

China-ASEAN Natural Rubber Industry Cooperation Research

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Abstract: Focusing on the natural rubber industry, this paper collects relevant data from 2007 to 2021 and calculates the Indicative Comparative Advantage Index (RCA) and Trade Complementarity Index (TC) to conduct a competitive analysis and complementarity analysis of China-ASEAN. The calculation results show that in the natural rubber industry, China and Singapore have relative disadvantages, and ASEAN countries led by Thailand and India Nisi have comparative advantages, so there is a certain inevitability of China-ASEAN cooperation in the natural rubber industry. Coinciding with the official entry into force of RCEP at the beginning of this year, it is believed that it will provide many opportunities for China-ASEAN to further deepen industrial cooperation.

1. Introduction

Natural rubber is an important economic resource, because of its good insulation and strong elasticity, widely used in various fields. The growth environment of natural rubber is very harsh, so there are fewer areas in the world suitable for large-scale cultivation, mainly concentrated in ASEAN countries and Brazil. China has long imported a large number of natural rubber from ASEAN countries, and the industrial cooperation between the two sides in this field has broad prospects, mainly reflected in the following aspects:

ASEAN countries have unique geographical advantages. Bordered by the Pacific Ocean to the east and the Indian Ocean to the west, it is a hub for the Maritime Silk Road and the Belt and Road, and its similar cultural background facilitates bilateral trade. In addition, most of the ASEAN countries are in tropical and subtropical areas, and the special climatic conditions have created rich rubber resources. To sum up, whether from the perspective of transportation distance with China or resource endowment, it provides a solid foundation for industrial cooperation between the two sides^[1].

The signing of RCEP provides opportunities for China-Asean industrial cooperation. Initiated by ASEAN in 2012, the Regional Comprehensive Economic Partnership (RCEP) took eight years to enter into force on January 1, 2022. This agreement includes ten ASEAN countries and China, Japan, South Korea, Australia, New Zealand, a total of 15 Asia-Pacific countries, will cover nearly half of the world's population and nearly one-third of the trade volume, both in terms of population and economic and trade scale are far more than the European Union and North American Free Trade area^[2].

The state has implemented the plan of "carbon neutrality and carbon peak". As the country

promotes low-carbon life, a new round of technological and industrial revolution is accelerating. China's labor-intensive industries and some low-value-added industries are gradually transferring to the ASEAN region, giving full play to the advantages of labor and resources, and realizing the division of labor and cooperation between regions^[3].

In general, the importance of natural rubber to China is self-evident, and the current international situation is very favorable for China-Asean cooperation on the natural rubber industry. Therefore, it is of practical significance to study the cooperation of natural rubber industry^[4].

2. Literature review

With the development of China's automotive industry, the demand for rubber is increasing year by year, and China is becoming the world's largest consumer and importer of natural rubber. From the existing literature, China can be used as the main body of rubber international trade research^[5].

China is the main research body. China relies heavily on the supply of ASEAN in the natural rubber industry (Huang Xianming, 2006), resulting in China's weak competitiveness in the natural rubber industry, and then there are certain difficulties in the formulation of tariffs on rubber and its products (Liu Dong, 2006). However, there is still a huge space for cooperation and development between China and major natural rubber countries (Dong Zhengyi and Wang Yubin, 2018).

China and a single rubber trading country are the main research subjects^[6]. Thailand's natural rubber exports are stronger than Malaysia's, but weaker than Indonesia's, mainly because Malaysia's labor costs are higher than Thailand's and then higher than Indonesia's (Sarawutinpan, 2008). Most of Vietnam's exports to China are low-value-added raw rubber cubes, which compete for export with low prices, but for long-term sustainable development, it needs to improve its processing technology to expand the export market, and should not rely too much on China (Quach Thi Bao Chau, 2011). In recent years, due to the zero-tariff preferential policy of the China-Asean Free Trade Area, Malaysia has reduced natural rubber cultivation and carried out industrial adjustment, becoming one of the top rubber consuming countries (Guangxi Oak, 2016). Indonesia is mainly dominated by private small rubber gardens, although the planting area ranks first in the world, but the level of planting technology is not high. In the early stage, it was mostly exported to the United States, Japan, Singapore and other places^[7]. Since 2003, the amount of rubber exported to China has steadily increased, and rubber exports are an important part of its national fiscal revenue (Yang Lianzhen, 2022).

China - ASEAN region is the main body of research. In fact, China - ASEAN in the natural rubber industry for a long time in the state of competition is greater than cooperation, the two sides did not benefit from it, but led to the price of natural rubber vicious reduction, complete the developed countries^[8]. From the perspective of supply, trade structure, and production capacity, China should establish a monitoring and warning mechanism for natural rubber imports and reserve regulation, and gradually diversify import sources to avoid unexpected supply situations in ASEAN (Li Ya, Miao Jingyu, 2016). From the perspective of economic effect, rubber trade has a positive growth effect on the economy of both sides, but the effect is more significant for ASEAN countries. (Hu Guoliang, 2017) Used GTAP to analyze the impact of Sino-US trade friction on the exports of major ASEAN natural rubber producing countries, and found that the export value of major ASEAN natural rubber producing countries declined significantly, and caused an average export loss of about 650 million US dollars per year (Zhou Yudong and Zhou Run, 2019). However, with the signing of RCEP, the path of cross-border industrial cooperation between China and ASEAN faces both opportunities and challenges (Tang Hongxiang and Xie Tingyu, 2022).

In summary, most of the literature takes China and the main producing countries of natural rubber as the research perspective, and analyzes the status quo, advantages and disadvantages, and

existing problems. Although there are a small number of empirical models, most of the literature data are out of date and cover only a few ASEAN countries. Therefore, this paper selects nine ASEAN countries (except Brunei, with incomplete data) to calculate the revealed comparative advantage index (RCA) and complementarity index (TC), so as to meet the actual demand for deepening bilateral trade under the background of RCEP^[9].

3. Overview of natural rubber

Overview of natural rubber industry. Rubber, as one of the four major industrial raw materials, is an important resource-constrained strategic material, which is divided into natural and synthetic rubber. Natural rubber is mainly obtained from rubber trees, and synthetic rubber is mainly obtained by smelting oil. In this paper, natural rubber is classified according to the fourth revision of the international standard STIC. It is divided into 2311 (Natural Rubber latex, whether or not per vulcanized) and 2312(Natural Rubber, other than latex), so the "natural rubber" mentioned below is the general name of the two types of rubber. According to the United Nations Food and Agriculture Organization (FAO) data show that rubber producers are mainly distributed in Asia, accounting for 88%; It is followed by Africa, accounting for 10%; The Americas accounted for 2.57%, followed by Oceania accounting for 0.07%. Europe is generally not planting rubber because it cannot provide rubber trees suitable for growing in a hot and rainy tropical environment^[10].

Overview of natural rubber industry in ASEAN. Asia is the world's largest natural rubber production base, most of which are distributed in ASEAN countries, mostly concentrated in Indonesia, Thailand, Malaysia. Singapore has always been a natural rubber importer, and it does not grow it locally, because it does not produce it, it has the pricing power of international rubber futures. However, the gap in the output of the main rubber producing countries has gradually widened, making Indo-China Peninsula gradually become the dominant region, indicating that there is a trend of production area transfer in geographical space (Xiao Chiwei, 2016).According to the data of FAO, the distribution proportion of major countries planting natural rubber in Asia in 2010 and 2020 was calculated, and it was found that the proportion of Indonesia dropped from 40.83% to 32.68%, and that of Malaysia from 12.09% to 9.86%. However, Thailand increased from 22.87% to 29%, and Vietnam, Myanmar and the Philippines all had small increases, indicating that the geographical distribution of main production countries was shifting from Indonesia and Malaysia to Thailand and other ASEAN countries^[11].

Overview of natural rubber industry in China. China's natural rubber planting area is mainly distributed in Guangdong, Guangxi, Hainan, Yunnan, Fujian five provinces^[12]. The competitiveness of China's natural rubber industry is very weak, mainly reflected in inappropriate natural conditions, a small number of rubber farmers and backward technology (He Zhongwei and Han Xiao, 2013). China's natural rubber harvest showed an increasing trend year by year; However, with the rapid development of China's automobile industry, natural rubber imports are also increasing year by year, so the formation of a situation of short supply, and the gap between supply and demand is getting larger and larger, perennial at the level of 1.5 to 1.9 million tons. This is shown in Table 1.

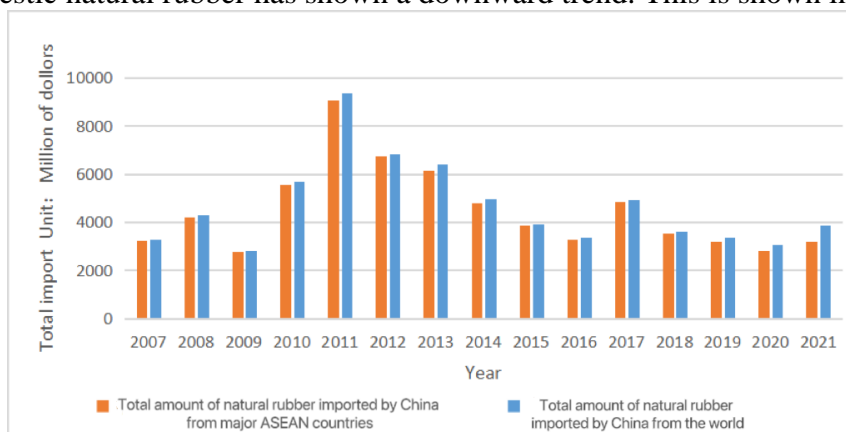
Table 1: Supply and demand gap of natural rubber in China from 2007 to 2020 (10,000 tons)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Supply and Demand Gap	-106	-113	-109	-117	-135	-138	-161	-177	-192	-156	-198	-177	-162	-161

Data source: FAO database, UNCTAD database, calculated

4. Overview of China-Asean natural rubber trade

China's domestic natural rubber industry is facing the dilemma of short supply and has become the world's largest importer of natural rubber. ASEAN countries are the main source countries of China's imports of natural rubber, accounting for about 90-98% of the proportion (see Figure 1), which shows that China has a strong dependence on ASEAN's natural rubber. Since 2011, the turnover of domestic natural rubber has shown a downward trend. This is shown in Figure 1.



Data source: UNComtrade database

Figure 1: China's total imports of natural rubber from major ASEAN countries/the world from 2007 to 2021

Table 2 shows the total amount of natural rubber imported by China from ASEAN countries from 2007 to 2021. Due to the low volume of natural rubber exports and the lack of data for countries such as Brunei and the Philippines, the final list includes six major ASEAN countries - Thailand, Indonesia, Laos, Malaysia, Vietnam and Myanmar.

Table 2: China's total imports of natural rubber from the six ASEAN countries from 2007 to 2021 (unit: 10,000tons)

Country \ Year	Thailand	Indonesia	Malaysia	Vietnam	Laos	Myanmar
2007	75.16	31.33	45.03	9.10	0.63	1.68
2008	83.59	34.29	36.42	6.29	0.73	3.50
2009	88.67	42.05	29.12	6.53	0.67	1.47
2010	90.14	41.29	35.84	11.72	0.71	2.39
2011	108.88	43.74	36.73	10.84	0.77	2.49
2012	120.75	40.43	29.86	18.76	1.59	3.45
2013	143.75	41.69	31.96	18.14	2.98	—
2014	162.68	36.20	31.02	18.73	3.83	—
2015	180.63	27.96	34.47	17.82	4.04	4.11
2016	145.48	27.07	28.08	16.14	6.75	9.66
2017	168.49	45.04	30.16	11.24	10.07	10.86
2018	152.21	26.80	31.73	20.24	10.87	12.17
2019	123.49	22.48	32.92	25.56	16.83	12.26
2020	95.06	31.42	28.27	21.33	17.98	14.55
2021	121.93	—	32.57	17.70	13.14	12.59

Source: UNComtrade database, missing data for Indonesia 2021 and Myanmar 2013 and 2014

Among them, Thailand has become the first cooperative country of China's import of natural rubber, far more than the second Indonesia. From 2007 to 2021, the average annual import is about 1.24 million tons; However, since 2015, China's total imports of natural rubber to Thailand have declined significantly. Indonesia and Malaysia ranked second and third, respectively providing about 400,000 tons of natural rubber to China in the past 15 years. Although the amount of natural rubber exported by Laos, Vietnam and Myanmar is difficult to be compared with the previous

countries, the export volume of the three countries has shown an overall upward trend since 2012, and its development momentum should not be underestimated. In the context of the epidemic in 2020, the amount of rubber imported by China from ASEAN countries has been reduced to varying degrees; In 2021, the epidemic has eased, and China's rubber imports have been increased to a certain extent, indicating that the ASEAN market is still dynamic in the natural rubber industry.

5. Analysis of the competitiveness and complementarity of natural rubber industry in China and ASEAN countries

5.1 Heoretical Analysis

Theory of comparative advantage. Ricardo believed that under the assumption of perfect competition, a country should concentrate on producing products with strong comparative advantage and importing products with weak comparative advantage, which confirmed the necessity of international division of labor. Although the overall economic level of ASEAN countries is still a certain gap compared with China, it does not mean that there is no room for cooperation between them. Therefore, ASEAN countries can rely on the comparative advantage of planting natural rubber to promote the development of bilateral trade between countries.

Factor endowment theory. Heckscher and Ohlin argue that a country should export products that use its abundant resources intensively and import products that use its scarce factors intensively. Asean countries have rich natural rubber resources, while China happens to be scarce in the field of natural rubber. Therefore, China should import natural rubber, while ASEAN should export natural rubber.

Competitive advantage theory. Porter pointed out that a country's trade advantage does not depend on natural resources and labor in the traditional sense, but depends on the country's ability to innovate and modernize industries. From the perspective of the current natural rubber industry, due to the unique rubber planting environment in ASEAN countries, which has created a low-cost advantage, it is currently exporting with a cost-leading strategy.

Trade complementarity theory. All countries in the world have their own kinds of trade that they are good at and not good at. If a country's concentrated export product happens to be another country's concentrated import product, the two countries have complementarity in the trade of this product, and can strengthen the trade between the two sides by eliminating trade barriers to achieve the purpose of learning from each other. Asean countries are good at growing natural rubber because of their unique geographical environment, but China is not good at this field, so China and ASEAN countries can trade.

5.2 Selecting Indicators

5.2.1 RCA

The Revealed Comparative Advantage Index (RCA) proposed by Balasa is an index method used to measure the comparative advantage of countries. The formula is expressed as:

$$RCA_{ij} = \frac{(X_{ij}/X_{it})}{(X_{wj}/X_{wt})}$$

Where i represents the country, j represents the product category, and w represents the world. Therefore, RCA_{ij} represents the index of explicit comparative advantage of the JTH product in country i. X_{ij} represents the export value of product j of country i; X_{it} represents country i's total exports of all products. In the same way, X_{wj} represents the exports of the world's JTH product, and

Xwt represents the total exports of all products in the world.

If $RCA_{ij} > 2.5$, it means that the country has a high international competitiveness in the j product and has a comparative advantage. The higher the value, the stronger the comparative advantage. If $1.25 \leq RCA_{ij} \leq 2.5$, it means that the J-type product of the country has strong international competitiveness. If $0.8 \leq RCA_{ij} < 1.25$, it means that the JTH product of the country is in the middle position in international competition, with no obvious advantages or disadvantages. If $RCA_{ij} < 0.8$, it means that the country's JTH product is at a disadvantage to compete in the international market.

5.2.2 TC

The Trade Complementarity Index (TC) is the product of the Index of Demonstrated comparative Advantage (RCA_{ij}) and the Index of demonstrated comparative Disadvantage (RCA_{mj}). When the calculated $TC > 1$, it indicates that there is a complementary relationship between the two countries in the trade in this industry. If $TC < 1$, it indicates that there is no trade complementarity between the two countries in this industry. When calculating the TC index, there are two directions: "China imports, ASEAN exports" and "China exports, ASEAN imports". In combination with the actual situation, only the result of "China imports, ASEAN exports" is calculated below. The formula is expressed as:

$$TC_{im} = RCA_{ij} \times RCA_{mj}$$

The Index of Revealed Comparative Disadvantage (RCA_{mj}) is calculated using the same concept as the Index of Revealed Comparative Advantage (RCA_{ij}), where m represents the country, j represents the product category, and w represents the world. Therefore, RCA_{mj} is the index of apparent comparative disadvantage, where it is the import amount of the j product of country m, the total import amount of all commodities of country m, the import amount of the j product in the world, and the total import amount of all products in the world. The formula is expressed as:

$$RCA_{mj} = \frac{M_{mj}/M_{mt}}{M_{wj}/M_{wt}}$$

5.3 Calculation Result

5.3.1 Competitiveness analysis

Table 3: China and ASEAN Natural Rubber RCA Index (Advantages) from October to 2020

Country \ Year	Vietnam	Singapore	Philippines	Cambodia	Myanmar
2010	18.2196	0.7050	0.6798	9.3272	9.4782
2011	12.4571	0.4941	0.6682	11.4945	15.1310
2012	11.3133	0.3862	0.6140	14.9158	10.6940
2013	13.3442	0.3209	0.9727	19.0013	15.5000
2014	12.6698	0.3870	1.4427	23.6786	11.9272
2015	8.3216	0.3866	1.2231	23.9314	12.9167
2016	6.8475	0.3632	0.8869	22.1641	16.8598
2017	4.8167	0.3243	1.6009	24.4712	16.8577
2018	5.8634	0.2620	1.6870	25.7308	16.4940
2019	5.8632	0.3925	1.7228	22.8840	15.5513
2020	5.0153	0.4313	2.6652	27.7444	23.3103
Mean	9.8611	0.4093	1.2876	17.4827	16.0977

Year \ Country	China	Thailand	Malaysia	Indonesia	Laos
2010	0.0320	25.4885	9.0819	29.2777	0.2027
2011	0.0098	23.2551	7.7210	23.3435	0.9935
2012	0.0116	19.7783	5.8102	21.4757	7.2652
2013	0.0117	26.6853	7.2279	28.0246	11.3143
2014	0.0175	30.1757	6.8095	30.7186	21.5597
2015	0.0050	29.8565	6.5384	31.1405	20.3452
2016	0.0139	28.2932	6.3117	32.0051	41.1303
2017	0.0148	27.9739	5.5562	33.2193	33.5083
2018	0.0120	27.3052	5.6358	32.8397	50.9357
2019	0.0134	27.3703	5.8542	32.4607	61.7661
2020	0.0073	27.3687	5.9998	33.1153	52.0322
Mean	0.0138	26.5523	6.6564	29.5157	25.7767

Data source: Calculated based on relevant data of UNComtrade, WTO and UNCTAD

In general, in the natural rubber industry, China and Singapore do not have a demonstrated comparative advantage, and the rest of the ASEAN countries have a demonstrated comparative advantage, but there are high and low points.

This is shown in Table 3. The RCA index of China and Singapore is much lower than 0.8, indicating that they are at a disadvantage in the international market competition, which is in line with the reality that the two countries have been in a large number of natural rubber imports. As an old rubber country, Thailand and Indonesia have an average RCA index of 25-30, which is the most competitive exporter among ASEAN countries. It should not be ignored that the average RCA index of Laos is also as high as 25, especially since 2016, the competitive advantage has gradually reflected. The average RCA index of Malaysia and Vietnam is 6.6564 and 9.8611 respectively, both at the level of more than 2.5, which is also very competitive. The Philippine RCA index averaged 1.2876, barely above 1.25, and is in a slightly stronger position. Although the total amount of natural rubber imported from Vietnam, Myanmar and Cambodia is much lower than that of several other ASEAN countries, the calculated RCA index is also much higher than 2.5, which has a clear competitive advantage.

5.3.2 Analysis of complementarity

Table 4: China and ASEAN Natural Rubber TC Index (Import from China, export from ASEAN), 2010-2020

Year \ Country	Thailand	Malaysia	Indonesia	Laos
2010	66.4100	23.6629	76.2829	0.5281
2011	58.4378	19.4022	58.6599	2.4965
2012	49.8256	14.6370	54.1017	18.3024
2013	66.8516	18.1073	70.2067	28.3445
2014	79.2689	17.8879	80.6952	56.6356
2015	81.0431	17.7480	84.5284	55.2254
2016	76.0806	16.9723	86.0619	110.5997
2017	75.2190	14.9401	89.3235	90.1006
2018	62.0866	12.8147	74.6708	115.8175
2019	60.8893	13.0235	72.2137	137.4080
2020	58.5463	12.8345	70.8391	111.3054
Mean	66.7872	16.5482	74.3258	66.0694

Year \ Country	Vietnam	Singapore	Philippines	Cambodia	Myanmar
2010	47.4710	1.8368	1.7712	24.3019	24.6953
2011	31.3035	1.2416	1.6791	28.8846	38.0227
2012	28.5006	0.9729	1.5469	37.5759	26.9403
2013	33.4296	0.8039	2.4368	47.6018	38.8305
2014	33.2825	1.0165	3.7899	62.2017	31.3317
2015	22.5884	1.0495	3.3202	64.9600	35.0614
2016	18.4130	0.9767	2.3849	59.5993	45.3362
2017	12.9517	0.8721	4.3047	65.8006	45.3286
2018	13.3321	0.5958	3.8358	58.5067	37.5040
2019	13.0436	0.8731	3.8326	50.9089	34.5962
2020	10.7287	0.9226	5.7013	59.3499	49.8645
Mean	24.0950	1.0147	3.1458	50.8810	37.0465

Data source: Calculated based on relevant data of UNComtrade, WTO and UNCTAD

This is shown in Table 4. In general, the Singapore TC index is at the level of 1, and the remaining ASEAN countries' TC index is greater than 1. Among the other countries, Indonesia was the highest, followed by Thailand, Laos and Cambodia, Myanmar, Vietnam and Malaysia were the lowest, and the Philippines the lowest. It shows that the trade complementarity between these countries and China is very strong in the natural rubber industry.

6. Conclusion

Our country should reduce its dependence on the main supplier of natural rubber and seek other alternative suppliers. The amount of natural rubber harvested in Vietnam, Cambodia and Myanmar is increasing year by year, so China can turn to these countries to import rubber, in order to weaken the voice of the main producing countries and achieve the purpose of reducing economic risks.

Relevant departments should establish a rubber industry chain and deeply bind cooperation. A large number of natural rubber imported by China occupies a large proportion in the automobile manufacturing, especially the low energy consumption and low price of new energy vehicles are favored by ASEAN countries. Therefore, on the premise of ensuring the supply of natural rubber, China and ASEAN can establish an industrial chain of "China imports natural rubber from ASEAN - for the production of new energy vehicle tires - new energy vehicles are exported to ASEAN", and the whole process is traded at preferential prices. The two sides draw on each other's strengths and make up for their weaknesses, while deeply tying cooperation with the main producers of natural rubber, expanding the market share of China's new energy vehicles in ASEAN countries.

Relevant companies use the platform to carry out cooperation between the natural rubber industry. China and ASEAN have established many platforms for economic cooperation, such as the China-Malaysia Kuantan Free Trade Area and the Lancang-Mekong subregion. These regional platforms bring together enormous human, material and financial resources. Therefore, enterprises can go abroad to invest in major natural rubber producing areas and promote inter-regional industrial cooperation to enter a new stage.

The company should also grasp the preferential policies of RCEP. The formal implementation of RCEP actually provides institutional guarantees for internal member countries to conduct international trade, including tariffs, industrial subsidies, rules of origin, etc. These preferential policies will promote the flow of production factors in various countries and further deepen industrial cooperation between countries. Since China's natural rubber has long been dependent on imports, in the face of the opportunity of the formal entry into force of RCEP, we can take

advantage of this opportunity to appropriately reduce import tariffs to encourage the export volume of natural rubber in ASEAN countries to increase.

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