

# Chinese Rosin Intra-Industry Trade and Trade Type Analysis

**Jin Wang**

Chinese forestry products trade research center, LongPan Road XinZhuang NO.159, Nanjing Forestry University, Nanjing, JiangSu Province, 210037

**E-mail:** *hollywood@njfu.edu.cn*

## Abstract

Rosin is China's largest export of chemical products, domestic and international research literature on rosin intra-industry trade have a certain amount, but the literature research is more focus on technology, involves the economic literature of intra-industry trade are few and far between. In this paper, combining normative analysis and empirical analysis, the principle of combining qualitative analysis with quantitative analysis, by means of revealing Chinese rosin industry trade import and export trade development and the change trend since 2001 to 2015, using all kinds of intra-industry trade index, and analysis the Chinese rosin industry trade type for hybrid intra-industry trade, and give priority to the vertical intra-industry trade, this is due to China's main exports to developed countries, labor-intensive rosin products and high value-added rosin products imported from developed countries, the Chinese rosin products, in terms of quality and larger gap with the developed countries. Further, to explore the countermeasures to promote the development of China import and export trade of rosin, realize the sustainable development of Chinese foreign trade rosin, first is to seize the resources endowment of sustainable competitive advantage development of intra-industry trade; The second is to create the competitive advantage of resources endowment, increase investment in scientific research, accelerate the development of intra-industry trade, rosin inter-industry trade and intra-industry trade form the benign complementary, promote the development of intra-industry trade with high quality; Third is to the government's policy support.

**Keywords:** Chinese rosin, Intra-industry trade, Trade type.

## 1. Symbol definition and description

$y_{11}$	2001 – 2015 Chinese rosin export quantity
$y_{12}$	2001 – 2015 Chinese rosin import quantity
$y_{13}$	2001 – 2015 Chinese rosin export amount
$y_{14}$	2001 – 2015 Chinese rosin import amount
$y_{15}$	2001 – 2015 Chinese rosin export price
$y_{16}$	2001 – 2015 Chinese rosin import price
$x_{11}$	380610 export amount
$x_{12}$	380610 import amount
$x_{21}$	380620 export amount
$x_{22}$	380620 import amount
$x_{31}$	380630 export amount
$x_{32}$	380630 import amount
$x_{41}$	380690 export amount

$x_{42}$	380690 import amount
$x_{51}$	3806 export amount
$x_{52}$	3806的 import amount
$GLI_i$	The i class of rosin products intra-industry trade index
$X_i$	The i class of rosin products export amount
$M_i$	The i class of rosin products import amount
$BI_i$	The marginal intra-industry trade index of a certain time span the i class of rosin products
$\Delta X_i$	Adjacent two during the i class of rosin products export trade volume variation
$\Delta M_i$	Adjacent two periods of rosin products import trade of the i class variation
$HMIIT$	Horizontal marginal intra-industry trade index
$VMIIT$	Vertical marginal intra-industry trade index

## 2. First, the research status both at home and abroad

At present, the research on intra-industry trade more concentrated in developed countries, developing countries have relatively few studies, and more focused on capital and technology intensive industries such as automobile, manufacturing, and for rosin intra-industry trade, also there are few systems research at home and abroad. Rosin is a kind of natural resin, raw materials from renewable resources the rosin, pine forest of pine trees.

### 2.1 Foreign related research

On the foreign trade of forest products abroad study is few, the study of Chinese rosin is less. Literature study abroad more focused on rosin, turpentine oil and natural rubber and other chemical products research, including rosin, turpentine oil research mainly focuses on the trade and the application field, research methods are basically is just simple data analysis, without too much quantitative evaluation research. Because rosin are scarce resources in the world, and about the research for Chinese rosin industry development and industrial upgrading has a reference value. But a lack of research on its system, foreign literature on Chinese rosin intra-industry trade is the lack of in-depth analysis.

Some scholars of rosin forest products such as the characteristics, application field and international trade related problems are analyzed. J.J.W.C oppen and G. A.H one of rosin, turpentine oil, types, characteristics, sources and application fields were studied, and analyzed the century s world trade situation of gum resin, the production and export of Chinese rosin and turpentine oil and in the future are analyzed and prospect, think in the next few years the world demand for rosin will still be the main imports from China. Foran C.D and Covington C.W for years the countries of the world grease production of turpentine oil and crude sulphate turpentine are compared, and the empirical analysis found that global turpentine oil production as a whole is on the rise, high profits and appropriate climate in turpentine oil production in China, including lipid turpentine oil production is concentrated in the cheap labor, the paper industry is not developed in China, Indonesia, Mexico and India and other developing countries, crude sulfate turpentine oil production is mainly focused on the paper industry developed, expensive labor in developed countries such as North America and northern Europe.

## 2.2 Domestic related research

Although forest products have been listed in China's forestry revitalization of ten big one of pillar industries, the Chinese rosin, activated carbon, turpentine and furfural and other forest products exports have also achieved great development, but the relevant domestic research mainly focused on technology, rosin for rosin intra-industry trade studies. In the domestic existing or a small amount of forest products industry in aspects of literature, the classification of forest products in the international trade and competition strategy research is relatively more, but on the quantitative evaluation of forest products lack of related research. Domestic has always insisted on rosin products and intra-industry trade related research work of scholars rarely, there are many literature data old problem, so the study of these has failed to Chinese rosin industry production, trade, systematically analyzes some existing problems and future development.

### (1) The relevant chemical products, industry and enterprise competition strategy research

Zhan-qian song together with the present situation of China's chemical industry development, puts forward the innovation and development of China's chemical industry processing products strategy, promote the development of large-scale chemical enterprise development strategy, strategy of wood pulp and paper and wood energy strategy development. Guang-ping xu From the enterprise micro level in ningxia activated carbon factory of enterprise competition strategy are studied, the related chemical forest product competitiveness in domestic study is relatively rare, he with the help of the porter/young model, SWOT, value chain analysis theory of strategic management methods, such as competitive strategy has carried on the system analysis of the plant, and found that China's economic outlook and national support for environmental protection industry and industry structure adjustment opportunity factors promotes the development of 217 factory, but the factory is faced with multinational companies to enter China, activated carbon raw material prices and transportation costs rise, the lower level of product differentiation and administration of state-owned enterprises to protect challenge factors, and put forward the enterprise competitive power promotion get government support, strategic alliance, domestic market strategic measures such as cost leadership, differentiation and foreign markets have a certain practical significance, also for the Chinese chemical enterprise international competitiveness research provides a good case. Li Yi Chinese rosin international sales market distribution was analyzed and the development potential of the market, will China rosin main sales market is divided into stars, Taurus, and dogs, are put forward for each type of market development strategy, maintain strategy, harvesting strategy, give up strategy, strategic countermeasures.

### (2) Studies of forest product trade condition determination

Huang Li, square moat and Lv Jie use net trade conditions and income terms of trade index from the aspects of overall and classification for years in China's major forest products trade conditions are analyzed, and research shows that China's main forest products trade conditions improved in most times, but a single product trade conditions of each are not identical. Huang Li and Lv Jie analysis major Chinese forest products import and export trade situation and characteristics, using intra-industry trade index of Chinese forest products intra-industry trade level measurement and analysis, found in China's major forest products trade intra-industry trade and inter-industry trade in two ways, but trade between industry dominance. Lin-lin liu, Song Weiming with developing countries, the conceptual model and porter diamond model analysis of the efficiency of Chinese rosin industry trade relationship with the technology development, the study found that in Chinese rosin industry factors to investment phase transition, has been with the form and development of the industry competitiveness of resource

advantages and market demand conditions, but the lack of economies of scale effect, and put forward the deep processing strategy, government support strategy and to grasp the strategic opportunity of China - asean free trade area.

(3) Research on forest products trade barriers and industry safety

Xiao-li Chen, Wang Hezhen Chen Rongyi effect on the content of the REACH regulation, such as, response procedures and principles are analyzed, such as shu-zhu jiang Of Chinese wooden furniture export trade barriers and strategic countermeasures are analyzed, but the impact on China's forest industry and countermeasures of the REACH regulation lack of research. Some scholars also brown put oil and natural rubber industry security problems were studied. Du inferior smooth, Wang Feng, you-peng ke, etc About the present situation of China's natural rubber industry and trade, sustainable development strategy and establishment of early warning forecast system is studied. Zhang Rongfang, Zhang Xicai, ham, qian cheng international trade present situation, for the scholars to brown put oil prices, supply and demand and development strategy of China's main palm oil industry such as the macroscopic analysis and research. Hai-ping xu, guohua, from the perspective of natural rubber production, circulation and consumption safety index system is established, and the empirical determination in the security situation in China's natural rubber.

### **3. Second, Chinese rosin industry trade development present situation, characteristics and trends**

#### **3.1 Chinese rosin production**

World rosin production has been stable in recent years, annual production in ten thousand tons. China's production accounted for more than 60% of the global output of rosin and rosin became the first country rosin production, but most are in raw products, the low added value. According to Chinese customs statistical yearbook, according to data from 2001 year to 2015 year for 15 years, the rapid growth of China's rosin production and leveled off. Among them, 2006 was the fastest growing years, the growth rate of 39.46%; With annual growth rate is negative, negative were greater than that shows these two years more Chinese rosin production decline in 2008; Rebound immediately after 2010 years of rosin production, the annual production of rosin has a surge in growth of 20.41%.

#### **3.2 Rosin in China import and export features and trends**

Rosin products trade mainly for export and import is relatively small. Rosin products show the large trade surplus. China rosin export market diversification development trend.

In the international trade market, the rosin is an important trade good. Mainly rosin state: Japan, Australia, Germany, the Netherlands, such as Britain, France, Italy and Spain. Mainly rosin export state: China, USA, Indonesia, Brazil, Europe needs from China imported ten thousand tons a year. The US is the exporter and importer, and Portugal was a major exporter of rosin, due to the decline in output in recent years, also began to import rosin. China has been the world's leading exporter of rosin, exports are always occupies the world first.

From 2001-2015, rosin in China annual exports reached 0.47 billion\$, and the average annual imports is only 0.028 billion\$. China trade export amount in China in rosin products exports reached its peak in 2011, exports 0.9billion\$than 2001 increased by 4.3times. Rosin in China export prices are steadily rising, in 2011, rosin export prices for the dollar, even than the dollar increased by times. In this year, the export of Chinese rosin average price of 2806.22\$/t. Compared with rosin trade export amount, to the overall rise in rosin trade import amount, this fifteen years rise obviously(table1). Rosin imports since a downward

trend, 2012 to 2015 obvious rise, show that China's import demand for rosin products abroad also began to increase year by year.

Table1 the amount of China's import and export quantity rosin of year 2001 – 2015

year	Export quantity	Import quantity	Export amount	Import amount	Export price	Import price
2001	36.17	0.49	1.87	0.07	517	1428.57
2002	40.57	0.64	2	0.1	492.98	1562.5
2003	35.97	0.82	1.88	0.12	522.66	1463.41
2004	42.22	1.09	2.31	0.18	547.13	1651.38
2005	43.46	1.13	3.46	0.2	796.13	1769.91
2006	48.51	1.06	5.25	0.22	1082.25	2075.47
2007	50.33	0.98	5.05	0.26	1003.38	2653.06
2008	44	0.72	5.22	0.27	1186.36	3750
2009	36.09	0.78	4.15	0.22	1149.9	2820.51
2010	39.59	0.74	8.24	0.25	2081.33	3378.38
2011	35.35	0.7	9.92	0.3	2806.22	4285.71
2012	28.95	1.46	5.27	0.39	1820.38	2671.23
2013	24.63	3.56	5.21	0.68	2115.31	1910.11
2014	22.09	1.86	5.51	0.55	2494.34	2956.99
2015	21.67	2.51	4.57	0.53	2108.91	2111.55
average	36.64	1.236	4.660667	0.289333	1381.619	2432.585

Data sources: the customs of the People's Republic of China statistical yearbook (2001-2015)

The relationship must be: Export amount= Export quantity\* Export price. Similarly, imports amount, import prices and also should satisfy the relation between imports. In general, there will be a certain linear relationship between exports and export or inverse proportion. Assuming that exports of, imports, exports, imports, exports, imports, application of least square method, the hypothesis

$$y_{15} = \hat{\beta}_0 + \hat{\beta}_1 y_{11} \quad (1)$$

Fitting for  $y_{15} = 3341.6 - 53.5y_{11}$

The confidence interval for  $\hat{\beta}_0$  is [1774.6, 4908.6],  $\hat{\beta}_1$  [-95.1, -11.9]. The confidence interval is too large, obviously cannot meet the needs of linear relationship.

Also, the fitting, import price and imports also does not meet the linear relationship between, also does not meet the inverse proportion. The following failed to involve, but for the import and export quantity and price to discuss separately.

#### 4. Third, the Chinese rosin intra-industry trade level and type analysis

HS code classification standard statistical rosin products including 380610, 380620, 380630, and 380690, four subdivision rosin category. Four types of rosin products in China's imports and exports are as shown in table. In year of 2001 to year 2015, China's import and export of rosin mainly focus on 380610 rosin resin rosin acid derivatives and 380690 resin rosin. And class rosin exports from annual to maintain growth, a declining in 2011-2015, and the annual growth rate faster, in particular from

2010-2011, fell faster in year 2012; visible in 2011 was a turning point. Years and class rosin imports are steady growth on the whole, in 2013, 380610 rosin imports totaled 0.48billion\$ import proportion in this year is much higher than 380690 rosin. In year 2014-2015 gradually returned to the mean.

Table 2 China's import and export of all kinds of rosin products amount from 2001-2015 / billions of US dollars (EA: export amount, IA: import amount)

	380610		380620		380630		380690		3806	
Year	EA	IA	EA	IA	EA	IA	EA	IA	EA	IA
2001	1.4175	0.0148	0.0007	0.0099	0.0636	0.0067	0.3869	0.0389	1.87	0.07
2002	1.5953	0.0201	0.0004	0.0132	0.0941	0.0095	0.3067	0.0525	2	0.1
2003	1.398	0.0377	0.0014	0.0149	0.1053	0.0144	0.3791	0.053	1.88	0.12
2004	1.6386	0.0456	0.0073	0.0164	0.1081	0.018	0.5606	0.0951	2.31	0.18
2005	2.5453	0.051	0.0086	0.0132	0.1192	0.0228	0.7863	0.1106	3.46	0.2
2006	3.6526	0.0606	0.0098	0.0094	0.1445	0.0366	1.4382	0.1125	5.25	0.22
2007	2.7426	0.073	0.0431	0.0037	0.1658	0.032	2.0982	0.1533	5.05	0.26
2008	2.7194	0.0525	0.0307	0.0025	0.1913	0.026	2.2817	0.1859	5.22	0.27
2009	1.8202	0.0626	0.0236	0.0035	0.1623	0.0274	2.1421	0.1254	4.15	0.22
2010	4.8675	0.0895	0.055	0.0019	0.1917	0.0242	3.1294	0.1312	8.24	0.25
2011	5.9334	0.0873	0.0393	0.0027	0.5084	0.0312	3.4422	0.1811	9.92	0.3
2012	2.6808	0.1755	0.0136	0.0032	0.3179	0.0304	2.2611	0.1804	5.4	0.39
2013	2.7222	0.4762	0.0068	0.0044	0.3325	0.0346	2.1536	0.1659	5.22	0.68
2014	2.9659	0.2538	0.0032	0.0048	0.3139	0.0474	2.2292	0.2396	5.51	0.55
2015	2.1222	0.2682	0.0026	0.004	0.3322	0.042	2.1144	0.2147	4.57	0.53

(1) Products impact on industry and trade

Using the analysis of the relationship of product type and industry trade, analyze the kinds of products for industry trade.

Model assumes the following:

Assume 380610 export amount is  $x_{11}$ , import amount is  $x_{12}$ ; 380620 export amount is  $x_{21}$ , import amount is  $x_{22}$ ; 380630 export amount is  $x_{31}$ , import amount is  $x_{32}$ ; 380690 export amount is  $x_{41}$ , import amount is  $x_{42}$ ; 3806 export amount is  $x_{51}$ , import amount is  $x_{52}$ .

Application of multivariate linear regression, hypothesis:

$$x_{51} = \hat{\beta}_{01} + \hat{\beta}_{11}x_{11} + \hat{\beta}_{21}x_{21} + \hat{\beta}_{31}x_{31} + \hat{\beta}_{41}x_{41} \quad (2)$$

Get the estimate:  $\hat{\beta}_{01} = 0.0055$ ,  $\hat{\beta}_{11} = 0.9914$ ,  $\hat{\beta}_{21} = 0.8553$ ,  $\hat{\beta}_{31} = 1.0743$ ,  $\hat{\beta}_{41} = 1.0075$ . namely

$$x_{51} = 0.0055 + 0.9914x_{11} + 0.8553x_{21} + 1.0743x_{31} + 1.0075x_{41} \circ$$

The confidence interval of the corresponding estimates, respectively  $[-0.0491, 0.0602]$ ,  $[0.9589, 1.0238]$ ,  $[-2.2074, 0.39181]$ ,  $[0.6090, 1.5397]$ ,  $[0.9357, 1.0793]$ . The residual error as shown in table 3:

Table 3 multiple linear regression residuals corresponding confidence interval

Year	The corresponding residual	Residual confidence interval
2001	0.0005	[-0.0770,0.0780]
2002	0.0025	[-0.0736,0.0786]
2003	-0.0077	[-0.0836,0.0681]
2004	-0.0072	[-0.0838,0.0694]
2005	0.0035	[-0.0742,0.0812]
2006	0.0108	[-0.0464,0.0680]
2007	-0.0034	[-0.0679,0.0612]
2008	-0.0120	[-0.0895,0.0655]
2009	-0.0127	[-0.0811,0.0557]
2010	0.0031	[-0.0530,0.0593]
2011	-0.0155	[-0.0498,0.0188]
2012	0.1056	[0.0984,0.1128]
2013	-0.0170	[-0.0933,0.0593]
2014	-0.0217	[-0.0910,0.0476]
2015	-0.0288	[-0.0974,0.0399]

By the calculation, the residual variance is very small, only 0.001. The residual graph as shown in figure 1:

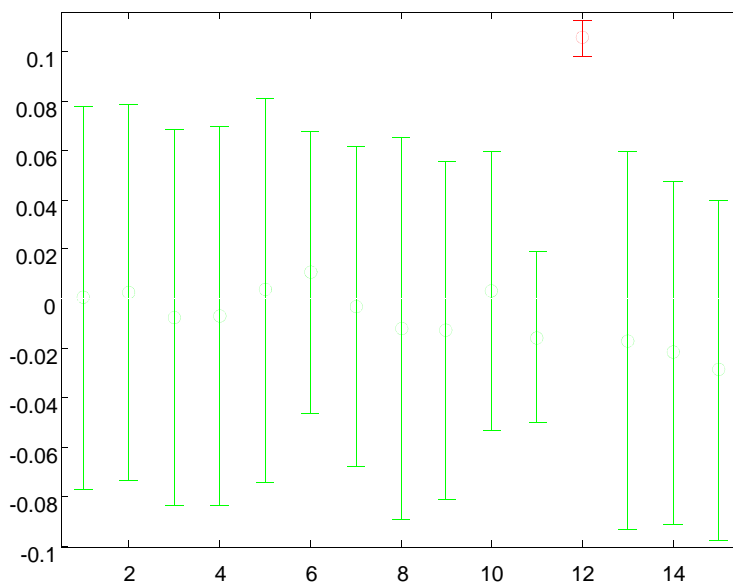


Figure 1 Export volume and product types of linear regression residuals

As can be seen from the residual figure, in addition to the 12 sets of data, the rest of the points coincide very well. And the confidence interval contains zero residual, shows that the regression model can better conform to the original data. 12 sets of data can be viewed as an exception.

Similarly, suppose

$$x_{52} = \hat{\beta}_{02} + \hat{\beta}_{12}x_{12} + \hat{\beta}_{22}x_{22} + \hat{\beta}_{32}x_{32} + \hat{\beta}_{42}x_{42} \quad (3)$$

Get

$$x_{52} = 5.5101 - 3.7854x_{12} - 288.432x_{22} + 48.9951x_{32} + 2.648x_{42}$$

The residual figure as shown:

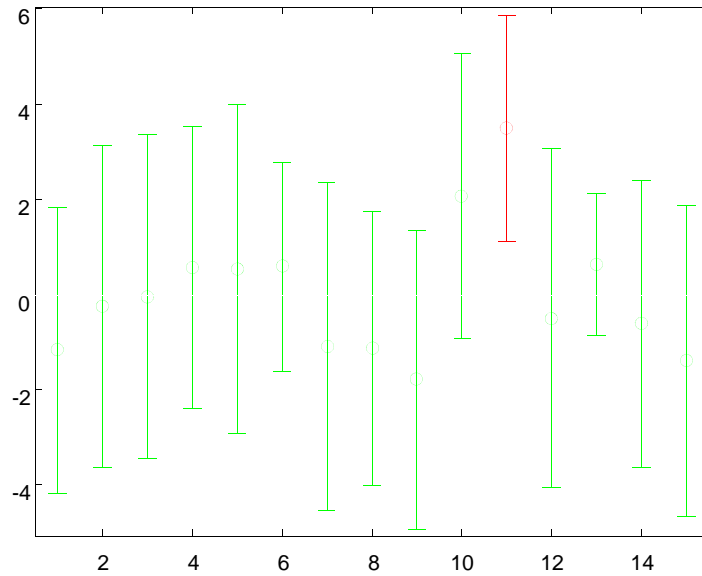


Figure 2 Imports with the product type linear regression residual error map

After calculation, the residual variance is 2.7695, Also with actual.

(2) intra-industry trade measure system

Through the calculation of China rosin intra-industry trade index of static and dynamic of the marginal index of industry inner trade, judge the current situation of Chinese rosin intra-industry trade level, so as to lay a foundation for trade type judgement.

Relatively common in the current international is to measure the degree of index of industry inner trade Grubel - Lloyd and marginal intra-industry trade index.

1. Grubel – Lloyd

$$GLI_i = 1 - \frac{|X_i - M_i|}{X_i + M_i} \tag{4}$$

2. BI

In order to reflect the time span from the perspective of dynamic intra-industry trade level of predecessors' study puts forward the marginal intra-industry trade index of this concept, are widely used in the study of Brulhart marginal intra-industry trade index. Bruthart (1994) proposed by marginal intra-industry trade index, and its expression is:

$$BI_i = 1 - \frac{|\Delta X_i - \Delta M_i|}{|\Delta X_i| + |\Delta M_i|} \tag{5}$$

By MatLab, we get GLLi index is shown in the table below:



Table 4 GLI<sub>i</sub> index of year 2001-2015

Year	380610	380620	380630	380690	3806
2001	0.021	0.132	0.191	0.183	0.072
2002	0.025	0.059	0.183	0.292	0.095
2003	0.053	0.172	0.241	0.245	0.12
2004	0.054	0.616	0.285	0.29	0.145
2005	0.039	0.789	0.321	0.247	0.109
2006	0.033	0.979	0.404	0.145	0.08
2007	0.052	0.158	0.324	0.136	0.098
2008	0.038	0.151	0.239	0.151	0.098
2009	0.066	0.258	0.289	0.111	0.101
2010	0.036	0.067	0.224	0.08	0.059
2011	0.029	0.129	0.116	0.1	0.059
2012	0.123	0.381	0.175	0.148	0.135
2013	0.298	0.786	0.189	0.143	0.231
2014	0.158	0.8	0.262	0.194	0.182
2015	0.224	0.788	0.224	0.184	0.208

The corresponding diagram as shown in figure 3:

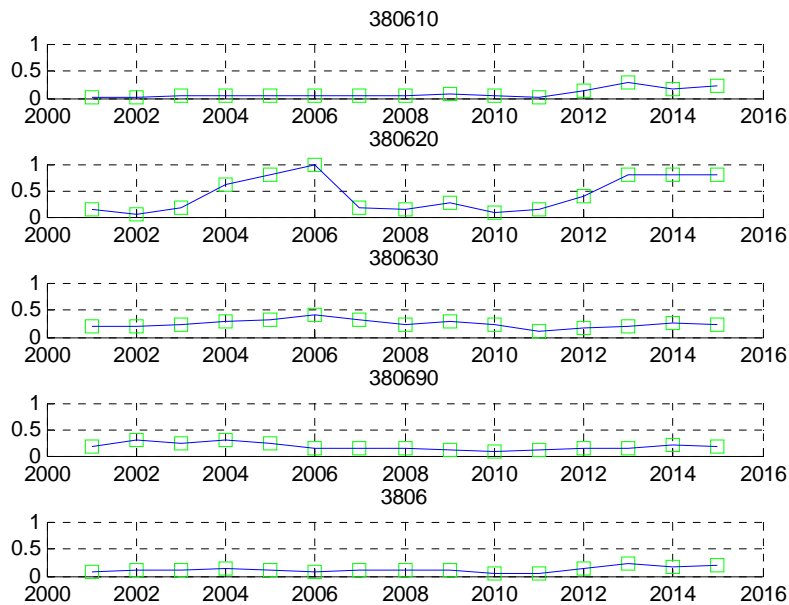


Figure 3 from 2001 to 2015 GL index of all kinds of rosin products in China

From year 2001 to 2015, through rosin industry on the Grubel - Lloyd index change trend of the industry analysis, the index range is not big, from year 2001 to 2006 steadily rising, 2006 to 2008 declined, 2009 to 2012 slightly rebounded. Weighted Grubel-Lloyd Index had no obvious rising trend, more smoothly. From the numerical analysis, unweight index maintained between 0.3 to 0.35, the weighted index is lower, at 0.2 levels. According to the above analysis, the whole of China rosin

intra-industry trade level is not high. From 2001 to 2015 in China marginal output of rosin industry trade index contrast analysis, intra-industry trade as the main reason arousing the rosin import and export trade in China, in 2001, 2003, 2008, 2013, the important reason for the increase in rosin.

And the marginal industry trade index as shown in the figure below:

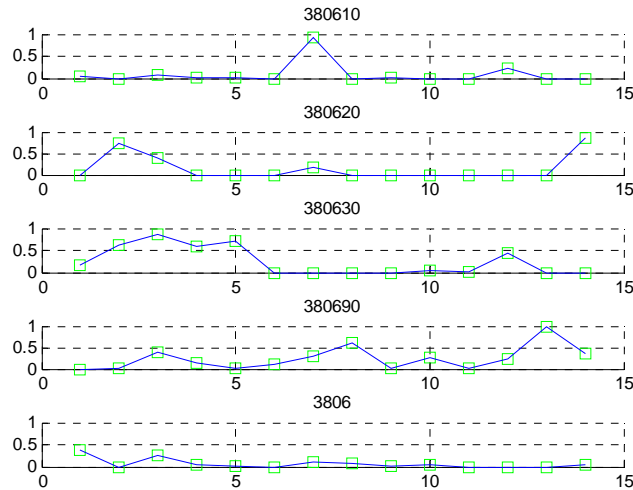


Figure 4 2001-2015, the marginal intra-industry trade's index of Chinese all kinds of rosin products

(3) Chinese rosin type of intra-industry trade

Intra-industry trade can be divided into vertical intra-industry trade and horizontal intra-industry trade. Vertical intra-industry trade is caused by the same products have different quality, mainly in the economic development level between different countries. Horizontal intra-industry trade is caused by the characteristics of similar products are different, mainly in the economic development level between the same country. Generally speaking, high degree of horizontal marginal intra-industry trade, reflected the pursuit of the degree of product differentiation between trading countries is higher, also reflects the traders production and consumption level is higher.

Chinese rosin type determination of intra-industry trade which based on the determination of the level of intra-industry trade, a further analysis of this trade is a horizontal or vertical. Major Chinese rosin products by calculation of the horizontal and vertical intra-industry trade index, and to determine rosin type of intra-industry trade in China.

According to the marginal intra-industry trade means:

$$HMIIT = \sum_{i=1}^n \frac{|\Delta X_i + \Delta M_i|}{\sum_{i=1}^n (|\Delta X_i| + |\Delta M_i|)} BI_i \quad (6)$$

Table 5 year from 2001 to 2015 HMIIT Index

Year	01~02	02~03	03~04	04~05	05~06	06~07	07~08
HMIIT	0.1608	0.0287	0.2342	0.039	0.025	0.0423	0.2652
Year	08~09	09~10	10~11	11~12	12~13	13~14	14~15
HMIIT	0.0974	0.0152	0.0611	0.0003	0.1251	0.1377	0.0459

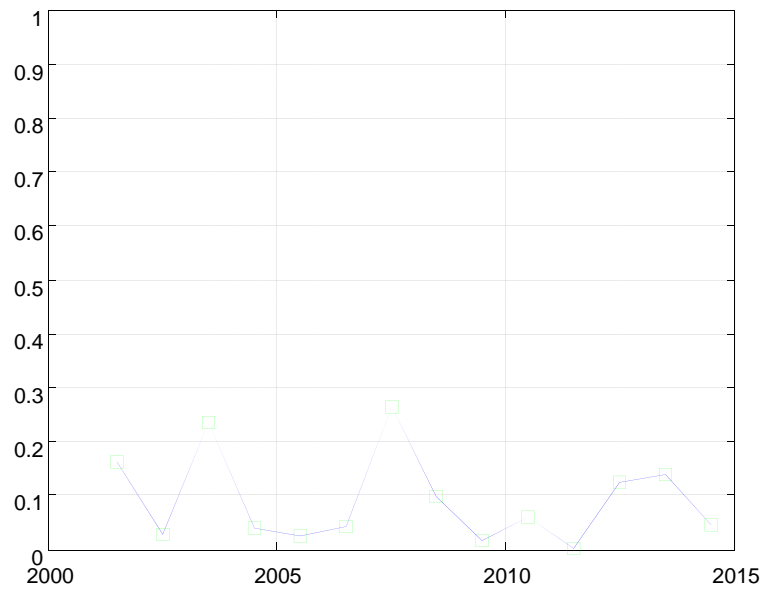


Figure 5, 2001-2015 China all kinds of rosin products horizontal intra-industry trade index

Vertical marginal intra-industry trade index is equal to the marginal output of the industry trade index minus the horizontal intra-industry trade index.

$$VMIIT = A_t - HMIIT \quad (7)$$

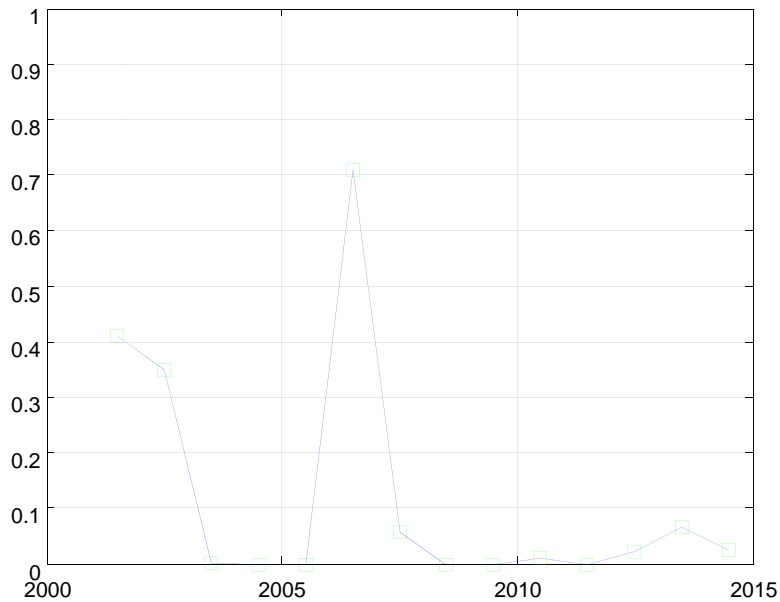


Figure 5 2001-2015 China's all kinds of rosin products vertical intra-industry trade index

China intra-industry trade belongs to mixed rosin, rosin trade already exist in the horizontal intra-industry trade, again there is a vertical intra-industry trade.

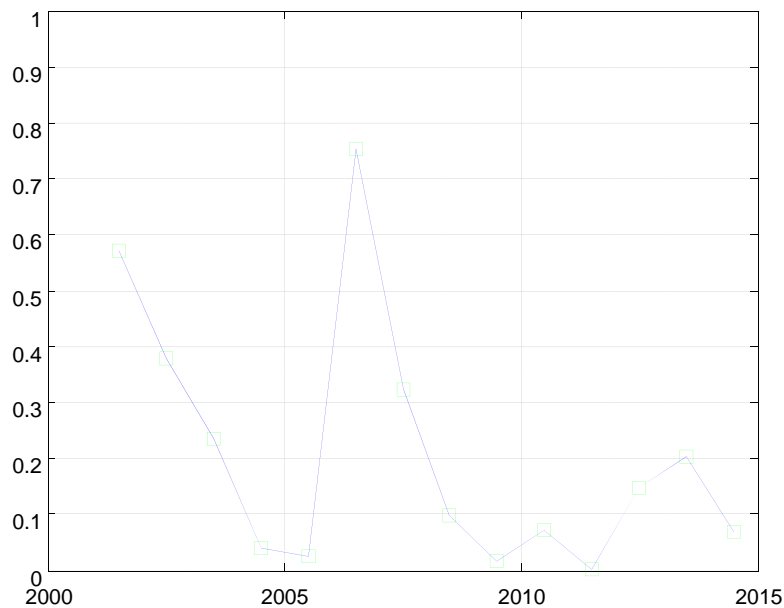


Figure 6, 2001-2015 China the marginal output of all kinds of rosin products industry trade index

#### 5. Four, the conclusion and discussion

In conclusion, Chinese rosin industry trade belongs to mixed type, rosin trade already exist in the horizontal intra-industry trade, again there is a vertical intra-industry trade, and intra-industry trade of Chinese rosin industry is given priority to with vertical intra-industry trade []. This is due to China's main exports to developed countries, labor-intensive rosin products and high value-added rosin products imported from developed countries, the Chinese rosin products deep processing rate is low, and the developed countries there is a big gap between.

First, seize the resources endowment of sustainable competitive advantage of intra-industry trade. The second is to create the competitive advantage of resources endowment. Increase investment in scientific research, accelerate the development of intra-industry trade, rosin inter-industry trade and intra-industry trade form the benign complementary, and promote the development of intra-industry trade with high quality. One is the active implementation of rosin processing and brand strategy; improve the Chinese rosin product added value.

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