“Competitiveness and complementarity of agricultural products between Thailand and China on a short-term basis”

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ARTICLE INFO	Zhe Tao (2022). Competitiveness and complementarity of agricultural products between Thailand and China on a short-term basis. *Problems and Perspectives in Management*, *20*(3), 425-436. doi:10.21511/ppm.20(3).2022.34
DOI	http://dx.doi.org/10.21511/ppm.20(3).2022.34
RELEASED ON	Friday, 23 September 2022
RECEIVED ON	Thursday, 07 July 2022
ACCEPTED ON	Friday, 09 September 2022

JOURNAL	"Problems and Perspectives in Management"
ISSN PRINT	1727-7051
ISSN ONLINE	1810-5467
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
44	5	5

BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine

www.businessperspectives.org

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COMPETITIVENESS AND COMPLEMENTARITY OF AGRICULTURAL PRODUCTS BETWEEN THAILAND AND CHINA ON A SHORT-TERM BASIS

Abstract

China and Thailand belong to Regional Comprehensive Economic Partnership countries, and agricultural trade is vital to Thailand's economy. Competition in agricultural trade between countries is fierce. Therefore, it is crucial to understand the advantages and disadvantages of agricultural trade between Thailand and China. Complementarity and competitiveness of international business show the benefits and drawbacks of cross-border exports and the trend of future exports. This study uses quantitative techniques to analyze the agricultural trade between Thailand and China. It employed four methods, including the calculations of the Grubel-Lloyd index, revealed comparative advantage index (RCA), trade intensity index (TII), and trade complementarity index (TCI). The result of method 1 indicates that Thailand's agricultural trade has a more substantial competitive advantage (three years average RCA = 1.69 > 1.25) than China (three years average RCA = 0.37 < 0.8) from 2017 to 2019; they are complementary in specific categories of agricultural products. The result of method 2 indicates that items 03, 07, 13, and 14 of China's exports and Thailand's imports have strong complementarity. Items 10, 11, 17, and 19 of Thailand's exports and China's imports have strong complementarity. The result of method 3 indicates that the positive factor on bilateral trade flow is significant. The result of method 4 indicates that items 06, 07, 12, 19, 20, and 21 have advantages in intra-industry trade, and items 09, 10, 13, and 18 have advantages in inter-industry trade. The paper has important implications for Thailand's government to formulate relevant trade policies to enhance its agricultural export competitiveness, which is also conducive to developing bilateral agricultural trade.

Keywords competitiveness, complementarity, China's agricultural trade, Thailand's agricultural trade

JEL Classification F14, Q13, Q17

Received on: 7th of July, 2022
Accepted on: 9th of September, 2022
Published on: 23rd of September, 2022

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Conflict of interest statement:
Author(s) reported no conflict of interest

INTRODUCTION

Thailand is a member of WTO, APEC, and ASEAN and has had an increasing economic development from 2010 to 2019. China, the largest GDP entity in Asia and the world's second-largest GDP entity in 2021, is a vital trade partner to Thailand. From 2010–2020, the import contribution rate of total imports from China to the world was 27%, more than the USA and EU, which increased from 12.1% in the period from 2001 to 2009 (Wei, 2021). It has also been the largest trade partner of Thailand for eight consecutive years. In 2021, the total trade between China and Thailand had increased to 131 billion US dollars (General Administration of Customs of PRC, 2022b), which made China the top trade partner of Thailand.

Due to the impacts of deep cooperation with ASEAN countries and the "One Belt, One Road" initiative, ASEAN became the leading trade

partner to China, whose total trade was 5.67 trillion RMB (equal to 878.2 billion USD) in 2021 (General Administration of Customs of PRC, 2022a). In 2019, China's total exports of agricultural products amounted to 79.1 billion US dollars, imports reached 150.9 billion US dollars, and a trade deficit was 71.8 billion US dollars (its growth rate is 26.5% annually) (Ministry of Agriculture and Rural Affairs of PRC, 2020). In addition, China's "One Belt, One Road" initiative in 2013 also intensified the trade with Thailand and other ASEAN countries; the total trade volume between China and ASEAN stood at 43.9% of the "One Belt, One Road" initiative total trade in 2014 (Zou et al., 2015).

Furthermore, based on the World Bank Database, Thailand and China had a stable increase in GDP from 2010–2019, and their total exports to each other increased stably (see Figures 1-5). RCEP agreement implemented in 2022 also helped Thailand to promote its exports to China. Therefore, one crucial issue is how to help Thailand's government and related third parties find a scientific path to improve agricultural exports to China. Economic integration and global trade could offer better resource use and support domestic producers in their efforts to enter larger markets, paying attention to their countries' comparative advantages (Mayes, 1978). After an accurate analysis of the agricultural trade, Thailand's government could use more targeted strategies to improve agricultural exports. The issue is identifying the advantages and disadvantages of agricultural trade based on a rational methodology between Thailand and China.

1. LITERATURE REVIEW

Following the traditional economic theory, competitiveness aligns with the comparative advantage of Ricardo (1821) and the absolute advantage of Smith (1776). Scholars have offered many approaches to analyzing trade effects in one sector under the traditional economic theory. An example of such approaches is the revealed comparative advantage index of Balassa (1965). However, due to the limit of the measurement method, the result could only be effective on specific hypotheses.

Strategies such as economic integration could be applied based on the outcome of these methods. Economic integration might effectively promote regional trade and national competitiveness (Petrović et al., 2008). Different countries can benefit from mutual economic integration (Rivera-Batiz & Romer, 1991). Balassa (1965) proposed the empirical method of comparative advantage in a commodity. This method compares one country's export performance with a specific group of countries' export performance in the same industry. Therefore, economic integration could be applied after the analysis result is achieved, which means that the agricultural data analysis is the foundation of governance.

In order to analyze the agricultural data based on an efficient method, the study conducted experiments verifying procedures from the literature. Zhou and Zhan (2009) analyzed China-Thailand's agricultural trade based on the trade data from 1996 to 2006. It was found that the vertical structure was the primary trade structure in the trade area. They researched the data using the Grubel-Lloyd index, Bruelhart Index method, and Thom & McDowell Index to analyze the agricultural trade data and discovered the potential relationship between different factors. The study proposed strategies for producing agricultural products based on geographical growing categories to improve China and Thailand's agricultural trade through empirical quantitative analysis.

Analysis of the China and ASEAN countries' trade offered this study significant guidance in various directions. First, Xie and Yue (2011) researched the effects of trade facilitation on trade flows between China and ASEAN countries. They analyzed the impact based on data on port efficiency, custom environment, and policy environment. It was found that GDP and Free Trade Zone benefited trade flow, and the trade facilitation promoted trade flow (Xie & Yue, 2011). Second, Pöyhönen (1963) and Tinbergen (1962) researched the determinants of trade flows. Finally, Ekanayake et al. (2010) analyzed Asia's regional trade agreements and their impact on intra-regional trade flows. They employed the gravity model with 1980–2009 trade data. It was found that transportation and other distance-related costs are important deter-

http://dx.doi.org/10.21511/ppm.20(3).2022.34

minants of trade flows (Ekanayake et al., 2010). Therefore, distances could be one crucial factor in analyzing trade data. Due to the nearby geographical advantages, analyzing trade between Thailand and China is a meaningful sub-case. However, the specified agricultural trade case is only one variable case, and this paper will not consider geographical factors.

Other research also identified the significance of trade effects between Thailand and China. For example, Nidhiprabha (2019) analyzed the effects of the China-USA trade war on Thailand's exports using the vector autoregressive model. It was indicated that the escalating trade dispute negatively influences Thailand's exports. In addition, the slowdown of the Chinese economy constrains and reduces Thailand's exports (Nidhiprabha, 2019). Thus, Thailand and China have a very close relationship in trade.

Zhao and Lin (2008) researched the trade relationship of agricultural products between 10 ASEAN countries and China. They applied the trade gravity model to analyze the 2000–2006 agricultural trade data. The study concluded that the trade flows relied on the economic scale, population, trading policy, and the distances between capital cities (Zhao & Lin, 2008). Therefore, the most crucial factors were the trading policy and economic scale. Therefore, China and ASEAN countries have more potential opportunities in trading agricultural products.

Zhang and Yu (2018) researched traffic infrastructure, side reactions, and bilateral trade effects based on the countries covered by the "One Belt, One Road" initiative. The study found that although the improvement of the transportation infrastructure of the importing country is more conducive to the export trade of neighboring countries, it has not affected the increase of China's export share in the importing country. Instead, the transportation infrastructure of the importing country and its neighboring countries promoted China's export trade, and the degree of this impact has increased over time.

Fang and Zhu (2013) explored the impact of trade facilitation in China and ASEAN countries on the export trade of each country. The trade facilitation levels in 2004, 2009, and 2011 were investigated based on quantitative research methods, the Global Competitiveness Report, and other business survey data. At the same time, the panel data of multilateral export flows between China and 6 ASEAN countries in 2004, 2009, and 2011 were selected. The trade gravity model verified the impact of the trade facilitation level on a country's exports. It was shown that the higher the degree of trade facilitation, the more it could promote an increase in exports (Fang & Zhu, 2013).

Yang and Wang (2005) analyzed the complementary of China-Russia cross-board trade. They found that the complementary effect was high, and the potential opportunity was highly based on the model of revealed comparative advantage (Balassa, 1965). They found that China and Russia had a strong relationship based on high TCD (as a trade intensity index) from 1992 to 1993 due to Russian policy effects. From 1994 to 2003, they discovered that the TCD from Russia to China had different trends but still had high TCD compared to other countries. Since Russia and Thailand are geographically nearby countries to China, the model could also be conducted in this study.

Hoang (2020) analyzed ASEAN agricultural competitiveness using RCA, RTA, and NRCA as objectives. He discovered that ASEAN countries show significant competitiveness in crustaceans, rice, rubber, spices, vegetable fat and oils, wood, fish, and fuel wood. Thailand, Vietnam, and Indonesia are the most competitive, while Singapore, Brunei, and Cambodia are the weakest countries (Hoang, 2020). Hoang (2020) also discussed the effectiveness of the RCA model and defined weak, medium, and strong competitiveness levels.

Kuang and Tang (2012) analyzed the complementarity and competitiveness between China and Thailand's agricultural products based on data from 2000 to 2010. They aimed to assess the trade structure and find the relationships. The study analyzed both the whole structure and the separate structures and found that China had low competitiveness overall but still showed competitiveness in exporting some agricultural products.

Source: The World Bank (n.d.) Database.

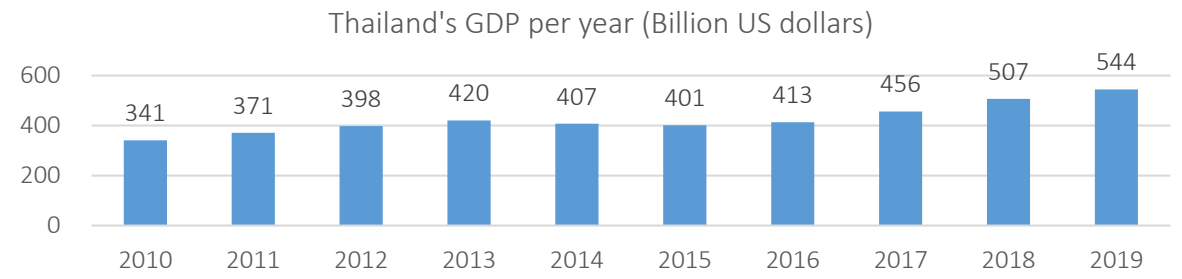

Figure 1. Thailand's GDP per year from 2010 to 2019

Source: The World Bank (n.d.) Database.

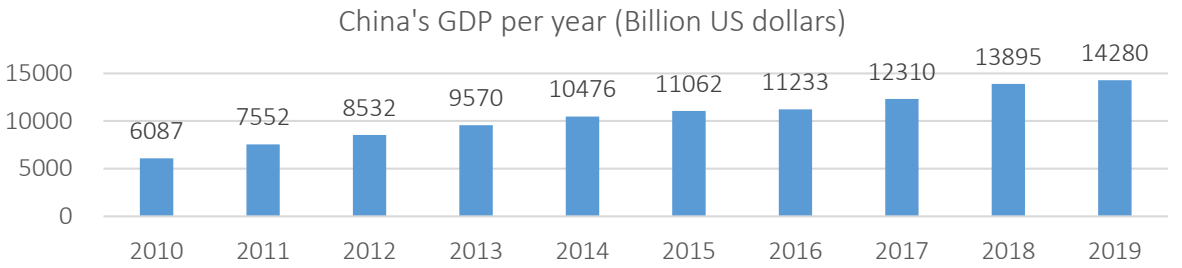

Figure 2. China's GDP per year from 2010 to 2019

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

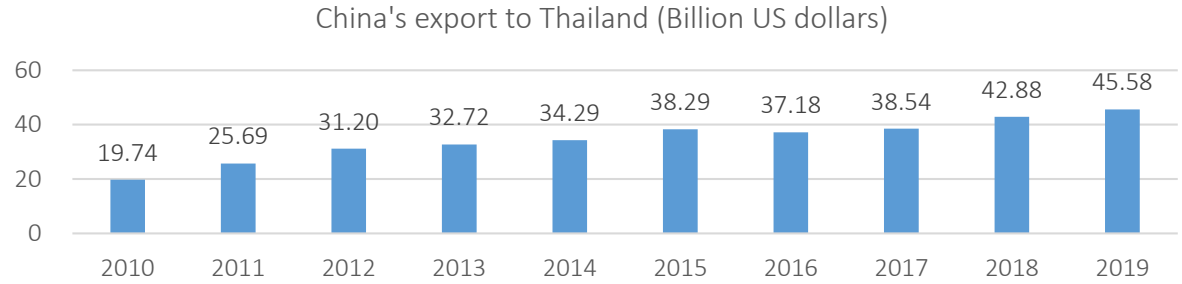

Figure 3. China's export of goods to Thailand from 2010 to 2019

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

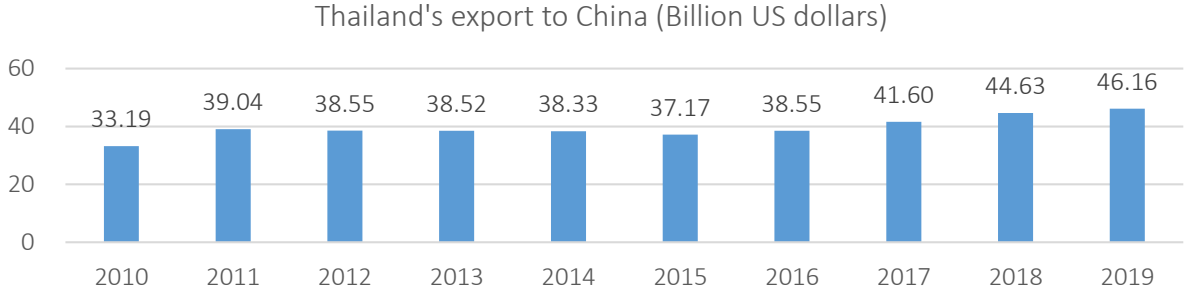

Figure 4. Thailand's export of goods to China from 2010 to 2019

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

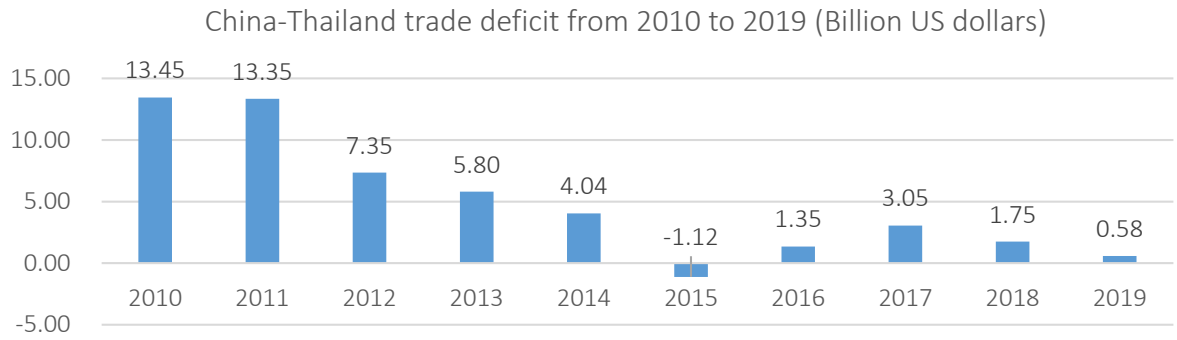

Figure 5. China-Thailand trade deficit from 2010 to 2019

The study also found whether there was a significant change in the trade factors between the two countries on a time base (Kuang & Tang, 2012).

Based on the studies of agricultural trade, the research models proved to be effective in analyzing related agricultural trade factors. The paper aimed to use the models to analyze the advantages and disadvantages of agricultural trade between Thailand and China on a competitive and complementary scale.

2. METHODOLOGY

The study analyzes agricultural exports and imports trade data between Thailand and China. Moreover, it determines the advantages and disadvantages of agricultural trade on a competitive and complementary scale. The theoretical assumption is that the short-term data (2017–2019) could reflect the latest trade trend in the short run, and long-term data might bring more uncertainty. The analysis was limited to three years because Thailand suffered a severe drought in 2016, and after 2019, the Covid-19 pandemic adversely affected world trade. Long-term data might bring more errors and deviations. Therefore, the data before 2017 and after 2019 should be eliminated from the experimental analysis.

The paper analyzed the data using comparative advantage theory, complementary trade theory, trade intensity approach, and the Grubel-Lloyd index method. The study used 2017, 2018, and 2019 agricultural products import and export trade data coded by the HS12 classification (Table 1) in the United Nations Commodity Trade Statistics Database. It determined Grubel-Lloyd Index, revealed comparative advantage index, trade intensity index, and trade complementarity index. Moreover, trade structure, trade dependence, trade development, inter- and intra-industry situation of agriculture products between the two countries were analyzed.

2.1. Method 1

Due to the differences in agricultural technology and industry structure between China and Thailand, they have comparative advantages in agricultural exports. In order to analyze the comparative advantages of their agricultural exports, this paper employs the revealed comparative advantage (RCA) index (Balassa, 1965):

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

where RCA_i^k is a revealed comparative advantage index, $RCA_i^k \geq 2.5$ means that the export k commodity in country i has an extreme competitive advantage; $1.25 \leq RCA_i^k < 2.5$ means that the export k commodity in country i has a strong competitive advantage; $0.8 \leq RCA_i^k < 1.25$ means the export k commodity in country i has a medium competitive advantage; $RCA_i^k < 0.8$ means that the k commodity in country i has a weak competitive advantage. X_i^k and X_ω^k are the export value of k commodities from country i to the world and the total export value of all k commodities to the world. X_i^t and X_ω^t are the value of total exports from country i to the world and the total export value of all commodities on the world market.

Zhang (2021) implemented this method in analyzing the agricultural product relationship between

China and Brazil, and he found comparative advantages between the two countries. Furthermore, the paper set the RCA classification level based on the JETRO standard (X. Wang & J. Wang, 2018).

2.2. Method 2

Method 2 measures China and Thailand's agricultural trade complementarity based on the TCI index. The trade complementarity index (TCI) is employed to determine the correlation between the export of a particular product in one country and the import of that product in another country, which can reflect the corresponding complementary relationship between one country's exports and another country's imports.

It is calculated by:

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

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

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

where RCA_i^k is a comparative advantage index of i country exports of k commodity, X_i^k and X_ω^k are the export value of k commodities from country i to the world, and the total export value of all k commodities to the world. X_i^t and X_ω^t are the value of total exports from country i to the world and the total export value of all commodities on the world market. rca_i^k is a competitive disadvantage index of j country imports of k commodity. y_j^k and y_w^k are the trade value of all k commodity imported to j country and the trade value of all k commodities imported to the world. y_j^t and y_w^t are the total trade value of all imports to j country and the total value of all imports to the world. In the method, the total value of world imports of A products equals the total value of world exports of A products.

The more extensive TCI index means that the two countries have stronger complementarity. If the TCI index is bigger than 1, the two countries have strong complementarity; if it is lower than 1, the two countries have weak complementarity.

2.3. Method 3

The next step is to use the Trade Intensity Index (TII) approach. TII analyzes the trade flow and evaluates the relationship between the countries. Kojima (1962) improved the trade intensity index method. After that, Drysdale (1967) improved procedures again and made two determinants: one is commodity bias, and the other one is special country bias. The special country bias includes the effect on international commerce from politics, geography, institutions, and history. Finally, Yang and Wang (2005) applied TII to analyze the trade dependence and relationship between China and Russia.

According to Brown (1947) and Kojima (1962), it shows that the higher the TII (>1), the more positive factors will be in the bilateral trade between the countries (e.g., better free trade agreements, better geographical factors, and better comparative advantages).

The formula is given by:

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

where x_{ij} is the value of country i's exports to country j, X_{it} is the country i's total exports, x_{wt} is the value of j's total imports, and X_{wt} is the total world imports. An index of $T_{ij} > 1$ indicates the positive factor on bilateral trade flow is significant, the bigger the number, the better the positive effect. While $T_{ij} < 1$ indicates a positive factor on bilateral trade flow that is insignificant, the lower the number, the worse the trade relationship effect. In this method, the total value of world imports of A products equals the total value of world exports of A products.

2.4. Method 4

Grubel and Lloyd (1971) implemented Grubel-Lloyd Index to analyze the intra-industry trade. Egger et al. (2007) researched multinational firms based on the Grubel-Lloyd measure to analyze intra-industry trade (IIT) and developed a new model to analyze focused areas, and this measurement was widely used. However, the study used the traditional method.

Grubel-Lloyd index method was implemented to analyze intra-industry trade, and the formula is:

http://dx.doi.org/10.21511/ppm.20(3).2022.34

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

where the X_j is country A's export to country B, M_j is country A's import from country B, and j is the targeted category of product industry. If GL_j is near 1, they are developed in intra-industry trade; if GL_j is near 0, they are developed in inter-industry trade.

Table 1. HS12 classification of agricultural products

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

HS Code	Meaning
01	Live animals.
02	Meat and edible chop.
03	Fish and other aquatic invertebrates.
04	Milk; eggs; honey; other edible animal products.
05	Other animal products.
06	Living plants; stems, roots; flower arrangements, tufted leaves.
07	Edible vegetables, roots, and tubers.
08	Edible fruits and nuts; fruit peels such as melon.
09	Coffee, tea, mate, and spices.
10	Grains.
11	Milling products; malt, starch, etc., gluten.
12	Oilseeds; kernels; industrial medicinal plants; feed.
13	Shellac; gum, fat, and other plant liquids, juice.
14	Plaiting materials; other plant products.
15	Animal or vegetable fats and oils; refined edible oils and fats.
16	Meat, fish and other aquatic invertebrate products.
17	Sugar and confectionery.
18	Cocoa and cocoa products.
19	Cereal flour, starch, etc. or dairy products; cakes.
20	Products of vegetables, fruits, or other parts of plants.
21	Miscellaneous food.
22	Beverages, wine, and vinegar.
23	Food industry residues and waste; formulated feed.
24	Tobacco and tobacco substitute products.

3. RESULTS

Due to the different factors between Thailand and China in agricultural trade, the experimental results effectively demonstrated their different trade characteristics. The results also proved the advantages and disadvantages of agricultural trade on different scales in their specific situations.

Table 2. Revealed comparative advantage (RCA) index of Thailand and China 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 Thailand's Agricultural Products Export		
	2017	2018	2019	2017	2018	2019
01	0.196	0.180	0.165	0.544	0.960	1.330
02	0.057	0.052	0.046	0.470	0.616	0.599
03	0.881	0.837	0.774	1.347	1.232	1.228
04	0.052	0.050	0.046	0.243	0.270	0.294
05	1.747	1.705	1.594	0.366	0.404	0.426
06	0.126	0.132	0.143	0.441	0.463	0.469
07	1.177	1.124	1.048	1.416	1.298	0.942
08	0.346	0.328	0.364	1.451	1.693	2.349
09	0.441	0.531	0.553	0.215	0.227	0.212
10	0.049	0.065	0.075	3.770	3.846	3.045
11	0.240	0.303	0.306	4.846	5.969	5.631
12	0.206	0.207	0.222	0.155	0.193	0.210
13	1.469	1.424	1.424	0.281	0.267	0.271
14	1.037	1.038	0.902	0.543	0.771	0.708
15	0.065	0.089	0.099	0.415	0.462	0.419
16	1.431	1.479	1.321	9.568	9.416	10.221
17	0.279	0.333	0.347	4.562	5.435	6.692
18	0.062	0.064	0.060	0.053	0.085	0.119
19	0.178	0.197	0.208	1.345	1.394	1.563
20	0.964	0.952	0.912	2.745	2.496	2.617
21	0.357	0.362	0.371	2.322	2.238	2.491
22	0.149	0.146	0.123	1.044	1.129	1.305
23	0.291	0.301	0.272	1.658	1.743	1.942
24	0.255	0.243	0.237	0.281	0.308	0.455
Total	0.371	0.374	0.360	1.610	1.695	1.775

Table 2 shows that China and Thailand have comparative advantages in exporting agricultural products. China has a total RCA index lower than 0.8 in three years, which means that it has a weak competitive advantage in exporting agricultural products. On the other hand, Thailand has a very high total RCA Index, which is higher than 1.25, meaning a strong comparative advantage in exporting agricultural products overall. Therefore, Thailand has a much higher RCA index than China, and this means that Thailand has a more substantial advantage in agricultural export than China.

Considering different product categories, China has comparative advantages in exporting items 05 (Other animal products), 07 (Edible vegetables, roots, and tubers), 13 (Shellac; gum, fat, and other plant liquids, juice), 14 (Plaiting materials; other plant products), 16 (Meat, fish and other aquatic invertebrate products), and 20 (Products of vegetables, fruits,

or other parts of plants). In contrast, Thailand has comparative advantages in exporting 03 (Fish and other aquatic invertebrates), 07 (Edible vegetables, roots, and tubers), 08 (Edible fruits and nuts; fruit peels such as melon), 10 (Grains), 11 (Milling products; malt, starch, etc., gluten), 16 (Meat, fish and other aquatic invertebrate products), 17 (Sugar and confectionery), 19 (Cereal flour, starch, etc. or dairy products; cakes), 20 (Products of vegetables, fruits, or other parts of plants), 21 (Miscellaneous food), 22 (Beverages, wine, and vinegar), and 23 (Food industry residues and waste; formulated feed).

However, there are differences in categories of items with competitive advantages between the two countries; China has weak comparative advantages in exporting agricultural products overall, but it has some categories with comparable advantages that Thailand does not have. The results also show they have a complementary advantage in exporting specific agricultural products.

Table 3. TCI index based on China's export and Thailand's import, and Thailand's export and China's import (2017, 2018, and 2019)

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

HS Code	TCI index based on China's export			TCI index based on Thailand's export		
	2017	2018	2019	2017	2018	2019
01	0.0704	0.0652	0.0522	0.0850	0.1527	0.2577
02	0.0044	0.0041	0.0036	0.3374	0.4704	0.7345
03	1.9326	1.8623	1.6381	0.8874	1.0520	1.4116
04	0.0320	0.0308	0.0297	0.1343	0.1498	0.1847
05	0.9720	0.7480	0.6429	0.2084	0.2313	0.2916
06	0.0154	0.0179	0.0221	0.0567	0.0548	0.0502
07	1.0378	1.0434	1.1031	0.3695	0.3295	0.1800
08	0.2173	0.1764	0.1999	0.7392	1.0638	1.9226
09	0.2603	0.3222	0.3429	0.0188	0.0272	0.0368
10	0.0238	0.0351	0.0543	2.1697	1.7642	1.2299
11	0.2838	0.3204	0.3461	2.4105	3.1389	3.2601
12	0.2335	0.2248	0.2707	0.6579	0.7452	0.7783
13	1.6545	1.5027	1.6561	0.0962	0.0911	0.1232
14	2.8325	3.0421	3.3177	0.9235	1.0398	0.8502
15	0.0171	0.0217	0.0243	0.3246	0.3789	0.4171
16	0.5383	0.6165	0.6355	0.4454	0.6241	0.6924
17	0.0904	0.1212	0.1398	1.2509	1.6378	2.4017
18	0.0191	0.0196	0.0191	0.0071	0.0123	0.0176
19	0.1133	0.1167	0.1200	1.0134	1.0723	1.2716
20	0.3497	0.3394	0.3757	0.4614	0.4822	0.5472
21	0.3308	0.3125	0.3453	0.7451	0.8354	1.0282
22	0.0355	0.0375	0.0338	0.4525	0.5217	0.5409
23	0.6916	0.6649	0.6372	0.7566	0.7460	0.8962
24	0.1130	0.1153	0.1325	0.1166	0.1085	0.1740

Table 3 shows that considering specific types of agricultural products, China's exports of agricultural products and Thailand's imports of agricultural products are strongly complementary, mainly in items 03 (Fish and other aquatic invertebrates), 07 (Edible vegetables, roots, and tubers), 13 (Shellac; gum, fat, and other plant liquids, juice), and 14 (Plaiting materials; other plant products). On the other hand, Thailand's exports of agricultural products and China's imports of agricultural products are strongly complementary, mainly in items 10 (Grains), 11 (Milling products; malt, starch, etc., gluten), 17 (Sugar and confectionery), and 19 (Cereal flour, starch, etc. or dairy products; cakes).

The results show that Thailand and China have specific complementary categories of agricultural products in one country's export and another's imports. Therefore, they could cooperate further to enforce their advantages on both sides.

Table 4. Trade intensity index (TII) based on China's export to Thailand and Thailand's export to China (2017, 2018, and 2019)

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

Export direction base	China's export to Thailand base			Thailand's export to China base		
Year	2017	2018	2019	2017	2018	2019
Trade intensity index	1.33	1.31	1.54	1.64	1.57	1.74

Table 4 shows that from 2017 to 2019, the intensity index from both export directions between China and Thailand is above 1, which means that the positive factor on bilateral trade flow is significant. In this case, the higher the intensity index means the two countries have more significant advantages in trading from better factors such as comparative advantage structures, better free trade agreements, and better geographical nearby locations (Zhang & Tang, 2017). Therefore, the two countries could cooperate with agricultural trade on a vast political and economic scale.

The study examined 24 different HS12 categories of agricultural products between Thailand and China from 2017–2019 and got the result of the GL index.

http://dx.doi.org/10.21511/ppm.20(3).2022.34

Table 5. GL index based on HS01-HS24 (2017, 2018, and 2019)

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

HS Code	GL Index		
	2017	2018	2019
01	0.43	0.96	0.12
02	–	–	0.00
03	0.42	0.61	0.78
04	0.26	0.59	0.35
05	0.10	0.16	0.24
06	0.71	0.83	0.96
07	0.57	0.80	0.89
08	0.80	0.50	0.35
09	0.03	0.02	0.03
10	0.00	0.00	0.01
11	0.21	0.16	0.21
12	0.70	0.58	0.59
13	0.05	0.05	0.09
14	0.26	0.32	0.54
15	0.63	0.65	0.57
16	0.39	0.33	0.28
17	0.52	0.71	0.47
18	0.16	0.08	0.10
19	0.87	0.87	0.91
20	0.66	0.72	0.71
21	0.77	0.79	0.97
22	0.27	0.34	0.39
23	0.60	0.52	0.49
24	0.09	–	0.72

Note: Data of Thailand export to China item 24 in 2018, and China export to Thailand item 02 in 2017 and 2018 could not be achieved, "–" means the data could not be calculated, the 0.00 number means that the number is minimal but still positive.

Table 5 shows that items 06 (Living plants; stems, roots; flower arrangements, tufted leaves), 07 (Edible vegetables, roots, and tubers), 12 (Oilseeds; kernels; industrial medicinal plants; feed), 19 (Cereal flour, starch, etc. or dairy products; cakes), 20 (Products of vegetables, fruits, or other parts of plants), 21 (Miscellaneous food) has a stable index over 0.5 and near 1, which means that China and Thailand have a short-term trend in advantage in intra-industry trade area in these items.

In contrast, items 09 (Coffee, tea, mate, and spices), 10 (Grains), 13 (Shellac; gum, fat, and other plant liquids, juice), and 18 (Cocoa and cocoa products) have a stable index near 0. The two countries have advantages in inter-industry trade in these items. The results described the intra-industry and inter-industry effects in different agricultural categories. It would guide the measurement of the special agricultural industry in specific categories. However, evaluating the extent of the trade structure of agricultural trade by this method would help to recognize the macro frame of the existing advantage structure.

4. DISCUSSION

The findings indicated that Thailand and China have specific comparative advantages in agricultural exports in different agricultural product categories. Thailand (RCA = 1.69) has a more substantial comparative advantage than China (RCA = 0.37) in exporting agricultural products overall, and differences in figures show that Thailand has a more substantial agricultural export advantage. TII (> 1) shows significant positive factors in the trade between the two countries. It also shows the better value of trade than expected, considering the importance of world trade. Therefore, it is vital to strengthen the cooperation in bilateral trade of agricultural products based on the TII figures.

The TCI results indicate that items 03, 07, 13, and 14 of China's exports and Thailand's imports and items 10, 11, 17, and 19 of Thailand's exports and China's imports have strong complementarity. However, X. Li and M. Li (2021) researched 2013, 2016, and 2019 trade data between Thailand and China. They found that items 05, 07, 08, 11, 16, 17, and 20 based on China's export and Thailand's import, and items 07, 08, and 11 based on Thailand's export and China's import are strongly complementary. The primary factor that causes the differences is that their TCI method's variable rca_j^k contains the factors of one country's imports from another country instead of from the world. The study does not recommend their method in this case since the analysis focused on the assumption that the RCA_i^k and rca_j^k should have comparable levels on the world base.

The intra-industry and inter-industry effects of the various categories of agricultural items in the study would be critical elements in assessing the scale of agricultural product industrialization. Items 06, 07, 12, 19, 20, and 21 have advantages in intra-industry trade, and items 09, 10, 13, and 18 have advantages in inter-industry trade. These different types of agricultural exports show the

characteristics of agricultural industrialization and its natural agricultural advantages. The other issue is how to set up policies according to the result of experiments. New free trade agreement policies negotiated and designed could be one way to build a more open trade environment, and it might speed up the intra-industry trade flows and enhance trade diversity. Adjusting foreign exchange policy could help agricultural exports but could lead to further trade conflicts.

Franke (1991) concluded that increased exchange rate volatility reduces international trade volumes because the firms are careful and cautious. The study found evidence that some of the consequences of an overvalued currency are to be compensated by trade policy, especially the trade policy about antidumping interventions (Nicita, 2013). Lamb (2000) found that the exchange rate in explaining export crop production, food, and aggregate agricultural supply has a significant position, and it might be a proxy for excluded macroeconomic variables. Therefore, using more open trade policies to promote agricultural exports is much better than using foreign exchange policies alone. Thailand's government could use financial tools to control the exchange rate fluctuation since the price change might indirectly affect the local farmers' revenue. A targeted subsidy policy could also remedy the local producers in special agricultural categories to help them find a more efficient way to export. While from the outcome of the experiment, Thailand could design specific export strategies to balance its future agricultural development by segmenting the advantages and disadvantages of agricultural trade.

CONCLUSION

The paper assessed the complementarity and competitiveness of agricultural exports between Thailand and China. It is found that both countries have advantages in exporting different agricultural products. Thailand has better competitive advantages than China overall, and they both have complementarity in particular categories of agricultural products. The two countries have potential advantages in cooperation in agricultural trade.

The higher trade intensity index indicated that the two countries have more significant advantages in trading from better factors such as comparative advantage structures, better free trade agreements, and better geographical locations. It also found differences in the advantages of inter- and intra-industry trade for different agricultural products. The advantages could also be enhanced by implementing trade policies by adjusting domestic industrial policies. Inter- or intra-industry trade can also be converted mutually, regardless of the natural factors. However, this study has its limitations in sampling; three years' data analysis could only be used on a short-run base, but the long-period data might bring unpredictable errors in this case.

AUTHOR CONTRIBUTIONS

Conceptualization: Zhe Tao.
Data curation: Zhe Tao.
Formal analysis: Zhe Tao.
Investigation: Zhe Tao.
Methodology: Zhe Tao.
Project administration: Zhe Tao.
Supervision: Zhe Tao.
Validation: Zhe Tao.
Visualization: Zhe Tao.
Writing – original draft: Zhe Tao.
Writing – review & editing: Zhe Tao.

http://dx.doi.org/10.21511/ppm.20(3).2022.34

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