutual complementation and inevitable trade competition characterize the bilateral trade between China and ASEAN [3]. This holds true for bilateral agricultural trade as well. In 2022, the top ten agricultural products exported by China to ASEAN were, sequentially, HS07, HS16, HS08, HS03, HS20, HS21, HS17, HS23, HS09, and HS15, and the top ten agricultural products exported by ASEAN to China were, sequentially, HS15, HS08,

HS03, HS11, HS07, HS23, HS10, HS22, HS20, and HS12, featuring both common and different commodities. This indicates strong competitiveness and significant complementarity in the agricultural trade between the two. Simultaneously, the imbalance in the agricultural trade between China and ASEAN underscores a notable gap in competitiveness and complementarity. As shown in Figure 1, except for 2016, China's agricultural exports to ASEAN had consistently been smaller than its import scale, with the deficit fluctuating from USD 3.01 billion to USD 13.29 billion from 2013 to 2022. Thus, what is the competitiveness and complementarity of the agricultural trade between China and ASEAN? What is the degree of cooperation and development potential of bilateral agricultural trade?

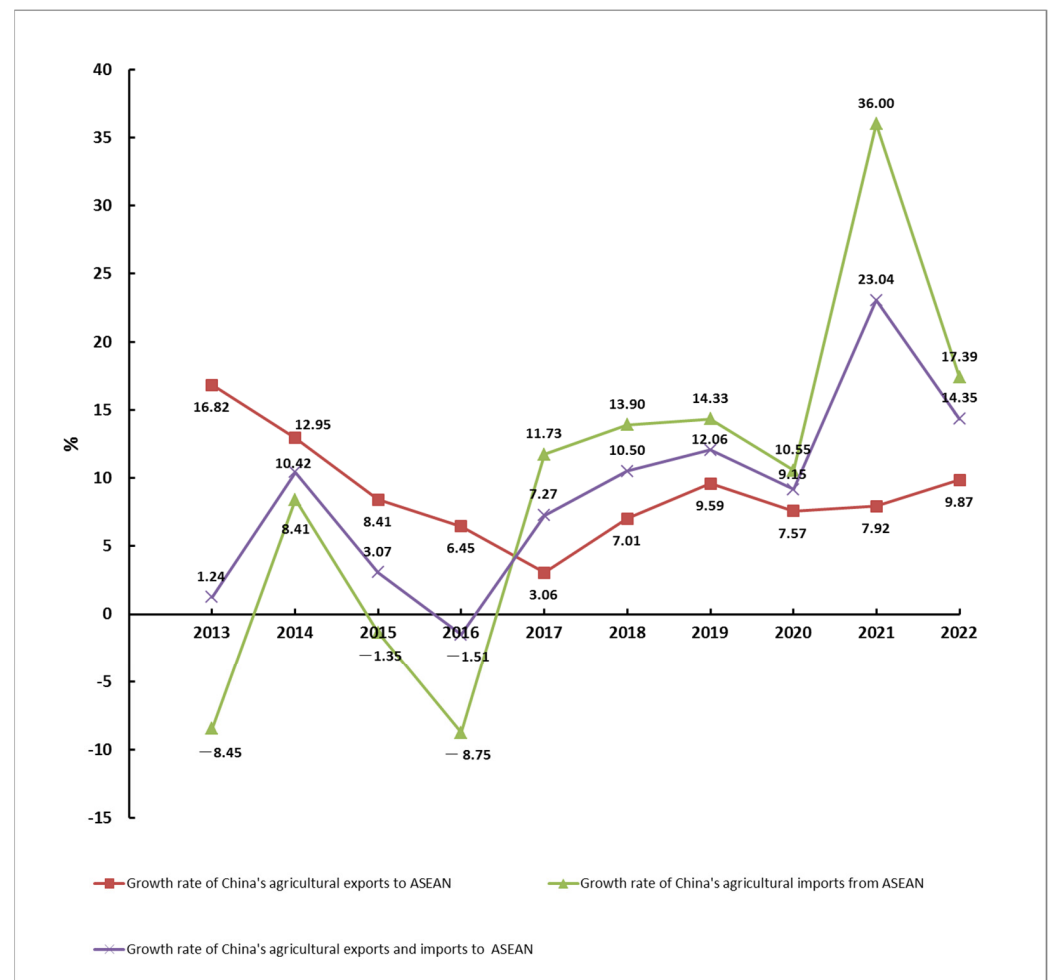


Figure 2. Growth rate of China's agricultural exports and imports to ASEAN from 2013 to 2022. Source: Calculated based on United Nations Commodity Trade Statistics Database.

Existing research pays more attention to China–ASEAN agricultural trade. The research hotspots focus on zero tariffs, countermeasures, trade effects, influencing factors, binary margin, pig products, cotton imports, export volume, trade potential, the Belt and Road Initiative, and Three Yuan Margins [4]. Some studies involve the competitiveness and complementarity of agricultural trade between China and ASEAN or certain ASEAN countries. It is generally believed that there is competitiveness and complementarity in bilateral agricultural trade, and competitiveness is very important. Inherent comparative advantages generally exist in different categories of agricultural products in the agricultural trade between China and Malaysia [5]. Advantageous agricultural products, especially those from Southeast Asia and other regions, are strongly complementary to China's imports and show huge trade potential [6]. Competitiveness is the main factor driving the growth of China's vegetable exports to ASEAN [7]. The competitiveness between

China and ASEAN or specific ASEAN countries in terms of agricultural trade is often compared. Southeast Asia's agricultural trade competitiveness is strong, while China's is weak [8]. Thailand's agricultural trade has a more significant competitive advantage than China's but is complementary in specific agricultural product categories [9,10]. Vietnam's agricultural products are more competitive than China's; China's exports to Vietnam and Vietnam's imports have strong complementarity in Category 0 products, while Vietnam's exports to China and China's imports have strong complementarity in Category 2 products [11].

Trade potential and cooperation are closely related to the competitiveness and complementarity of international trade. Among China's agricultural exports to ASEAN, the export trade potential of different types of agricultural products varies significantly. There is insufficient trade in animal products and animal and plant oils, excessive trade in plant products, and normal trade in food, beverages, and tobacco. Among China's agricultural imports from ASEAN, China's trade with Brunei, Indonesia, Cambodia, and Laos is insufficient, while trade with other countries is normal [12]. Vietnam's agricultural exports to China are closer to their potential levels than China's exports to Vietnam, and there is still room for improvement in the export efficiency of the China–Vietnam partnership [13]. China's central region has huge trade potential with Indonesia and the Philippines, and there is still room for development in trade with Thailand [14]. China and Thailand have both competitive and complementary relations in agricultural trade, and the bilateral relationship is more suitable for cooperative development [10].

Agricultural trade between China and ASEAN is an important part of bilateral trade and China's foreign trade in agricultural products, which could be expanded through the expansion of bilateral agricultural trade. The question is how to expand agricultural trade between China and ASEAN. The complementarity and competitiveness of international trade show the advantages and disadvantages of cross-border exports and future export trends [9]. Therefore, studying the competitiveness and complementarity of agricultural trade could provide effective paths for expanding the agricultural trade between China and ASEAN. Existing research either explores the competitiveness and complementarity of agricultural trade between China and the "Belt and Road" countries or between China and a certain ASEAN country. Few studies specifically study the competitiveness and complementarity of the current agricultural trade between China and ASEAN, especially the competitiveness and complementarity of bilateral agricultural trade specifically. Thus, which agricultural products sold between China and ASEAN are competitive and which are complementary? What policies should be adopted for different agricultural products? According to the theory of comparative advantage, trade complementarity theory, and intra-industry trade theory, this study uses the Regional Revealed Comparative Advantage Index (RRCA index), the Trade Complementarity Index (TCI), and the Intra-Industry Trade Index (G–L Index) to calculate the competitiveness, complementarity, and level of intra-industry trade in the agricultural trade between China and ASEAN from 2013 to 2022; explore their evolution laws; tap into their development potential; and seek effective development paths in order to provide a basis for expanding cooperation and consolidating the status of bilateral trade.

The innovations of this study are as follows: (1) A detailed calculation and analysis is conducted of the competitiveness, complementarity, and intra-industry trade level of each agricultural product trade of HS01-24 between China and ASEAN from 2013 to 2022, and the development potential and expansion paths of the bilateral agricultural trade based on commodity segmentation are explored. (2) Considering that this study examines the relationship of competition and cooperation in bilateral trade, the Regional Revealed Comparative Advantage Index (RRCA index) method is used to measure the competitiveness of China's agricultural exports to ASEAN and ASEAN's agricultural exports to China. Moreover, the Regional Revealed Comparative Advantage Index and the Regional Revealed Comparative Disadvantage Index are used to measure the complementarity of China's agricultural exports to ASEAN and ASEAN's agricultural exports to China. The remain-

der of this article is organized as follows. Section 2 explains the data sources and research methods, Section 3 presents the research calculation results and discussion, and Section 4 provides the conclusions, policy recommendations, and limitations.

2. Data and Methods

2.1. Data Composition and Sources

According to Annex 1 of the WTO Agreement on Agriculture, agricultural products include Chapters 1 to 24 (HS01-24) of the Harmonized Commodity Description and Coding System, except fish and fish products, and other commodities listed in the list. Since the HS01-24 commodities are the main agricultural products sold between China and ASEAN, they reflect the dynamics of bilateral agricultural trade to a large extent. In addition, considering the feasibility of quantitative analysis, the scope of agricultural products selected in this article includes commodities in HS01-24. See Table 1 for details.

Table 1. HS01-24 of agricultural products of the harmonized commodity description and coding system.

Category	HS Code	Species
1 (Live Animals, Animal Products)	01	Live animals
	02	Meat and edible meat offal
	03	Fish and crustaceans
	04	Dairy produce
	05	Products of animal origin
2 (Plant Products)	06	Live trees and other plants
	07	Edible vegetables
	08	Edible fruit and nuts
	09	Coffee, tea
	10	Cereals
	11	Products of the milling industry
	12	Oil seeds and oleaginous fruits
	13	Lac; gums
	14	Vegetable plaiting materials
3	15	Animal or vegetable fats and oils
4 (Food; Beverages, Wine, and Vinegar; Tobacco and Tobacco Substitute Products)	16	Preparations of meat, of fish, or of crustaceans
	17	Sugars and sugar confectionery
	18	Cocoa and cocoa preparations
	19	Preparations of cereals, flour, starch, or milk
	20	Preparations of vegetables, fruit, or nuts
	21	Miscellaneous edible preparations
	22	Beverages, spirits, and vinegar
	23	Residues and waste from the food industry
	24	Tobacco and manufactured tobacco substitutes

Data on China's export and import of agricultural products to ASEAN came from the United Nations Commodity Trade Statistics Database (UN Comtrade). On the platform, the relevant data were obtained by entering 01-24 of HS (as reported) Commodity Codes, and selecting Periods (2013–2022), Reporters (China), Partners (Malaysia, Indonesia, Thailand, Philippines, Singapore, Brunei, Vietnam, Laos, Myanmar, and Cambodia), 2nd Partner (World), Trade Flows (export or import), Modes of Transport (TOTAL modes of transport), Customs Codes (TOTAL customs procedure codes), and Aggregate By (None). Other relevant data are obtained in the same way.

2.2. Research Methods and Statistical Indicators

The Regional Revealed Comparative Advantage Index (RRCA index) was used in this study to calculate the trade competitiveness, the Trade Complementarity Index (TCI) was used to measure the trade complementarity, and the Intra-Industry Trade Index (G–L In-

dex) was used to calculate the level of intra-industry agricultural trade, including total products and each HS01-24, between China and ASEAN from 2013 to 2022.

2.2.1. Regional Revealed Comparative Advantage Index (RRCA Index)

The Revealed Comparative Advantage Index (RCA index) refers to the ratio of a country's share of its exports of a certain product or industry in its total exports to the share of the world's exports of that product or industry in the world's total exports. It is the most convincing indicator used to measure the international market competitiveness of a certain type of product or industry in a country. The larger the RCA index, the stronger the international competitiveness of a country's product or industry, and vice versa [15]. When the $RCA \geq 2.5$, this indicates that the product or industry of a country is very strongly competitive; when $1.25 \leq RCA < 2.5$, it is strongly competitive; when $0.8 \leq RCA < 1.25$, it has average competitiveness; and when the $RCA < 0.8$, it is weakly competitive. Because this study examines bilateral trade competitiveness, the Regional Revealed Comparative Advantage Index (RRCA index) method is used to measure the competitiveness of China's agricultural exports to ASEAN and ASEAN's agricultural exports to China.

Assuming i represents China and j represents ASEAN, the calculation formula for the RRCA index of China's agricultural exports to ASEAN is

$$RRCA_{xij}^k = (X_{ij}^k/X_{ij}^t)/(X_i^k/X_i^t) \quad (1)$$

$RRCA_{xij}^k$ represents the RRCA index of product k of China's exports to ASEAN, and X_{ij}^k and X_{ij}^t represent the export volume of product k and total products of China's exports to ASEAN, respectively. X_i^k and X_i^t represent the export volume of product k and total products in China, respectively.

The calculation formula for the RRCA index of ASEAN's exports of agricultural products to China is

$$RRCA_{xji}^k = (X_{ji}^k/X_{ji}^t)/(X_j^k/X_j^t) \quad (2)$$

$RRCA_{xji}^k$ represents the RRCA index of product k of ASEAN exports to China, and X_{ji}^k and X_{ji}^t represent the export volume of product k and total products of ASEAN exports to China, respectively. X_j^k and X_j^t represent the export volume of product k and total products of ASEAN, respectively.

2.2.2. Trade Complementarity Index (TCI)

The TCI was proposed by Japanese scholar Kiyoshi Kojima and further improved by economist Peter Drysdale (1967) [16]. It is used to measure the closeness of trade relations between countries or regions. It is the product of the export revealed comparative advantage index of a certain product or industry in one country or region and the import revealed comparative disadvantage index of the product or industry in another country or region. When the $TCI > 1$, this indicates that the trade complementarity of product k between countries or regions is strong, and the larger the value, the stronger the complementarity; when the $TCI < 1$, it is weak, and the smaller the value, the weaker the complementarity. The index primarily measures how well a country's export patterns match another country's import patterns, rather than how well they match world import patterns [17]. This study uses the Regional Revealed Comparative Advantage Index and the Regional Revealed Comparative Disadvantage Index to measure the TCI of China's agricultural exports to ASEAN and ASEAN's agricultural exports to China.

1. TCI for one single agricultural product.

The calculation formula for the TCI of China's exports of each HS01-24 to ASEAN is

$$TCI_{xij}^k = RRCA_{xij}^k \times RRCA_{mji}^k \quad (3)$$

TCI_{xij}^k represents the TCI of product k of China exports to ASEAN and ASEAN imports from China; for $RRCA_{xij}^k$, see formula (1). The calculation formula for $RRCA_{mji}^k$ is

$$RRCA_{mji}^k = (M_{ji}^k/M_{ji}^t)/(M_j^k/M_j^t) \quad (4)$$

$RRCA_{mji}^k$ is the Revealed Comparative Disadvantage Index of ASEAN imports of China's product k . M_{ji}^k and M_{ji}^t represent ASEAN imports of China's product k and total products, respectively, and M_j^k and M_j^t represent ASEAN imports of world products k and total products, respectively.

The calculation formula for the TCI of ASEAN's exports of each HS01-24 to China is

$$TCI_{xji}^k = RRCA_{xji}^k \times RRCA_{mij}^k \quad (5)$$

TCI_{xji}^k represents the TCI of product k of ASEAN exports to China and China imports from ASEAN; for $RRCA_{xji}^k$, see formula (2). The calculation formula for $RRCA_{mij}^k$ is

$$RRCA_{mij}^k = (M_{ij}^k/M_{ij}^t)/(M_i^k/M_i^t) \quad (6)$$

$RRCA_{mij}^k$ is the revealed comparative disadvantage index of China imports of ASEAN's product k . M_{ij}^k and M_{ij}^t represent China's import of ASEAN's product k and total products, respectively, and M_i^k and M_i^t represent China's import of world product k and total products, respectively.

2. TCI for total agricultural products.

Formulas (3) and (5) are applicable for calculating the TCI of one single agricultural product, while this study covers HS01-24 of commodities. To examine the overall trend of total agricultural products, the weighted average method is used in this study to calculate the TCI of the agricultural trade between China and ASEAN, with the weighting coefficient using the international market share (MS) of each agricultural product. The calculation formula for the weighted TCI of China's agricultural products exported to ASEAN and ASEAN imports from China is

$$TCI_{xij}^k = \Sigma[(RRCA_{xij}^k \times RRCA_{mji}^k) \times MS_i^k] \quad (7)$$

$$MS_i^k = X_i^k/X_w^k \quad (8)$$

The calculation formula for the weighted TCI of ASEAN's agricultural products exported to China and China's imports from ASEAN is

$$TCI_{xji}^k = \Sigma[(RRCA_{xji}^k \times RRCA_{mij}^k) \times MS_j^k] \quad (9)$$

$$MS_j^k = X_j^k/X_w^k \quad (10)$$

2.2.3. Intra-Industry Trade Index (G-L Index)

Global intra-industry trade has grown steadily since the early 1960s [18]. The Intra-Industry Trade Index is usually used to measure the degree of trade between trading parties in the same industry. If trading parties have both export and import trade in a certain industry, it means that the two trading parties have trade complementarity in this industry. Grubel and Lloyd first proposed the Grubel-Lloyd index, also known as the Intra-Industry Trade Index (G-L index), in 1975 [19]. The specific formula is as follows:

$$GL_{ij}^k = 1 - 1X_{ij}^k - M_{ij}^k/(X_{ij}^k + M_{ij}^k) \quad (11)$$

GL_{ij}^k represents the G-L index of product k between China and ASEAN, X_{ij}^k represents China's exports of product k to ASEAN, M_{ij}^k represents China's imports of product

k from ASEAN, $|X_{ij}^k - M_{ij}^k|$ refers to the absolute value of the difference between China's exports and imports of product k to ASEAN, and $X_{ij}^k + M_{ij}^k$ refers to the sum of China's exports and imports of product k to ASEAN. When $GL = 0$, the bilateral trade in product k is complete inter-industry trade; when $0 < GL < 0.5$, it is mainly the inter-industry trade, and the smaller the value, the higher the level of the inter-industry trade—that is, the stronger the complementarity. When $GL = 0.5$, it exhibits both inter-industry and intra-industry trade; when $0.5 < GL < 1$, it is mainly the intra-industry trade, and the larger the value, the higher the level of the intra-industry trade—that is, the stronger the competitiveness. When $GL = 1$, it is complete intra-industry trade.

3. Results and Discussion

3.1. Competitiveness of Agricultural Trade between China and ASEAN

The trade competitiveness of agricultural products refers to a country's ability to continuously make profits in the international market for its agricultural products and its competitive advantage in developing international trade [8]. According to the means of the RRCA indices in Table 2, China's overall agricultural products exported to ASEAN were strongly competitive, while ASEAN's agricultural products exported to China were averagely competitive. The former was more competitive than the latter. Among China's agricultural products exported to ASEAN, HS03, HS12, HS15, HS16, HS19, and HS20 had average competitiveness; HS05, HS06, HS09, HS18, HS21, and HS23 had strong competitiveness; and HS07, HS08, HS11, HS17, and HS24 had very strong competitiveness. HS08 was the agricultural product with the highest mean of the RRCA index in China, because fruits and nuts (HS08) are China's dominant industries in the international market. Among ASEAN's agricultural products exported to China, HS03, HS04, HS15, HS17, and HS23 had average competitiveness; HS05, HS10, and HS14 had strong competitiveness; and HS07, HS08, HS11, and HS12 had very strong competitiveness. HS11 was the agricultural product with the highest mean of the RRCA index in ASEAN, because products of the milling industry (HS11) are ASEAN's dominant products in the international market.

By organizing the agricultural products in Table 2 whose mean in the RRCA index was more than 0.8 on one side and those whose mean was less than 0.8 on the other, the agricultural products in which China had a competitive advantage and ASEAN had a competitive disadvantage included HS06, HS09, HS16, HS18–21, and HS24. The agricultural products in which ASEAN had a competitive advantage and China had a competitive disadvantage included HS04, HS10, and HS14. However, among ASEAN's agricultural products exported to China, although the means of the RRCA indices of HS02 and HS13 were less than 0.8, the former was between 1.25 and 2.5 after 2019, and the latter was between 0.8 and 1.25 after 2018, which had obvious comparative competitive advantages; although the mean of the RRCA index of HS14 was more than 1.25, it was between 0 and 0.8 after 2019, demonstrating a competitive disadvantage. Therefore, agricultural products in which ASEAN had a competitive advantage and China had a competitive disadvantage included HS02, HS04, HS10, and HS13. The above-mentioned agricultural trade had an obvious comparative competitive advantage and had the potential for inter-industry trade. However, HS06, HS18, and HS19, for which China had a comparative competitive advantage, and HS04, for which ASEAN had a comparative competitive advantage, were not among the top ten agricultural products exported to each other's markets in 2013–2022. Thus, although these four agricultural products had obvious comparative competitive advantages, they had a small share of trade. Therefore, they had considerable trade potential and were the key areas for expanding the bilateral agricultural trade relationship.

Simultaneously, agricultural products of both China and ASEAN with means of RRCA indices of more than 0.8 included HS03, HS05, HS07, HS08, HS11, HS12, HS15, HS17, and HS23. According to the theory of comparative advantage, if the comparative advantages or trade patterns of two countries overlap, there will inevitably be competition between them in these areas [20]. Therefore, the trade in these agricultural products is highly competitive and is suitable for developing intra-industry trade. Given that compe-

tion is ubiquitous in agricultural trade, both sides should actively participate in competitive agricultural trade to stimulate their respective trade potential and enhance the positive role of competition [21].

Table 2. RRCA index of agricultural trade between China and ASEAN from 2013 to 2022.

HS Code	Export Country/Region	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Mean	Degree
Total	CHN	1.602	1.622	1.704	1.737	1.710	1.671	1.646	1.775	1.795	1.537	1.680	S
	ASEAN	1.124	1.063	1.109	1.163	1.054	1.124	1.188	1.132	1.156	1.190	1.130	AVG
01	CHN	0.009	0.005	0.013	0.051	0.099	0.088	0.111	0.090	0.100	0.116	0.068	—
	ASEAN	0.119	0.100	0.389	1.624	0.441	2.904	1.528	0.327	0.013	0.003	0.745	—
02	CHN	0.646	0.642	0.586	0.334	0.259	0.518	0.291	0.359	0.447	0.553	0.464	—
	ASEAN	0.199	0.357	0.152	0.151	0.170	0.613	1.455	1.663	1.502	1.621	0.788	—
03	CHN	1.121	1.275	1.322	1.301	1.233	1.109	1.066	1.278	1.368	1.179	1.225	AVG
	ASEAN	0.840	0.682	0.730	0.894	0.939	1.116	1.435	1.316	1.097	1.343	1.039	AVG
04	CHN	0.639	0.772	0.621	0.559	0.563	0.578	0.574	0.488	0.522	0.389	0.570	—
	ASEAN	0.329	0.269	0.439	0.531	0.756	0.991	1.359	1.808	1.637	2.001	1.012	AVG
05	CHN	1.032	1.191	1.518	2.020	2.123	2.217	1.923	1.460	1.351	1.443	1.628	S
	ASEAN	1.561	1.692	1.388	1.815	3.000	2.459	2.350	2.128	2.514	2.257	2.116	S
06	CHN	1.149	3.542	1.121	1.324	1.152	0.984	1.091	1.345	1.054	1.375	1.414	S
	ASEAN	0.197	0.205	0.272	0.420	0.409	0.378	0.381	0.216	0.279	0.286	0.304	—
07	CHN	2.990	3.078	3.106	2.912	2.897	3.053	2.821	2.530	2.428	2.133	2.795	VS
	ASEAN	4.642	4.319	4.271	3.522	3.296	3.488	2.630	2.540	2.854	3.459	3.502	VS
08	CHN	4.678	4.416	4.724	4.426	4.453	4.327	4.136	4.569	4.353	3.603	4.369	VS
	ASEAN	2.349	2.056	2.305	2.878	2.566	2.844	3.190	3.003	3.288	3.728	2.821	VS
09	CHN	0.961	0.851	0.883	1.258	1.197	1.344	1.454	1.747	1.690	1.528	1.291	S
	ASEAN	0.278	0.209	0.213	0.250	0.201	0.306	0.382	0.459	0.442	0.321	0.306	—
10	CHN	0.812	0.834	1.081	0.957	0.577	0.542	0.191	0.486	0.470	0.276	0.623	—
	ASEAN	1.700	1.852	2.040	1.919	1.857	1.459	0.876	1.010	0.979	0.920	1.461	S
11	CHN	2.725	2.704	2.673	3.164	3.233	3.521	3.573	3.547	2.241	2.227	2.961	VS
	ASEAN	4.237	4.380	4.290	4.198	3.837	3.924	3.944	3.852	4.013	4.153	4.083	VS
12	CHN	1.136	1.098	1.128	0.916	1.270	1.334	1.217	0.964	0.968	0.972	1.100	AVG
	ASEAN	4.404	3.342	3.199	3.536	3.163	3.273	3.729	3.747	3.551	3.544	3.549	VS
13	CHN	0.918	0.859	0.762	0.760	0.718	0.756	0.742	0.662	0.680	0.934	0.779	—
	ASEAN	0.600	0.369	0.541	0.648	0.465	0.954	1.275	1.124	0.894	1.062	0.793	—
14	CHN	0.451	0.322	0.239	0.291	0.528	0.429	0.295	0.413	0.867	0.853	0.469	—
	ASEAN	3.558	3.225	2.137	1.353	1.327	1.234	0.717	0.354	0.272	0.243	1.442	S
15	CHN	0.914	0.946	0.702	0.776	0.721	1.102	0.905	1.265	1.259	1.424	1.000	AVG
	ASEAN	1.245	1.120	1.122	1.046	0.859	0.957	1.170	0.996	0.968	0.967	1.045	AVG
16	CHN	0.896	0.640	0.637	0.630	0.630	0.684	0.744	1.054	1.590	1.738	0.924	AVG
	ASEAN	0.029	0.032	0.038	0.044	0.040	0.053	0.066	0.056	0.056	0.043	0.046	—
17	CHN	3.073	2.998	3.481	3.828	3.455	3.227	2.911	2.778	2.659	2.479	3.089	VS
	ASEAN	0.836	0.850	1.391	2.231	1.571	1.440	0.798	0.998	0.716	0.886	1.172	AVG
18	CHN	1.629	1.557	1.593	1.672	1.646	1.364	1.277	1.387	1.703	1.756	1.558	S
	ASEAN	0.594	0.565	0.563	0.562	0.505	0.564	0.558	0.466	0.565	0.606	0.555	—
19	CHN	0.966	0.903	0.868	0.921	0.924	0.803	0.822	1.069	1.203	1.239	0.972	AVG
	ASEAN	0.840	0.823	0.880	0.886	0.720	0.622	0.513	0.444	0.472	0.455	0.666	—
20	CHN	0.939	0.932	0.913	0.974	1.037	0.979	1.060	1.145	1.430	1.320	1.073	AVG
	ASEAN	0.288	0.300	0.300	0.406	0.429	0.622	0.946	0.888	0.878	0.960	0.602	—
21	CHN	1.890	1.833	1.939	1.922	2.093	2.124	1.937	2.029	2.312	1.795	1.987	S
	ASEAN	0.469	0.453	0.491	0.530	0.505	0.356	0.343	0.320	0.309	0.322	0.410	—
22	CHN	1.028	1.151	0.729	0.596	0.567	0.660	0.689	0.754	0.961	0.833	0.797	—
	ASEAN	0.745	0.665	0.449	0.466	0.485	0.689	0.762	1.128	1.156	0.891	0.744	—
23	CHN	1.035	1.590	1.187	1.526	1.251	1.289	1.158	1.238	1.499	1.578	1.335	S
	ASEAN	0.747	0.895	0.812	0.967	0.761	0.840	0.723	0.744	0.955	1.436	0.888	AVG
24	CHN	3.002	2.983	2.571	2.666	2.572	2.141	2.257	2.748	3.231	0.533	2.470	VS
	ASEAN	0.252	0.231	0.192	0.201	0.149	0.200	0.284	0.146	0.120	0.141	0.192	—

Note: 1. “Mean” is the average value of the RRCA index from 2013 to 2022. 2. Agricultural products that do not fill in the degree are weakly competitive. Source: Calculated based on United Nations Commodity Trade Statistics Database.

3.2. Complementarity of Agricultural Trade between China and ASEAN

The results of the TCI of agricultural trade between China and ASEAN in 2013–2022 are shown in Table 3. In 2013–2022, the weighted TCI of China’s agricultural exports to ASEAN fluctuated between two and four, and that of ASEAN’s agricultural exports to China fluctuated between 6 and 15. Both means were more than two, indicating that both had strong complementarity. This shows that the agricultural trade relationship between China and ASEAN was very close. According to trade complementarity theory, trade complementarity is a measure of the degree of similarity between a country’s export supply and its partners’ import demand [22]. ASEAN’s complementarity was much stronger than China’s, showing that the degree of consistency between ASEAN’s export supply and China’s import demand was higher than the degree of consistency between China’s export supply and ASEAN’s import demand. Thus, China’s agricultural trade deficit with ASEAN might continue to expand. Among China’s agricultural products exported to ASEAN, the TCIs of HS06, HS13, HS16, HS17, HS20, and HS21 were between one and two, which showed strong complementarity; the TCIs of HS05, HS07, HS08, HS11, and HS24 were more than two, showing very strong complementarity. HS07 was the agricultural product with the highest mean in the TCI of China’s exports to ASEAN, and it was also the largest one exported by China to ASEAN, indicating that China’s exports were highly compatible with ASEAN’s imports and had a large trade space in the region. Among ASEAN’s agricultural products exported to China, the TCIs of HS03, HS13, HS17, HS18, and HS20 were between one and two, which had strong complementarity; the TCIs of HS07, HS08, HS10, HS11, HS14, and HS15 were more than two, which were very strongly complementary. HS11 was the agricultural product with the highest mean in the TCI of exported products from ASEAN to China and was also one of the top ten commodities exported by ASEAN to China, indicating that ASEAN’s exports were highly consistent with China’s imports and also had a large trade space in the region. China’s agricultural imports were mainly concentrated on HS02, HS03, HS08, HS10, HS12, and HS15 in recent years, accounting for more than 75% in 2022. Among them, HS03, HS08, and HS15, for which ASEAN had a strong complementary advantage, could better meet China’s import needs and become the top ten agricultural products exported by ASEAN to China. HS02, for which ASEAN was short of complementary advantage, fail to fully leverage export competitiveness to China, leading to the small volume.

By organizing the agricultural products in Table 3 whose means in the TCI were more than one on one side and those whose means were less than one on the other, the agricultural products with strong complementarity in China and weak complementarity in ASEAN were found to be HS05, HS06, HS16, HS21, and HS24, and the agricultural products with strong complementarity in ASEAN and weak complementarity in China were HS03, HS10, HS15, and HS18 (although the mean in the TCI of HS14 was more than one, the TCI in the last three years was less than one, so it was not included). These agricultural products had complementary advantages and the potential for inter-industry trade. Simultaneously, agricultural products whose bilateral means in the TCI were more than one included HS07, HS08, HS11, HS13, HS17, and HS20. These agricultural products had strong competitiveness and significant potential for intra-industry trade.

However, some agricultural products with complementary advantages had not become bulk commodities exported to each other’s markets. In 2022, there were eleven highly complementary commodities in China’s agricultural exports to ASEAN and ten highly complementary commodities in ASEAN’s agricultural exports to China. Among them, China and ASEAN each had five commodities accounting for more than 5% of the total agricultural trade scale, while the trade share of other commodities was very small, with some agricultural products accounting for less than 1%. This indicates that the potential of complementary advantages between China and ASEAN had not been fully tapped, and there was significant potential for trade cooperation. The reason for this is that both sides faced competition from each other’s trading partners, which limited the expansion of many agricultural products. For example, China’s HS06 exports to ASEAN mainly faced

competition from the Netherlands and Japan, while ASEAN's HS10 exports to China faced competition from the USA, Australia, Ukraine, and so on.

Table 3. TCI of agricultural trade between China and ASEAN from 2013 to 2022.

HS Code	Export Country/Region	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Mean	Degree
Total	CHN	2.854	2.890	2.684	2.797	3.041	3.505	3.169	2.531	2.389	2.680	2.854	VS
	ASEAN	13.603	14.582	12.672	9.984	8.941	9.764	8.389	6.998	7.996	8.737	10.167	VS
01	CHN	0.000	0.000	0.000	0.001	0.003	0.002	0.002	0.001	0.001	0.003	0.001	–
	ASEAN	0.013	0.004	0.037	0.486	0.037	0.314	0.459	0.002	0.000	0.000	0.135	–
02	CHN	0.114	0.102	0.080	0.022	0.013	0.037	0.011	0.012	0.015	0.027	0.043	–
	ASEAN	0.000	0.000	0.000	0.000	0.000	0.023	0.121	0.139	0.109	0.134	0.053	–
03	CHN	0.810	1.095	0.927	0.844	0.798	0.645	0.613	0.625	0.695	0.606	0.766	–
	ASEAN	0.762	0.586	0.644	0.769	0.798	1.200	1.664	1.775	1.235	1.661	1.109	S
04	CHN	0.020	0.029	0.032	0.016	0.015	0.013	0.016	0.011	0.012	0.009	0.017	–
	ASEAN	0.020	0.010	0.055	0.087	0.178	0.322	0.545	0.966	0.660	0.967	0.381	–
05	CHN	1.594	1.976	2.003	2.691	3.569	4.943	4.109	2.371	2.264	2.752	2.827	VS
	ASEAN	0.546	0.561	0.261	0.310	0.970	0.987	1.208	0.941	1.515	1.004	0.831	–
06	CHN	1.739	3.372	0.994	1.048	0.838	0.954	1.110	1.445	1.251	1.716	1.447	S
	ASEAN	0.160	0.156	0.176	0.277	0.269	0.237	0.209	0.088	0.157	0.139	0.187	–
07	CHN	8.864	8.484	7.431	6.638	6.800	7.770	7.027	5.230	4.496	3.769	6.651	VS
	ASEAN	32.877	33.599	29.943	21.686	18.920	16.919	9.728	8.364	11.677	15.352	19.907	VS
08	CHN	9.525	7.126	5.883	5.068	4.295	4.983	4.674	6.234	4.646	4.743	5.718	VS
	ASEAN	12.778	9.755	9.291	9.567	8.076	9.851	10.472	10.342	12.521	13.734	10.639	VS
09	CHN	0.553	0.459	0.367	0.601	0.568	0.756	1.115	1.596	1.418	0.821	0.826	–
	ASEAN	1.238	1.032	0.897	1.340	0.470	0.914	0.543	0.758	0.667	0.504	0.836	–
10	CHN	0.040	0.032	0.026	0.022	0.013	0.012	0.003	0.013	0.009	0.003	0.017	–
	ASEAN	3.003	3.389	2.556	3.813	4.085	3.010	1.366	0.976	0.467	0.461	2.313	VS
11	CHN	1.723	1.711	1.308	1.795	2.271	3.061	3.378	3.097	1.072	1.414	2.083	VS
	ASEAN	36.477	37.151	32.207	29.556	25.008	26.489	24.684	22.494	24.554	25.973	28.459	VS
12	CHN	0.501	0.429	0.388	0.293	0.417	0.500	0.447	0.292	0.238	0.299	0.380	–
	ASEAN	0.281	0.223	0.181	0.169	0.154	0.207	0.265	0.214	0.201	0.299	0.219	–
13	CHN	1.315	1.417	1.074	1.008	0.979	1.022	0.925	0.777	0.803	1.262	1.058	S
	ASEAN	0.520	0.299	0.624	0.793	0.497	1.408	2.318	1.689	1.345	2.087	1.158	S
14	CHN	0.025	0.170	0.097	0.166	0.234	0.181	0.106	0.186	0.341	0.336	0.184	–
	ASEAN	16.093	16.154	9.011	3.219	4.240	4.695	2.077	0.774	0.371	0.399	5.703	VS
15	CHN	0.107	0.087	0.055	0.057	0.048	0.161	0.184	0.296	0.243	0.380	0.162	–
	ASEAN	6.753	6.614	6.011	5.084	4.218	4.453	4.838	3.411	3.670	4.170	4.922	VS
16	CHN	1.317	1.015	0.858	0.864	0.853	0.963	0.939	1.485	2.140	2.598	1.303	S
	ASEAN	0.054	0.043	0.047	0.083	0.063	0.072	0.103	0.104	0.095	0.061	0.072	–
17	CHN	1.744	1.728	2.090	1.769	1.814	1.920	2.081	1.386	1.120	1.332	1.698	S
	ASEAN	0.364	1.153	1.694	1.972	2.275	2.139	1.456	1.268	0.643	1.192	1.416	S
18	CHN	0.368	0.269	0.277	0.264	0.199	0.148	0.118	0.108	0.108	0.191	0.205	–
	ASEAN	1.650	1.393	1.255	1.498	1.333	1.506	1.412	1.066	1.312	1.668	1.409	S
19	CHN	0.298	0.285	0.228	0.239	0.234	0.209	0.232	0.298	0.408	0.436	0.287	–
	ASEAN	1.883	1.438	1.239	0.974	0.560	0.393	0.270	0.204	0.253	0.233	0.745	–
20	CHN	1.390	1.266	1.100	1.047	1.162	1.079	1.153	1.300	1.599	1.744	1.284	S
	ASEAN	0.381	0.414	0.431	0.637	0.728	1.068	2.007	2.043	1.935	2.407	1.205	S
21	CHN	1.140	1.016	0.890	0.937	1.155	1.160	0.928	0.999	1.107	0.982	1.031	S
	ASEAN	0.950	0.962	0.946	1.128	0.706	0.442	0.426	0.346	0.336	0.330	0.657	–
22	CHN	0.135	0.150	0.108	0.082	0.069	0.083	0.091	0.154	0.148	0.170	0.119	–
	ASEAN	0.095	0.107	0.067	0.061	0.111	0.204	0.130	0.365	0.316	0.214	0.167	–
23	CHN	0.187	0.472	0.237	0.358	0.229	0.253	0.211	0.214	0.274	0.316	0.275	–
	ASEAN	0.630	0.758	0.563	1.047	0.701	0.926	0.641	0.631	0.939	1.621	0.846	–
24	CHN	3.734	3.472	2.769	3.121	2.900	1.999	2.126	1.736	2.183	0.336	2.438	VS
	ASEAN	0.095	0.103	0.080	0.086	0.065	0.124	0.200	0.121	0.064	0.070	0.101	–

Notes: 1. The TCI of total agricultural exported by China to ASEAN is calculated according to Formula (7), while the TCI of total agricultural exported by ASEAN to China is calculated according to Formula (9). 2. The TCI of one single agricultural export from China to ASEAN is calculated according to Formula (3), and the TCI of one single agricultural export from ASEAN to China is calculated according to Formula (5). 3. "Mean" is the average value of the TCI from 2013 to 2022. Source: Calculated based on United Nations Commodity Trade Statistics Database.

3.3. Intra-Industry Agricultural Trade between China and ASEAN

Much of the growth in world trade is intra-industry in nature [23]. Therefore, the level of intra-industry trade is an important indicator for exploring bilateral trade. According to formula (11), the G–L index of the agricultural trade between China and ASEAN from

2013 to 2022 was calculated, as shown in Table 4. The overall G–L index was between 0.7 and 1, with a mean of 0.911, from 2013 to 2022, indicating that bilateral agricultural trade was dominated by intra-industry trade, and the level was very high. This was related to the similarity of the structure of the bilateral agricultural industry. However, the overall G–L index had been decreasing year by year since 2017. The main reason for this was the widening difference between the demands of the two markets. Although the overall G–L index of bilateral agricultural trade was relatively high, the level of the intra-industry trade of some major agricultural products was still low. Among the top ten agricultural products exported from China to ASEAN in 2022, HS15, HS16, and HS20 were still at the level of inter-industry trade.

Table 4. G–L index of agricultural trade between China and ASEAN from 2013 to 2022.

HS Code	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Mean	Type
Total	0.885	0.905	0.952	0.971	0.989	0.958	0.936	0.923	0.809	0.778	0.911	B
01	0.211	0.167	0.273	0.433	0.724	0.958	0.574	0.119	0.663	0.007	0.413	A
02	0.000	0.001	0.001	0.001	0.001	0.958	0.284	0.186	0.280	0.369	0.208	A
03	0.528	0.448	0.463	0.505	0.606	0.910	0.882	0.909	0.970	0.788	0.701	B
04	0.929	0.646	0.976	0.720	0.422	0.319	0.236	0.137	0.149	0.119	0.465	A
05	0.133	0.101	0.060	0.049	0.080	0.098	0.166	0.221	0.395	0.327	0.163	A
06	0.583	0.166	0.570	0.515	0.658	0.651	0.458	0.266	0.388	0.246	0.450	A
07	0.831	0.841	0.773	0.549	0.541	0.465	0.316	0.412	0.667	0.862	0.626	B
08	0.971	0.921	0.971	0.897	0.935	0.872	0.832	0.881	0.607	0.506	0.839	B
09	0.659	0.851	0.829	0.983	0.492	0.595	0.390	0.444	0.544	0.574	0.636	B
10	0.096	0.069	0.061	0.070	0.052	0.084	0.056	0.100	0.097	0.062	0.075	A
11	0.413	0.362	0.377	0.439	0.442	0.525	0.555	0.458	0.210	0.273	0.405	A
12	0.863	0.900	0.790	0.862	0.800	0.853	0.869	0.955	0.894	0.717	0.850	B
13	0.291	0.268	0.408	0.435	0.453	0.566	0.760	0.673	0.677	0.553	0.508	B
14	0.099	0.070	0.073	0.133	0.213	0.186	0.178	0.379	0.731	0.846	0.291	A
15	0.020	0.024	0.023	0.026	0.028	0.059	0.054	0.092	0.090	0.151	0.057	A
16	0.083	0.102	0.106	0.130	0.129	0.139	0.156	0.127	0.072	0.048	0.109	A
17	0.352	0.649	0.613	0.334	0.516	0.521	0.675	0.820	0.729	0.846	0.606	B
18	0.510	0.548	0.552	0.555	0.511	0.423	0.417	0.408	0.454	0.470	0.485	A
19	0.432	0.480	0.410	0.445	0.499	0.557	0.675	0.785	0.850	0.954	0.609	B
20	0.198	0.239	0.301	0.358	0.388	0.462	0.530	0.518	0.496	0.499	0.399	A
21	0.654	0.710	0.723	0.862	0.673	0.676	0.718	0.678	0.587	0.636	0.692	B
22	0.413	0.393	0.590	0.654	0.996	0.909	0.792	0.970	0.972	0.779	0.747	B
23	0.996	0.746	0.958	0.886	0.988	0.987	0.989	0.950	0.904	0.870	0.927	B
24	0.228	0.366	0.351	0.339	0.378	0.525	0.567	0.614	0.524	0.333	0.423	A

Note: A represents inter-industry trade, and B represents intra-industry trade. Source: Calculated based on United Nations Commodity Trade Statistics Database.

In terms of sub-commodities, the means of the G–L indices of HS10 and HS15 were between 0 and 0.1, which was very close to the state of the complete inter-industry trade. The reason for this was that ASEAN had complementary advantages that led to ASEAN's absolute volume in the two commodities' trade. China's import of HS10 and HS15 from ASEAN accounted for 96.92% and 92.47%, respectively, while China's exports of HS10 and HS15 to ASEAN accounted for 3.08% and 7.53%, respectively, in 2022. The G–L indices of HS01, HS02, HS04–06, HS11, HS14, HS16, HS18, HS20, and HS24 were between 0.1 and 0.5, which belonged to inter-industry trade. The G–L indices of the rest of the agricultural products—a total of eleven commodities—were between 0.5 and 1, which belonged to intra-industry trade. Their trade scale accounted for 59.26% of the bilateral agricultural trade in 2022. Among them, the means of G–L indices of HS08, HS12, and HS23 were close to one, indicating that the level of intra-industry trade is very high.

Additionally, the intra-industry trade between China and ASEAN was mainly concentrated in Category 2 and 4. Category 2 of agricultural products mainly consisted of plant products. Since China is in the subtropics and ASEAN is in the tropics, differences in natu-

ral conditions and resource endowments lead to large differences in the bilateral output of fruits and vegetables. Even the same product has different production cycles. Therefore, bilateral agricultural products have different characteristics and advantages. These agricultural products are necessities with low demand elasticity, so the level of intra-industry trade is relatively high. Category 4 of agricultural products includes processed goods. Compared with fresh agricultural products, processed agricultural products have the advantages of long storage time, relatively simple transportation conditions, and high added value [24], which are key areas for the development of agricultural intra-industry trade.

4. Conclusions, Policy Recommendations, and Limitations

4.1. Conclusions and Policy Recommendations

In the context of economic globalization, trade relations between countries increasingly rely on the division of labor in the value chain. Therefore, the analysis of trade relations between countries based on competitiveness, complementarity, and trade similarity is worth expanding [25]. This study examines the competitiveness and complementarity of agricultural trade between China and ASEAN. According to the theory of comparative advantage, trade complementarity theory, and intra-industry trade theory, the study utilizes data from the UN Comtrade database from 2013 to 2022 and uses the Regional Revealed Comparative Advantage Index (RRCA index), the Trade Complementarity Index (TCI), and the Intra-Industry Trade Index (G–L Index) to measure and evaluate the competitiveness, complementarity, and level of intra-industry agricultural trade between China and ASEAN. The findings provide substantial support for exploring growth potential and expanding bilateral agricultural trade relations.

The main conclusions of this research are as follows. First, the competition and complementarity of agricultural trade between China and ASEAN coexist. This finding is consistent with the conclusions in Min He's research (2016) [6]. Bilateral agricultural trade is highly competitive, and China's agricultural exports to ASEAN are more competitive than ASEAN's agricultural exports to China. From 2013 to 2022, the average RRCA index of China's agricultural exports to ASEAN was 1.680 (between 1.25 and 2.5), and the average RRCA index of ASEAN's agricultural exports to China was 1.130 (between 0.8 and 1.25). Due to the differences in calculation methods, time periods, and range of agricultural products, our conclusion differs from that of Zhou L., et al. (2022) [8]. In terms of complementarity, the agricultural products exported by both sides to each other's market are highly complementary, with the agricultural products exported by ASEAN to China being more complementary. From 2013 to 2022, the means of the bilateral weighted TCI were greater than two, with China at 2.854 and ASEAN at 10.167. Second, China and ASEAN have their own comparative advantages in agricultural products, while also having strong competitive relationships in some areas. Based on the empirical results of the competitiveness and complementarity, it can be concluded that China's agricultural products with the greatest comparative advantage include HS05-06, HS09, HS16, HS18-21, and HS24, and ASEAN's include HS02-04, HS10, HS13, HS15, and HS18. This is a key area for expanding bilateral agricultural trade and developing inter-industry trade. Bilateral competitive agricultural products include HS03, HS05, HS07-08, HS11-13, HS15, HS17, HS20, and HS23, which are suitable for developing intra-industry trade. Third, the agricultural trade between China and ASEAN is mainly intra-industrial in nature. From 2013 to 2022, the overall G–L index of China's agricultural exports to ASEAN was between 0.7 and 1, with an average of 0.911, indicating that the level of intra-industry trade is relatively high. The agricultural products with high levels of intra-industry trade include HS03, HS07-09, HS12-13, HS17, HS19, and HS21-23. By comparing agricultural products with strong bilateral competition with those at the intra-industry trade level, it can be seen that HS05, HS11, HS15, and HS20 commodities, which have strong competition, still remain at the inter-industry trade level, and urgent measures are necessary to promote the transformation of inter-industry trade into intra-industry trade.

Based on the findings of this study, the following policy recommendations are proposed. First, China and ASEAN should participate in bilateral trade based on the comparative advantages of their own agricultural products to enhance international competitiveness; meanwhile, agricultural products based on their own comparative disadvantages should be imported to increase the complementarity of agricultural products [25]. Second, ASEAN should attach importance to developing the quality of agricultural products and increasing the added value of agricultural exports; increase the intensity of the scientific and technological research and development of agricultural products; develop new forms and models of agricultural production; enrich the variety of agricultural products; and reduce production costs to enhance the international competitiveness of agricultural products. Third, China should explore the market demand for ASEAN agricultural products; seek complementarity in varieties, specifications, and characteristics; and continuously expand the categories of exported goods to enhance the complementarity of China's agricultural exports to ASEAN. Fourth, China and ASEAN should formulate different policies for different types of agricultural products [12] and optimize the agricultural structure according to resource endowment, and continue to develop respective products with comparative advantage. According to intra-industry trade theory, the industrial division of labor should be deepened, and specialized production should be carried out based on respective technical advantages, production environment, and conditions. Moreover, the differentiated development of bilateral agricultural products should be promoted to enhance the level of the intra-industry trade of agricultural products with strong competitive relationships, especially those that are still part of inter-industry trade.

4.2. Limitations

In this study, the competitiveness, complementarity, and intra-industry agricultural trade between China and ASEAN were evaluated using three core indicators. However, the agricultural products selected in this study did not include other agricultural products mentioned in Annex 1 of the WTO Agreement on Agriculture. In fact, some of these other agricultural products—for example, HS33.01 (essential oils), HS35.03 (gelatin), HS35.04 (peptones and their derivatives), HS35.05 (dextrins and other modified starches), and HS52.01 (cotton)—are important commodities in the agricultural trade between China and ASEAN. At the same time, this study did not measure or evaluate the competitiveness, complementarity, and intra-industry agricultural trade between China and major ASEAN countries, despite the fact that these can differ. For example, Vietnam, Thailand, and Indonesia are the strongest competitors in rice, rubber, spices, vegetable fat, and oils, whilst Brunei, Singapore, and Cambodia are the weakest [26]. Therefore, these aspects will be the main directions for future research on the agricultural trade relationship between China and ASEAN.

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