“Agricultural trade between Malaysia and China: Competitiveness and complementarity”

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AGRICULTURAL TRADE BETWEEN MALAYSIA AND CHINA: COMPETITIVENESS AND COMPLEMENTARITY

Abstract

The discernment of trade competitiveness and complementarity findings holds crucial implications for policymakers, facilitating the formulation and implementation of strategies conducive to fostering economic growth. This study aims to determine the latest level of competitiveness and complementarity of the agricultural trade between Malaysia and China. This investigation uses quantitative research methodologies to draw upon data extracted from the UN Commodity Trade Statistics Database, specifically employing the HS2012 (HS12) classification system from 2017 to 2019. The empirical findings illuminate significant trends. China displays a pronounced comparative advantage in exporting agricultural products classified by HS12 items 05, 13, and 16, whereas Malaysia exhibits a pronounced comparative advantage in exporting HS12 items 14, 15, 18, 19, and 21. The examination of trade dynamics unveils that HS12 item 07 demonstrates a complementary relationship in terms of China's exports and Malaysia's imports, while HS12 items 14, 15, and 19 exhibit complementarity from the perspective of Malaysia's exports and China's imports. The trade intensity index (>1) substantiates the profound interconnectedness characterizing bilateral agricultural trade ties between the two nations. The investigation uncovers inter-industry advantages within HS12 items 06, 07, 11, 14, and 16, juxtaposed with intra-industry advantages specifically about HS12 item 23. The findings provide evidence of the inherent comparative advantages prevalent within diverse agricultural product categories. Consequently, this study not only aids policymakers but also furnishes traders within Malaysia and China with strategic insights, thereby facilitating the development of plans to augment the competitive prowess within their respective agricultural sectors.

Keywords trade, agriculture, comparative advantages, inter-industry, intra-industry, import, export

JEL Classification Q17, Q13, F14

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INTRODUCTION

The competitiveness and complementarity of agricultural trade are regarded as one of the most significant scientific factors for policy decision-making. Previous research about trade competitiveness between Malaysia and China focused more on out-of-date data than new data. New research on trade is needed to contribute to the agricultural sector. Malaysia's agricultural sector contributed 9.6% to its total GDP in 2021 (Huajing Industry Research Institution, 2022), and China's agricultural sector contributed 16.05% of its total GDP (National Bureau of Statistics of China, 2022). The agricultural sector is a vital determinant of the two countries' trade. Due to their geographic and political circumstances, China and Malaysia established a reliable and enduring trade partnership. According to the Ministry of International Trade and Industry of Malaysia, Malaysia's international trade worth surged by 27.8% from 2021 to 2022, reaching 2.849 trillion ringgits (equivalent to 663.9 billion US dollars). Malaysia also has maintained a trade surplus for the past 25 years since 1998 (China Economic Net, 2023). Therefore, it is vital to find new comparative factors between

them in the new trade trend. Malaysia also had a GDP increase of 8.7% in 2022, the highest in ASEAN countries. China is the largest trade partner to Malaysia for 14 consecutive years until 2022. China's General Administration of Customs indicated that in 2021, ASEAN was China's primary trading partner (China's Ministry of Commerce, 2022). It means that the research on agricultural trade between China and Malaysia also has valuable implications for further studies on trade between China and ASEAN countries.

1. LITERATURE REVIEW

China-ASEAN free trade agreement policy enhances trade growth and resource allocation efficiency between ASEAN and China, promoting bilateral economic welfare growth (Qiu et al., 2007). In the macro policy trend, ASEAN promotes trade liberalization and investment accessibility, strengthening the interdependence of intra-regional trade in the free trade area and improving the legal and political systems related to the economy as the primary direction of its future trade policy (Zhao, 2014). Since China and ASEAN are close trade partners, there is a strong implication of further trade cooperation between them. The increasingly close trade complementarity between China and major ASEAN countries forms the material basis for trade cooperation (Chen & Xiao, 2004). The improvement of ASEAN airport infrastructure significantly affects the export of manufacturing products in the China-ASEAN region (Sun & Xu, 2011). Yeoh et al. (2018) found the possibility of industry transfer from China to ASEAN countries.

In past research, the concept of competitiveness and complementarity of agricultural trade between countries has become an intriguing worldwide discussion topic. He et al. (2016) indicated that the countries under "Belt and Road" policies and China should improve agricultural trade cooperation based on existing bilateral and multilateral mechanisms to strengthen development. Complementarity and competitiveness between countries are a foundation for cooperation in trade (Bi & Shi, 2010). Zhang and Xu (2003) researched the competitiveness and complementarity between China and ASEAN countries in bilateral trade. They found that the export trade structure of China and ASEAN has great similarities, and the trade between them is much more competitive than complementary.

Regarding primary products, China has an obvious disadvantage compared to ASEAN countries. Sang and Yang (2015) researched the competitiveness and complementarity of China and its "Belt and Road" partners to find the specific relationship between different countries to help guide better policies for China. They found strong trade complementarity between Southeast Asian Countries and China. Wang et al. (2018) researched Malaysia's and China's competitiveness and complementarity in trade, and the data they used were from before 2016. They used the RCA and trade complementarity indexes (TCI) to analyze the two countries' agricultural trade. The application of the comparative advantage theory has proven to be effective. Complementarity and competitiveness of agricultural trade would be a base factor for implementing trade policies. In the case of India and China, it might be possible to develop the potential of countries through comparative advantages (Zhu & Chen, 2006). Researching competitiveness and complementarity between countries would be a preferred method to improve countries' trading performance. Similarly, in the case of Thailand and China, Tao (2022) found that research on competitiveness and complementarity would be one way to improve trade effectiveness.

Researchers widely use traditional economic theories to analyze competitiveness. According to traditional economic theory, competitiveness corresponds to Smith's (1776) absolute advantage and Ricardo's (1821) comparative advantage. Under traditional economic theory, numerous approaches to analyzing trade effects in a single sector have been proposed by academics. An example of such approaches is the revealed comparative advantage index of Balassa (1965). This method examines the export performance of one country to that of a specific group of countries in the same industry. Due to the limitation of the measurement technique, the research result could only apply to specific hypotheses. Balassa (1965) also showed that

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RCA could be indicated by the trade performance of individual countries in regard to manufacturing products. Laursen (2015) researched Balassa's (1965) "revealed comparative advantage" and indicated a "revealed symmetric comparative advantage" (RSCA). However, the study indicated that the RSCA index could only better reflect a narrower area of economic activity within a given country. Lv (2009) indicated that the RCA index is an effective method for analyzing trade structure and trade policies. Therefore, the RCA index method would effectively measure macro-level settlements.

Intra-industry or inter-industry advantages in agricultural research would be one significant factor in comparing mutual advantages. Grubel and Lloyd (1971) implemented the Grubel-Lloyd (GL) index to analyze intra-industry trade and used it to analyze the intra-trade or inter-trade advantages. Feng (2013) found that Chinese scholars' studies on China's agricultural trade with ASEAN mainly focus on the analysis of the intra-industry trade situation, factors influencing agricultural trade, bilateral trade, its impact on China's economy after the implementation of zero tariffs on agricultural products, and the extent to which trade barriers affect agricultural trade. Azhar et al. (1998) indicated that the Grubel-Lloyd index is the most suitable measure of intra-industry trade for documenting an industry's trade pattern in a certain period. Furthermore, they introduced a novel methodology for assessing intra-industry trade (IIT) by utilizing the trade (import-export) ratio. This approach allows for the quantification of shifts in both relative and absolute IIT, irrespective of the scale and direction of trade flows. Previous studies also showed the effectiveness of the method. Fan and Li (2012) conducted an empirical study of intra-industry trade of agricultural products between China and ASEAN from 2001 to 2010 using the Grubel-Lloyd index. It showed that the level of intra-industry trade between China and ASEAN is low, and the increase in trade is mainly caused by inter-industry trade. Therefore, the Grubel-Lloyd index has become an effective method for researchers to analyze inter or intra-industry advantages.

The trade complementarity index could reflect the degree of product matching between export supply and import demand in bilateral trade, and trade complementarity depends on industrial structure, consumer demand, and endowment factors (Wang & Fan, 2006). Yu (2003) stated that countries could use their technology, resources, and economy-of-scale advantages to satisfy the trade demand based on international trade theories. Hoang (2018) researched the agricultural trade complementarity of ASEAN over the period 1997–2015 by trade complementarity index. The study indicated that the agricultural export patterns of ASEAN are weakly complementary in matching the demands of regional imports. Yu (2003) found that from 1980 to 1997, there was a weak complementarity between China's exports and Malaysia's imports and a strong complementarity between China's imports and Malaysia's exports. His analysis indicated a close relationship between the comparative advantage and the major East Asian economies' industrial structure. However, with the change in time and policy, the complementarity between China and Malaysia might also change.

Drysdale (1967) developed the intensity analysis by decomposing it into two main components: "commodity bias" or "the degree of complementarity". Yamazawa (1970) proposed a new analytical framework for international trade research by integrating theories or methods such as the trade intensity analysis, comparative advantage theory, and trade gravity model into the trade intensity index (TII) model. In the case of the Economic Community of West African States (ECOWAS) case, Hanink and Owusu (1998) used the trade intensity index to measure the regional trade patterns. They indicated that trade flows within the region are strong on a relative basis. Zhang and Tang (2017) used the TII model to measure the trade potential and closeness between countries and further analyze the trade complementarity based on TII results. It indicated that the "Belt and Road" policy significantly impacts China's exports with countries under the "Belt and Road" policy. Therefore, the relative basis factor would impact countries' trade intensity.

In previous studies on China and Malaysia's agricultural trade, Wang et al. (2018) found that the competitiveness of Chinese agricultural products is greater than that of Malaysia. The competitive advantage of China's agricultural products is decreasing, while the competitive advantage of most

Malaysian agricultural products is gradually increasing. Since Wang et al.'s (2018) research on trade between Malaysia and China is based on data before 2016, the study using data after 2016 would have vital cutting-edge and current attributes. Other research on Malaysia's agricultural exports also contains special research methods. For example, research on the competitiveness of Malaysian fisheries exports used a modified constant market share analysis incorporated with the geometric framework and a net-share approach index to measure the Malaysian fisheries sector's export competitiveness. However, Soh et al. (2021) focused more on the micro-level, and this paper focuses more on the macro-level. Therefore, their research methods are not recommended in macro-level research.

The research on comparative advantages also proved to be a scientific basis for governments to cooperate. Long-run trade openness policies benefit the sectors depending on their comparative advantages (Chandran & Munusamy, 2009). The improvement from international trade on countries' endowment factors and the social system might positively impact output per capita (Shen & Li, 2003). According to Petrović et al. (2008), economic integration policy methods may effectively promote regional trade and national competitiveness. Economic integration between nations can be beneficial (Rivera-Batiz & Romer, 1991). Al-Taie et al. (2022) found that merchandise trade might influence economic growth positively. However, these findings could only be applied to specific hypotheses, but they can still prove the effectiveness of directing policy based on these comparative advantages.

Agricultural trade policies might change due to different factors, e.g., countries' competitive factors. Scholars also provided a theoretical basis for macro policy development as a reference. Competition consideration should be introduced into trade defense policy (Opeida, 2023). Curran et al. (2021) found that identifying causal impacts and proper measurements are first-order issues in evaluating trade policy. The proper measurement could be measuring competitive advantages. Developing countries should focus more on the policy design of human resources capital, property rights protection, and fair competition to enhance their economic competitiveness (Zhang & Xu, 2007). Proper measurements, better free trade agreements, improved infrastructures, and attraction of foreign investments also help improve trade competitiveness between China and Malaysia. Other macro policies' effects also need to be specially investigated.

In their scholarly endeavor, Neoh and Lai (2021) undertook a comprehensive investigation into the ramifications of trade openness on the performance of the manufacturing sector, focusing on the Malaysian context. This study delved into the intricate interplay of trade openness, macroeconomic variables, and episodes of economic crises, discerning their concurrent and interdependent influences on the performance of Malaysia's manufacturing sector. The empirical analysis was conducted utilizing data spanning the years 1981 to 2016. They found that outward-looking strategies are the basis for formulating the trade policy direction in Malaysia. For monetary policies, Bahmani-Oskooee and Harvey (2010) found no strong support for a significant relationship between the Malaysian trade balance and the ringgit's real value. Whether the monetary policy could improve trade in Malaysia should be further analyzed depending on more variable factors. Policymakers can judge which policies to use to promote agricultural trade on the basis of comparative advantages.

This study aims to analyze the latest level of competitiveness and complementarity of the agricultural trade between Malaysia and China on a short-term basis.

2. METHOD

Since the long-term data might be affected by the COVID-19 pandemic and drought issues, data after 2019 in this study might bring more bias and errors. Malaysia suffered a severe drought disaster in 2016, significantly affecting the local agricultural industry. The study analyzed the agricultural data (2017, 2018, and 2019) using the comparative advantage theory, complementary trade theory, trade intensity approach, and the Grubel-Lloyd index method. The study used Malaysia's and China's agricultural products import and export trade data coded by the HS 2012 classification (see Table A1 in Appendix A) in the United Nations Commodity Trade Statistics database to measure

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the revealed comparative advantage index, trade complementarity index, trade intensity index, and Grubel-Lloyd index. The first method assesses the comparative advantages of specific agricultural items, the second method assesses the trade complementarity of agricultural products based on export direction, the third method investigates whether there are close positive trade factors between the two countries, and the fourth method estimates the inter or intra industry advantages among agricultural products. Sun and Li (2013) used the first three methods to analyze competitiveness and complementarity between China and India and indicated the effectiveness of these methods. Zhang (2021) conducted a study on agricultural data pertaining to China and Brazil. The paper employed the RCA index and trade complementarity index to discern the nature of their trade relationship. Suidarma et al. (2017) researched the intra-industry trade of the agricultural sector of ASEAN countries using the Grubel-Lloyd index to find the inter or intra-industry advantages. They revealed the scientific effectiveness of this method. On the other hand, these four methods can effectively analyze the data from different scientific perspectives to fully explain the correlations.

2.1. Method 1

There are differences in industrialization, agriculturalization, natural environment, and political structure between China and Malaysia; the two nations have their own unique comparative advantages in exporting agricultural products. The result evaluation standard is based on the JETRO standard of analyzing the RCA index (X. Wang & J. Wang, 2018). To evaluate the advantages and disadvantages of their agricultural exports, this paper used the revealed comparative advantage (RCA) index (Balassa, 1965):

$$RCA_i^k = \frac{X_i^k / X_\omega^k}{X_i^t / X_\omega^t}, \quad (1)$$

were X_i^k and X_ω^k are the values of k commodities from i country exporting to the world and the value of all k commodities exported to the world. X_i^t and X_ω^t are the values of country i 's total exports to the world and all commodities exported to the world market. RCA_i^k is the revealed comparative advantage index indicating export k in country i. $RCA_i^k \geq 2.5$ means an extreme competitive advantage; $1.25 \leq RCA_i^k < 2.5$ means a strong competitive advantage; $0.8 \leq RCA_i^k < 1.25$ means a medium competitive advantage; $RCA_i^k < 0.8$ means a weak competitive advantage.

2.2. Method 2

It measures the agricultural trade complementarity between China and Malaysia based on the trade complementarity theory. The trade complementarity index (TCI) is used to analyze the corresponding complementary relationship between the trade flow from one country to another, and it is used to examine the complementarity of products exported from one country to another. It is calculated by:

$$RCA_i^k = \frac{X_i^k / X_\omega^k}{X_i^t / X_\omega^t}, \quad (2)$$

$$TCI_{ij}^k = RCA_i^k \cdot rca_j^k, \quad (3)$$

$$rca_j^k = \frac{y_j^k / y_w^k}{y_j^t / y_w^t}, \quad (4)$$

were RCA_i^k is a comparative advantage index of country i 's k commodity exports, X_i^k and X_ω^k are the value of k commodities exported from country i to the world, and all k commodities' value exported to the world. X_i^t and X_ω^t are the total export value from country i to the world and all commodities' value exported to the world market. rca_j^k is a competitive disadvantage index of j country's k commodity imports. y_j^k and y_w^k are all k commodity's value imported to j country and all k commodity's value imported to the world. y_j^t and y_w^t are all import value to j country and all import value to the world. In the method, the world's total import value of A products equals the world's total export value of A products. $TCI > 1$ means the two countries have strong complementarity and $TCI < 1$ means the two countries have weak complementarity.

2.3. Method 3

The Trade Intensity Index (TII) approach analyzes the bilateral trade flow and measures the closeness of trade between different countries, and a higher TII indicates a closer trade relationship. Kojima (1962) improved the TII method. Drysdale (1967)

improved procedures again and made two determinants: special country bias and commodity bias. The special country bias includes the impact of geography, politics, history, and institutions on international trade. Brown (1947) and Kojima (1962) found that with a higher TII (>1), there will be more positive factors in the bilateral trade between the countries.

The formula is given by:

$$T_{ij} = \left(x_{ij} / X_{it}\right) / \left(x_{wj} / X_{wt}\right), \quad (5)$$

where x_{ij} means the country i's export value to country j, X_{it} means the country i's total export value, x_{wj} means the j's total import value, and X_{wt} means the world's total import value. $T_{ij} > 1$ indicates that there are significant positive factors on bilateral trade flow, and the bigger number means a better positive effect. $T_{ij} < 1$ indicates an insignificant positive factor on bilateral trade flow; the lower number means the worse trade effect on trade relationships. In the method, the world's total import value of A products equals the world's total export value of A products.

2.4. Method 4

Grubel and Lloyd (1971) implemented the Grubel-Lloyd index to analyze intra-industry trade. The Grubel-Lloyd index method was implemented to analyze intra-industry trade, and the formula is as follows:

$$GL_j = 1 - \frac{\left|X_j - M_j\right|}{X_j + M_j}, \quad (6)$$

were X_j means the country i's export value to country k, M_j is the country i's import value from country k, and j is the targeted category of the product industry. If GL_j is close to 1, the agricultural product in this research is in intra-industry trade advantage; if GL_j is close to 0, the agricultural product is in inter-industry trade advantage.

3. RESULTS

Tables 1, 2, 3, and 4 reveal the results based on the HS Code 2012 classification. The results provide a valid quantitative representation of the agricultural data by comparing and contrasting them effectively. However, these results are only valid to reflect the actual significance under certain hypotheses.

Table 1. Revealed comparative advantage (RCA) index of Malaysia's and China's agricultural exports (2017, 2018, and 2019)

Source: The United Nations (n.d.) Commodity Trade Statistics Database.

HS Code	RCA Index of China's agricultural products export			RCA Index of Malaysia's agricultural products export		
	2017	2018	2019	2017	2018	2019
01	0.1965	0.1805	0.1652	0.6621	0.6740	0.6807
02	0.0565	0.0515	0.0456	0.0236	0.0171	0.0146
03	0.8809	0.8371	0.7738	0.3518	0.3385	0.4193
04	0.0522	0.0501	0.0462	0.4328	0.4590	0.5029
05	1.7466	1.7052	1.5937	0.0677	0.0822	0.0690
06	0.1263	0.1317	0.1426	0.5418	0.5017	0.4904
07	1.1772	1.1241	1.0477	0.2931	0.2710	0.1947
08	0.3463	0.3282	0.3636	0.1200	0.1313	0.1312
09	0.4412	0.5311	0.5526	0.1960	0.1958	0.1961
10	0.0491	0.0646	0.0745	0.0103	0.0087	0.0090
11	0.2399	0.3031	0.3056	0.4155	0.3799	0.3763
12	0.2062	0.2070	0.2215	0.0439	0.0260	0.0259
13	1.4686	1.4244	1.4241	0.1266	0.1022	0.0883
14	1.0369	1.0383	0.9020	5.4797	6.0579	5.8958
15	0.0646	0.0893	0.0991	10.8319	9.8554	10.1905
16	1.4312	1.4786	1.3209	0.4595	0.4373	0.5003
17	0.2791	0.3327	0.3467	0.3857	0.3530	0.4397
18	0.0618	0.0638	0.0605	2.2127	2.1535	2.5118
19	0.1781	0.1974	0.2081	1.5397	1.4449	1.4287
20	0.9636	0.9522	0.9116	0.2125	0.1874	0.1942
21	0.3568	0.3620	0.3710	1.5328	1.3945	1.3839
22	0.1487	0.1460	0.1234	0.5413	0.4577	0.4360
23	0.2909	0.3009	0.2716	0.4964	0.5146	0.5251
24	0.2548	0.2426	0.2371	0.5001	0.2900	0.2389
Total	0.3712	0.3743	0.3595	1.1460	0.9982	1.0060

Table 1 indicates that, from 2017 to 2019, China had a strong comparative advantage in exporting items 05 (Animal originated products; not elsewhere specified or included), 13 (Lac; gums, resins and other vegetable saps and extracts), 16 (Meat, fish or crustaceans, molluscs or other aquatic invertebrates; preparations thereof), and the RCA index of them are all bigger than 1.25. Malaysia had a strong comparative advantage in exporting items 14 (Vegetable plaiting materials; vegetable products not elsewhere specified or included), 15 (Animal or vegetable fats and oils and their cleavage products; prepared animal fats; animal or vegetable

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waxes), 18 (Cocoa and cocoa preparations), 19 (Preparations of cereals, flour, starch or milk; pastrycooks' products), and 21 (Miscellaneous edible preparations), and the RCA index of them are all bigger than 1.25. In addition, items 14 (Vegetable plaiting materials; vegetable products not elsewhere specified or included) (RCA index >2.5) and 15 (Animal or vegetable fats and oils and their cleavage products; prepared animal fats; animal or vegetable waxes) (RCA index > 2.5) in Malaysia shows an extreme strong comparative advantage in exports. China and Malaysia both have comparative advantages in exporting their specific items. China has a lower overall RCA index (0.37) than Malaysia (1.05), and Malaysia appears to have significant comparative advantages over China in the overall agricultural trade scale. Furthermore, the result reveals that they also have complementary advantages in exporting specific items.

Table 2. TCI based on Malaysia's exports and China's imports, and China's exports and Malaysia's imports (2017, 2018, and 2019)

Source: The United Nations (n.d.) Commodity Trade Statistics Database.

HS Code	TCI index based on China's exports and Malaysia's import			TCI index based on Malaysia's exports and China's import		
	2017	2018	2019	2017	2018	2019
01	0.0502	0.0465	0.0376	0.1035	0.1073	0.1319
02	0.0381	0.0328	0.0260	0.0169	0.0131	0.0180
03	0.5528	0.5351	0.5648	0.2317	0.2890	0.4821
04	0.0473	0.0443	0.0445	0.2390	0.2544	0.3161
05	0.4050	0.2833	0.3186	0.0386	0.0471	0.0473
06	0.0061	0.0069	0.0090	0.0697	0.0594	0.0525
07	1.3528	1.1983	1.0780	0.0765	0.0688	0.0372
08	0.1876	0.1774	0.2032	0.0612	0.0825	0.1074
09	0.4041	0.5379	0.6334	0.0171	0.0234	0.0341
10	0.0602	0.0819	0.0990	0.0059	0.0040	0.0036
11	0.4721	0.6480	0.6177	0.2067	0.1998	0.2178
12	0.1118	0.1005	0.1127	0.1867	0.1003	0.0962
13	0.9989	0.9056	1.0253	0.0433	0.0348	0.0401
14	0.3628	0.4257	0.3263	9.3265	8.1689	7.0795
15	0.0937	0.1426	0.1648	8.4773	8.0845	10.1479
16	0.3866	0.3627	0.3206	0.0214	0.0290	0.0339
17	0.5523	0.6298	0.6243	0.1058	0.1064	0.1578
18	0.1197	0.1236	0.1260	0.2947	0.3100	0.3709
19	0.1639	0.1749	0.1852	1.1597	1.1115	1.1626
20	0.4981	0.5100	0.5027	0.0357	0.0362	0.0406
21	0.4273	0.4196	0.4473	0.4918	0.5206	0.5713
22	0.0724	0.0746	0.0568	0.2346	0.2115	0.1807
23	0.4036	0.3755	0.3479	0.2265	0.2203	0.2424
24	0.1409	0.1348	0.1358	0.2078	0.1024	0.0914

Table 2 indicates that, from 2017 to 2019, China's exports and Malaysia's imports of agricultural products are strongly complementary mainly to item 07 (Vegetables and certain roots and tubers; edible). China's imports and Malaysia's exports of agricultural products are strongly complementary mainly to items 14 (Vegetable plaiting materials; vegetable products not elsewhere specified or included), 15 (Animal or vegetable fats and oils and their cleavage products; prepared animal fats; animal or vegetable waxes), and 19 (Preparations of cereals, flour, starch or milk; pastrycooks' products). The analysis shows that China and Malaysia have a high complementarity in these specific agricultural products. From the basis of Malaysia's export and China's import, the TCI index of items 14 (Vegetable plaiting materials; vegetable products not elsewhere specified or included) and 15 (Animal or vegetable fats and oils and their cleavage products; prepared animal fats; animal or vegetable waxes) are extremely high, which means that the complementarity effect is exceptionally high on the two items. The results show that Malaysia and China have complementary advantages in specific agricultural items, and further cooperation policies based on the results would help enforce the trade between them.

Table 3. Trade intensity index (TII) based on China's export to Malaysia and Malaysia's export to China (2017, 2018, and 2019)

Source: The United Nations (n.d.) Commodity Trade Statistics Database.

Export Direction	China's exports to Malaysia			Malaysia's exports to China		
Year	2017	2018	2019	2017	2018	2019
Trade Intensity Index	1.63	1.58	1.86	2.34	2.25	2.64

Table 3 indicates that, from 2017 to 2019, all TII numbers are above 1 in each trade direction between Malaysia and China. This means they have advantages in bilateral trade related to positive factors and the intense closeness of trade ties. These factors might include geographical, political, and local industrial construction factors (Zhang & Tang, 2017). Therefore, the two nations could further cooperate in agricultural trade through improved trade agreements and industry cooperation.

Table 4. Grubel-Lloyd index based on agricultural trade between China and Malaysia based on HS 2012 code classification (2017, 2018, and 2019)

Source: The United Nations (n.d.) Commodity Trade Statistics Database.

HS Code	Grubel–Lloyd Index		
	2017	2018	2019
01	0.2949	0.3333	0.2591
02	–	–	–
03	0.2276	0.5698	0.9518
04	0.1617	0.1163	0.0591
05	0.2917	0.6111	0.3782
06	0.0580	0.0569	0.0709
07	0.0003	0.0003	0.0022
08	0.1913	0.3286	0.4144
09	0.5128	0.4655	0.3150
10	–	0.0598	0.1920
11	0.0951	0.0325	0.0058
12	0.1273	0.0543	0.0782
13	0.1112	0.1088	0.0312
14	0.0682	0.0772	0.0880
15	0.0270	0.1191	0.1162
16	0.0428	0.0443	0.0642
17	0.5941	0.6912	0.8821
18	0.2330	0.1699	0.1731
19	0.5243	0.5535	0.6389
20	0.1055	0.1489	0.1968
21	0.8882	0.8139	0.7165
22	0.9501	0.6329	0.7671
23	0.8400	0.9430	0.9517
24	0.0106	–	0.0173

Note: Data of Malaysia export to China, including item 02 in 2017,2018 and 2019, item 10 in 2017, and item 24 in 2018, could not be retrieved, "-" means the data could not be retrieved.

Table 4 indicates that, from 2017 to 2019, China and Malaysia have advantages in items 06 (Trees and other plants, live; bulbs, roots and the like; cut flowers and ornamental foliage), 07 (Vegetables and certain roots and tubers; edible), 11 (Products of the milling industry; malt, starches, inulin, wheat gluten), 14 (Vegetable plaiting materials; vegetable products not elsewhere specified or included), and 16 (Meat, fish or crustaceans, molluscs or other aquatic invertebrates; preparations thereof) on an inter-industry scale, and the index of the items are all close to 0. It means that Malaysia and China have inter-industry advantages in these items in the short term. In contrast, China and Malaysia have advantages in item 23 (Food industries, residues and wastes thereof; prepared animal fodder) on an intra-industry scale since the item index is close to 1. It means Malaysia and China have intra-industry advantages in this item in the short term. This method's results would help build a trade framework to enforce inter or intra-industry advantages in particular items.

4. DISCUSSION

According to the study, China and Malaysia have comparative advantages in exporting agricultural commodities. Malaysia exhibits a higher comparative advantage (RCA index = 1.05) than China (RCA index = 0.37) in the overall export. The situation of China's comparative disadvantage in agricultural trade with Malaysia might be due to the direction of industrialization in China. Malaysia has an extreme comparative advantage in exports for items 14 (Vegetable plaiting materials; vegetable products not elsewhere specified or included) (RCA index > 2.5) and 15 (Animal or vegetable fats and oils and their cleavage products; prepared animal fats; animal or vegetable waxes) (RCA index > 2.5). Since the products exhibit a high level of comparative advantage, Malaysia may have a strong natural advantage in producing these agricultural products.

According to the TII (> 1), the trade between the two countries has numerous favorable aspects and holds a better value than expected based on their importance in global trade. Zhang and Tang (2017) found that the "Belt and Road" policy might be one contributing factor. It is important to note that there may be multiple relative basis factors. The long-term stable political environment between countries and the geographical advantage may enforce this relationship. Based on TII, enhancing bilateral agricultural trade cooperation is crucial.

The TCI result shows substantial complementarity in item 07 (Vegetables and certain roots and tubers; edible) of China's exports and Malaysia's imports and in items 14 (Vegetable plaiting materials; vegetable products not elsewhere specified or included), 15 (Animal or vegetable fats and oils and their cleavage products; prepared animal fats; animal or vegetable waxes), and 19 (Preparations of cereals,

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flour, starch or milk; pastrycooks' products) of China's imports and Malaysia's exports. Wang et al. (2018) researched agricultural data (2001, 2005, 2010, 2011, 2012, 2013, 2014, and 2015) between China and Malaysia by using the trade complementarity index. They found substantial complementarity in item 07 of China's exports and Malaysia's imports and in items 14 and 15 of Malaysia's exports and China's imports. The research findings, which were based on data before 2016, align strongly with the results of this current study. This suggests that the agricultural complementarity characteristics of the specific agricultural products have remained unchanged, and both countries can utilize these attributes to implement sustainable agricultural strategies in the long run. When it comes to agricultural dominance, two key factors should be taken into account: natural advantages and industrial advantages. The former, including favorable climate, prolonged exposure to sunlight, and high-quality soil, cannot be easily replicated through artificial means. Achieving agricultural excellence requires a deeper understanding of these natural advantages. Once achieved, Malaysia could work with China to develop cooperation policies to enhance economic growth.

The Grubel and Lloyd index results showed that the two nations have distinct agricultural items with inter-industry or intra-industry advantages. Items 06 (Trees and other plants, live; bulbs, roots and the like; cut flowers and ornamental foliage), 07 (Vegetables and certain roots and tubers; edible), 11 (Products of the milling industry; malt, starches, inulin, wheat gluten), 14 (Vegetable plaiting materials; vegetable products not elsewhere specified or included), and 16 (Meat, fish or crustaceans, molluscs or other aquatic invertebrates; preparations thereof) have inter-industry advantages, and item 23 (Food industries, residues and wastes thereof; prepared animal fodder) has an intra-industry advantage. These differences might result in natural agricultural advantages, local consumption demand, and agricultural industrialization. Implementing a more open and free trade policy could promote the growth of intra-industry trade and improve trade diversity. However, implementing foreign exchange adjustment policies that target specific areas may benefit agricultural exports but could also result in trade conflicts. According to Chen et al. (2004), several factors such as product differentiation, economic scale, market structure, and foreign direct investment significantly impact intra-industry development in China. Economic scale, market structure, and foreign direct investment positively correlate with intra-industry development. However, Malaysia and China have different social and industrial structures, so the Malaysian government needs to consider these differences while referring to China's policies on cooperation.

For further cooperation, the study offers suggestions for comparative advantages. According to Wu's (2012) research on trade complementarity and competitiveness among BRICS countries, highly complementary products in different markets also vary in their levels of competitiveness. The findings suggest potential policy directions based on the results. Policymakers must consider the changes in the competitiveness of complementary products, even if these items possess long-term complementary features. The main factors affecting agricultural exports differ due to the differences in economic growth and industrial structure between China and the United States (Shuai, 2009). It is essential to consider the internal differences between Malaysia and China when enhancing their trade cooperation. The global value chain would enforce the global industry's upgrade to a higher level (Sheng & Chen, 2015). It indicated that the government should understand the role of trade in FDI, services, and intermediate goods in promoting domestic industrial upgrading based on a global view. Malaysia and China should consider cooperation and identify the side effects of other competitors and partners. According to Shen et al. (2002), the impact of subsidies on listed agricultural enterprises in China varied depending on the implementation stage. Given the widespread use of subsidy policies globally, this study could serve as a valuable reference for subsidy policies. However, it is necessary to note that countervailing policies may adversely affect exports. Thus, before implementing a subsidy policy, the nations should negotiate a balanced trade agreement to avoid potential trade conflicts.

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CONCLUSION

The study aimed to unveil valuable insights into the intricacies of the trade relationship between China and Malaysia, shedding light on the contemporary status of agricultural trade complementarity and competitiveness. The results reveal that both nations possess distinct advantages when exporting specific agricultural commodities. This study significantly contributes to the existing trade research paradigm, furnishing empirical evidence that can guide policymakers in shaping the contours of contemporary policies. The study discloses that Malaysia boasts a superior comparative advantage in total agricultural trade compared to China. Additionally, specific agricultural product categories are identified as exhibiting complementary patterns in exports and imports. This substantiates the potential for both countries to synergize their efforts in bilateral agricultural trade, particularly by concentrating on areas with relative disadvantages and tactically transforming these into strengths through targeted policies.

The high trade intensity index reveals the pronounced affinity characterizing the trading relationship between the two nations, suggesting avenues for heightened collaboration. Moreover, the inquiry unveils the diverse ramifications of inter-industry and intra-industry trade across various agricultural products. Enhanced benefits could arise from strategic alterations to domestic industrial policies and trade strategies, thereby capitalizing on inter-industry and intra-industry trade advantages without considering the influence of inherent environmental factors.

However, the study bears certain limitations. First, the implications of the findings are constrained to a hypothetical context, necessitating further comprehensive investigation to concretely operationalize these results into policy implementation. Second, the temporal scope of the study introduces limitations, as more extended datasets might bring potential biases attributed to the COVID-19 pandemic and natural disasters. Third, the ever-evolving political landscape introduces an element of uncertainty that could impact agricultural trade dynamics. Given the Chinese government's initiation of novel pandemic-controlling policies in 2022, future research could delve into agricultural trade data between Malaysia and China post-2023, elucidating potential shifts these interventions engendered.

AUTHOR CONTRIBUTIONS

Conceptualization: Zhe Tao, Siva Shankar Ramasamy.
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Formal analysis: Zhe Tao.
Funding acquisition: Zhe Tao.
Investigation: Zhe Tao.
Methodology: Zhe Tao.
Project administration: Zhe Tao, Fangli Ying.
Resources: Zhe Tao, Siva Shankar Ramasamy.
Software: Zhe Tao.
Supervision: Siva Shankar Ramasamy, Fangli Ying.
Validation: Zhe Tao.
Visualization: Zhe Tao.
Writing – original draft: Zhe Tao, Siva Shankar Ramasamy.
Writing – review & editing: Zhe Tao, Siva Shankar Ramasamy, Fangli Ying.

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APPENDIX A

Table A1. HS 2012 classification of agricultural products

Source: The United Nations (n.d.) Commodity Trade Statistics Database.

HS Code	Meaning
01	Animals; live
02	Meat and edible meat offal
03	Fish and crustaceans, mollusks and other aquatic invertebrates
04	Dairy products; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included
05	Animal originated products; not elsewhere specified or included
06	Trees and other plants, live; bulbs, roots and the like; cut flowers and ornamental foliage
07	Vegetables and certain roots and tubers; edible
08	Fruit and nuts, edible; peel of citrus fruit or melons
09	Coffee, tea, maté and spices
10	Cereals
11	Products of the milling industry; malt, starches, inulin, wheat gluten
12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit, industrial or medicinal plants; straw and fodder
13	Lac; gums, resins and other vegetable saps and extracts
14	Vegetable plaiting materials; vegetable products not elsewhere specified or included
15	Animal or vegetable fats and oils and their cleavage products; prepared animal fats; animal or vegetable waxes
16	Meat, fish or crustaceans, molluscs or other aquatic invertebrates; preparations thereof
17	Sugars and sugar confectionery
18	Cocoa and cocoa preparations
19	Preparations of cereals, flour, starch or milk; pastrycooks' products
20	Preparations of vegetables, fruit, nuts or other parts of plants
21	Miscellaneous edible preparations
22	Beverages, spirits and vinegar
23	Food industries, residues and wastes thereof; prepared animal fodder
24	Tobacco and manufactured tobacco substitutes

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