

Analysis of the evolution of the internal regional structure of China's foreign trade in plastic products

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Abstract: The article selects the import value, export value, foreign trade scale, dependence, difference and trade performance index of plastic products in China. We measure the plastic products of 31 provinces (municipalities and districts) in the three economic regions of east, central and west from 2011 to 2016 by using data analysis method. These data show significant regional differences in the import and export of plastic products.

Keywords: *plastic products; foreign trade; regional structure*

1. Introduction

Although China has a certain development in plastic products at this stage, it cannot guarantee the balanced development of its domestic regions, especially the development of the three major economic regions in the east, middle and west, there are differences.

2. The spatial and temporal evolution of the scale of foreign trade in plastic products in the three major economic regions

2.1. Time dimensional evolution

As can be seen from Table 1, the total foreign trade of plastic products in the eastern region is the largest, more than \$209.2 billion, accounting for 91.2% of the total national trade, the total foreign trade of plastic products in the western region is the second largest, more than \$12.7 billion, accounting for 5.6% of the total national trade, and the total foreign trade of plastic products in the central region is more than \$7.4 billion, accounting for 3.3% of the total national trade. From the development trend, the western region is developing rapidly, the growth rate exceeds the sum of the eastern and central regions, the eastern region continues to develop with a growth rate of 9.3%, and the central region has relatively minimal development momentum, with a growth rate of 7.3%. As can be seen from the table, under the external environment of rising production costs and insufficient land supply in the eastern coastal region, the foreign trade of plastic products in the central and western regions has risen rather than fallen, reflecting the huge development potential of foreign trade in the central and western regions.

Analysis of the net export value, the export growth rate of east, central and west are significantly higher than the import growth rate, among which, the western region has the largest export growth rate of 34.5%, followed by the east at 12.3%, and the central region's export growth rate is 6.9%, indicating that the western region of China is the main area of plastic products exports, and the central region mainly relies on imports, showing that the transformation of China's plastic products trade pattern has gradually improved[1-3].

In summary, although the growth rate of the east, central and western regions is positive, maintaining a good momentum of development, in which the western region has the largest growth rate, but the base of the central and western regions is too small, the proportion is still low, the gap between regions has a tendency to narrow, but the progress is relatively slow.

Table 1: Time evolution of the scale of foreign trade in plastic products and its proportion in the three major economic regions of China

Unit: USD billion

Region	Year	Between 2010 and 2016			
	Indicators	Total trade volume (USD billion)	Average trade volume	Specific Gravity	Growth Rate
Eastern Region	Total import and export	2092.20	298.86	91.2%	9.3%
	Import amount	1318.20	188.07	95.2%	8.1%
	Export amount	773.83	110.55	85.2%	12.3%
Central Region	Total import and export	74.67	10.67	3.3%	7.3%
	Import amount	32.80	4.69	2.4%	8.4%
	Export amount	41.87	5.98	4.6%	6.9%
Western Region	Total import and export	127.45	18.21	5.6%	23.6%
	Import amount	34.27	4.90	2.5%	10.3%
	Export amount	93.18	13.31	10.3%	34.5%

Source: Calculated based on the official website of the National Bureau of Statistics of China and data from the RISE database.

2.2. Spatial dimensional evolution

The geographic structure within China's foreign trade in plastic products is undergoing positive changes. From the spatial dimension, the development of the scale of foreign trade in plastic products from 2010 to 2016 in each region is shown in Table 2. Overall, the highest scale of foreign trade in plastic products is Shanghai in the eastern region with an average trade volume of \$13.885 billion, and the lowest average trade volume is Qinghai Province in the western region with only \$0.17 billion, a difference of 817 times and its disparity. The analysis by region is as follows:

2.2.1. Eastern region

Between 2010 and 2016, the total foreign trade of plastic products in the eastern provinces is at the leading level in the country, the top ten provinces and cities in the national foreign trade scale of plastic products, the eastern region accounted for eight, the western region accounted for two, in the eastern region, Shanghai, Zhejiang, Tianjin, Jiangsu, Guangdong and other provinces occupy an absolutely dominant position, accounting for about 85% of the total foreign trade in the eastern region. The average trade volume gap in the eastern region and its disparity, the full distance of 13.838 billion U.S. dollars, of which, Jilin, Liaoning, Hainan, Hebei and other provinces are smaller average trade volume, the smallest reached 0.47 billion U.S. dollars, in the foreign trade in plastic products in a backward position;

2.2.2. Central region

Central region of the eight provinces of plastic products foreign trade development level is relatively close to the internal external development level gap is small, including the highest level of development for Anhui Province, the average trade volume of 348 million U.S. dollars, Shanxi Province is the most backward, the average trade volume of 0.25 billion U.S. dollars, the full distance of 323 million U.S. dollars, a difference of 13 times;

2.2.3. Western region

Between 2010 and 2016, the gap between foreign trade of different provinces, cities and autonomous regions in the western region is also relatively obvious. The highest average trade volume is Chongqing province with an average trade volume of 486 million U.S. dollars, and the lowest is Qinghai province with the lowest trade volume of 0.17 billion U.S. dollars, the full distance is 469

million U.S. dollars, a difference of 28 times. in contrast, Gansu, Ningxia, Tibet Guangxi and other provinces and autonomous regions, the average trade volume are smaller, not more than 100 million U.S. dollars. Five of the 11 provinces with the lowest level of trade in the country are in the western region[4-6].

Table 2: Spatial dimensional perspective of the total foreign trade distribution of plastic products by regional provinces and municipalities (2010-2016)

Unit: USD billion

Eastern Region	Average trade volume	Central Region	Average trade volume	Western Region	Average trade volume
Beijing	12.81	Shanxi	0.25	Sichuan	3.14
Tianjin	26.98	Inner Mongolia	1.78	Guizhou	1.11
Hebei	3.01	Heilongjiang	0.72	Yunnan	1.09
Liaoning	1.27	Anhui	3.48	Tibet	0.54
Shanghai	138.85	Jiangxi	1.02	Shaanxi	1.08
Jiangsu	24.66	Henan	0.94	Gansu	0.48
Zhejiang	39.62	Hubei	1.56	Ningxia	0.49
Fujian	8.78	Hunan	0.92	Qinghai	0.17
Shandong	16.54			Xinjiang	4.32
Guangdong	24.54			Chongqing	4.86
Jilin	0.47			Guangxi	0.93
Hainan	1.33				
full distance	138.38		3.23		4.69

Source: Calculated based on the official website of the National Bureau of Statistics of China and data from the RISE database.

As shown in Table 3, between 2010 and 2016, the top ten provinces and cities in terms of foreign trade volume of plastic products are mostly concentrated in the eastern region, while the provinces and cities with lower foreign trade volume are mostly concentrated in the western region, and the scale of foreign trade of plastic products in the central region is at the middle level. From the dimension of spatial geographic location, the scale of foreign trade in plastic products in the east, central and west regions shows a gradient downward as the distance between them and the eastern coastal provinces and cities becomes more and more distant, that is, the development of foreign trade in plastic products is closely related to the convenience of transportation. Anhui province, which has a high level of development of foreign trade in plastic products in the central region, and Chongqing and Sichuan provinces, which have a high level of development of foreign trade in plastic products in the western region, are not only located near the Yellow River or the Yangtze River inland route with convenient transportation, but also are one of the closest provinces to the eastern region in the region. Thus, in the spatial dimension, the foreign trade of plastic products in provinces and cities in the internal region of China shows the distribution characteristics of spreading from the eastern coastal provinces to the inland, and from near the banks of the Yellow River and Yangtze River to other areas.

Table 3: Spatial distribution of foreign trade volume ranking of plastic products in the three major economic regions in 2010-2016

Unit: pcs

Ranking	Eastern Region	Central Region	Western Region
Top 10	8	0	2
11-20 places	3	3	4
20-31 places	1	5	5

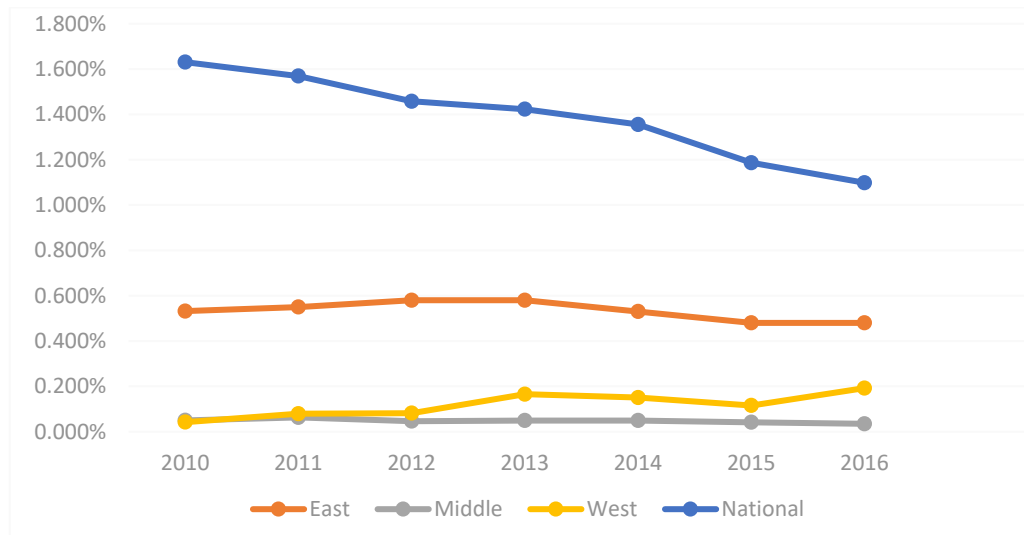
Source: Calculated based on the official website of the National Bureau of Statistics of China and data from the RISE database.

3. The spatial and temporal evolution of foreign trade dependence of plastic products in the East, Central and Western regions

3.1. Time dimensional evolutionary characteristics

Thanks to the reform and opening up, China is increasingly integrated into the wave of economic globalization, and the overall foreign trade dependence of plastic products has increased significantly.

However, the increase in the proportion of general trade methods and the constraints on high technology have led to a decrease in China's foreign trade dependence on plastic products since 2010, and China's open plastic market is more often shown in the eastern region. As shown in Figure 1, during the seven years from 2010 to 2016, China's foreign trade dependence on plastic products has shown an overall declining trend, in which the eastern region is significantly higher than the western region, but the highest only reached 0.58%, while the highest in the central and western region is less than 0.2%, which does not match the general environment of China's continuous expansion and opening.



Source: Calculated based on the official website of the National Bureau of Statistics of China and data from the RISE database.

Figure 1: Time evolution of foreign trade dependence of plastic products in East, Central and West regions during 2010-2016

From the overall time dimensional development trend of 2010-2016, the foreign trade dependence of plastic products in the eastern region is relatively stable, basically maintaining a level of 0.48%-0.60%. The time evolution trend of the foreign trade dependence of plastic products in the central region is relatively stable, basically maintaining a level of about 0.044% after 2012. The foreign trade dependence of plastic products in the western region increased during 2013-2016 and reached the maximum in 2016. Figure 1 clearly reflects that the evolutionary trends of the foreign trade dependence curves of the East, Central and West regions and the whole country are not similar, that is, the East, Central and West regions do not reflect the overall characteristics and development trend of China's foreign trade in plastic products. The reason is probably the large trade deficit of plastic products, and the trade dependence of this category is very low for the whole country and all regions, and there is a certain degree of market segmentation of plastic products in the east, middle and west regions of China[7-9].

3.2. Spatial dimensional evolutionary characteristics

The rise in China's foreign trade dependence is brought about by the deep reform and opening up of the eastern region, and for plastics, while the very limited level of opening up in the central and western regions is reflected in the trade of plastic products. During the seven years from 2010-2016, the national foreign trade dependence of plastic products averaged 0.368%, with only six provinces and cities above 1%, three of which are in the eastern region, namely Shanghai, Tianjin and Jilin Province, and 24 provinces and cities below the average, evenly distributed among the three regions. The eastern region has a certain advantage in the level of openness, excluding the foreign trade dependence of plastic products more than 1% of the region, the remaining nine provinces and cities in the eastern region, the average foreign trade dependence of plastic products at the level of 0.222%. In the western region, Qinghai Province's foreign trade in plastic products dependence of more than 1%, the remaining 10 provinces and cities in the average of 0.14% level. And the central part of the foreign trade dependence of plastic products has always maintained a relatively low state, not more than 0.2%. From the perspective of the distribution within each region (see Table 4).

Table 4: Spatial evolution of foreign trade dependence of plastic products in East, Central and West regions, 2010-2016

Region		Trade Dependence	Export Dependence
East	Beijing	0.390%	0.121%
	Tianjin	1.235%	0.280%
	Hebei	0.070%	0.034%
	Liaoning	0.034%	0.004%
	Shanghai	3.788%	1.181%
	Jiangsu	0.266%	0.150%
	Zhejiang	0.676%	0.359%
	Fujian	0.258%	0.080%
	Shandong	0.195%	0.014%
	Guangdong	0.013%	0.000%
	Jilin	1.352%	0.005%
Middle	Hainan	0.102%	0.264%
	Shanxi	0.198%	0.008%
	Inner Mongolia	0.013%	0.085%
	Heilongjiang	0.105%	0.040%
	Anhui	0.022%	0.057%
	Jiangxi	0.041%	0.025%
	Henan	0.032%	0.010%
	Hubei	0.023%	0.017%
West	Hunan	0.027%	0.011%
	Sichuan	0.027%	0.063%
	Guizhou	0.040%	0.083%
	Yunnan	0.026%	0.030%
	Tibet	0.155%	0.415%
	Shaanxi	0.182%	0.043%
	Gansu	0.550%	0.052%
	Ningxia	0.257%	0.139%
	Qinghai	1.179%	0.051%
	Xinjiang	0.089%	0.335%
Chongqing	0.044%	0.084%	
Guangxi	0.026%	0.035%	

Source: Calculated based on the official website of the National Bureau of Statistics of China and data from the RISE database.

3.2.1. Eastern region

Although the overall dependence of the eastern region is relatively high, but the internal spatial distribution is not balanced. Within the eastern region, foreign trade dependence is the highest in Shanghai, followed by Jilin Province and Tianjin City. The total foreign trade dependence of the average value of 0.698% over the years. The production of plastic products in China is in short supply, and the deficits of all provinces and cities are large, thus in terms of export dependence, the highest export dependence is in Shanghai during 2010-2016, which is related to the establishment of a free trade zone and strengthening the construction of ports in Shanghai, and the overall export dependence is at 0.208% on average.

3.2.2. Central region

The central region of plastic products foreign trade dependence is low compared with the east and west, fluctuations are not large, the internal differences between different regions are small. 2010-2016, the central region of foreign trade dependence is higher than 0.1% of the provinces have two, including Shanxi Province foreign trade dependence of 0.198%, the remaining six provinces on average at the level of 0.026%. In terms of the development trend of plastic products export dependence in the central region, each occupies half of the boundary at 0.02%, with an average value of 0.031%.

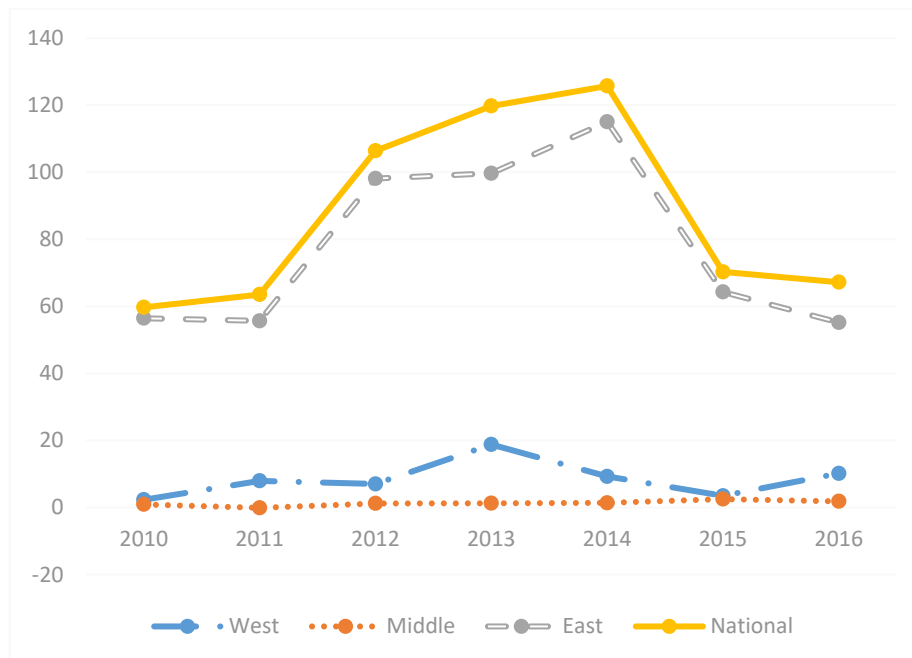
3.2.3. Western region

The development of foreign trade dependence of plastic products in the western region compared with the central region, the spatial distribution is more uneven, during 2010-2016, the foreign trade dependence of Qinghai Province and Gansu Province is larger, more than 0.5%; while the remaining nine provinces and cities in the average of 0.094%. In terms of export dependence, the Tibet Autonomous Region and Xinjiang Autonomous Region are higher, while the remaining provinces and cities are more evenly distributed, with an average value of 0.064%.

4. The spatial and temporal evolution of the foreign trade balance of plastic products in the three major economic regions

4.1. Time dimensional evolution

As shown in Figure 2, during 2010-2016, the evolutionary trends of the foreign trade balance of plastic products in the eastern, central and western regions are different, of which the eastern region is more volatile, while the development trend in the central and western regions is close to a steady increase. The trade balance of the eastern region began to turn in 2011 when the rise was larger, mainly concentrated in 2018 when the economic crisis had initially passed and the plastic chemical industry was gradually on the right track. 2013, it began to slowly recover and was on a slow upward trend. 2015, the foreign trade surplus of plastic products turned down after reaching the maximum. The trade surplus of the central and western regions is larger compared with the eastern region. However, from the overall level, the trade balance of plastic products in the western region is higher than that in the central region. Before 2013, the trade balance of plastic products in the two regions was relatively close, basically not more than USD 1 billion. But after 2013, the plastic products trade balance between the central region and the western region gradually opened up the gap, the western region's plastic products trade surplus reached its maximum, at nearly 2 billion U.S. dollars. The central region's plastic products trade surplus in recent years has not exceeded 0.3 billion U.S. dollars. During the seven years, the central region had a trade deficit in one year, while the eastern and western regions maintained a trade surplus[10].



Data source: Calculated from RESET database data.

Figure 2: Time evolution of the foreign trade balance of plastic products in the East, Central and West regions between 2010 and 2016

Overall, the eastern region plastic products foreign trade surplus accounted for the largest overall proportion, and consistent with the national development trend, leading the overall trade to achieve a large trade surplus amount. Among all regions, foreign trade competitiveness is the strongest, but its fluctuations are also large. Central and western regions have smaller trade surpluses in plastic products,

and the level is particularly low in the central region, but shows an evolutionary trend of steady increase year by year.

4.2. Spatial dimensional evolution

Overall, China's foreign trade in plastic products shows a long-term surplus. From the spatial dimension, the distribution of plastic products trade surplus is extremely uneven. As shown in Table 5, in 2010, China's overall plastic products foreign trade surplus was 5.97 billion U.S. dollars, of which the eastern region was 5.65 billion U.S. dollars, accounting for 94.6% of the overall plastic products trade surplus.

Table 5: Spatial distribution of foreign trade balance of plastic products in three major economic regions

Unit: USD billion

	2010		2013		2016	
	Total trade balance	Proportion of surplus areas	Total trade balance	Proportion of surplus areas	Total trade balance	Proportion of surplus areas
Eastern Region	56.5	8.3%	99.7	25%	55.2	50%
Central Region	0.9	37.5%	1.3	50%	1.8	62.5%
Western Region	2.3	54.5%	18.8	81.8%	10.2	72.7%

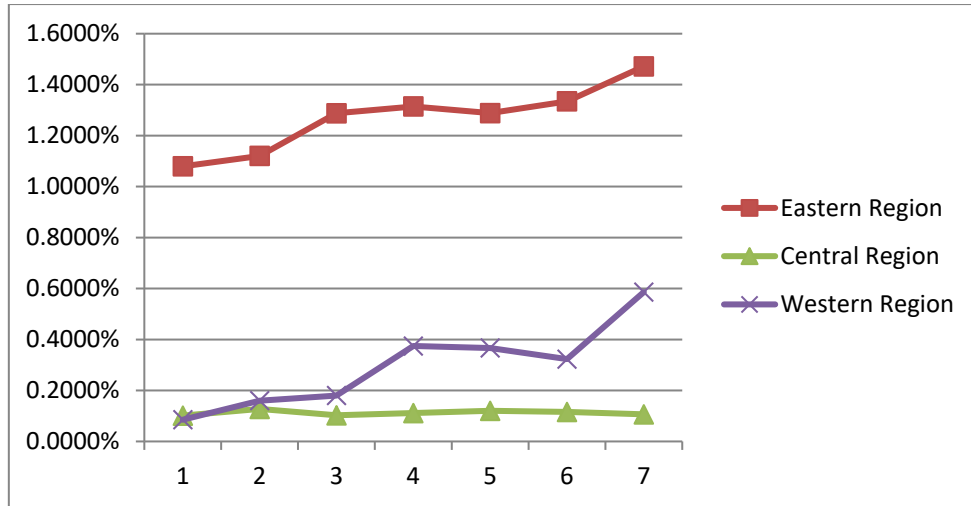
Data source: RESET database

From the spatial distribution of the internal trade balance of plastic products in the East, Central and West regions, the provinces that achieve a surplus in foreign trade of plastic products within each region all account for more than half. In 2010, the Western region achieved a surplus of 54.5% of the provinces, the highest proportion in each region. In 2013, the highest proportion of the Western region, amounting to 81.8%, the Central region and the Eastern region surplus areas accounted for the proportion of the central region can be up to one-half. In 2016, the three parts of the east and west reached more than 50%. From this proportion, the proportion of the eastern region has been the lowest over the years, and the trade surplus in the eastern region is mainly contributed by a few provinces and cities, and the spatial distribution of the internal trade balance is extremely uneven.

5. Spatial and temporal evolution of foreign trade performance index of plastic products in three major economic regions

5.1. Time dimensional evolution

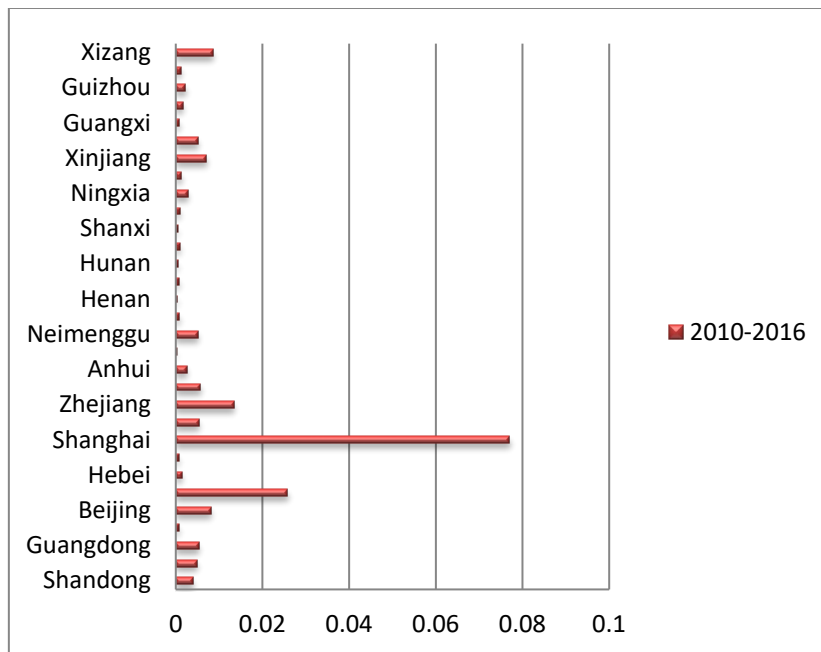
As shown in Figure 3, in terms of the time dimension, the foreign trade performance index of plastic products in China as a whole and in each region remained basically stable without much fluctuation during the period of 2010-2016. The eastern region has the highest foreign trade performance index for plastic products, with its plastic products trade performance index fluctuating up and down around 1.3%. From the data distribution, it is obviously higher than the national average, which shows that since 2010, the eastern region has been maintaining a good opening to the outside world, and the foreign trade is leading the growth of the national economy, and the advantages of foreign trade are increasing, and the quality is becoming better and better. However, in recent years, the trend of the growth of foreign trade performance index of plastic products is not obvious, reflecting the trend of labor-intensive industry transfer in the eastern region, and the decline of its foreign trade scale. For a long time, the foreign trade performance index of plastic products in the central and western regions fluctuates up and down at the level of about 0.1% and 0.4%, and since 2013, it can be seen that the level of foreign trade performance index of plastic products in the western region has improved and gradually increased. It can show that the opening level of the western region is also greatly improved in recent years. Externally, with the "Belt and Road" strategy, the central and western regions can accelerate the development of border trade with neighboring countries. Internally, it has taken over the transfer of labor-intensive industries in the eastern region, and the development of foreign trade has gained momentum, and the quality of foreign trade has been improving.



Data source: Calculated based on RISE database and China Statistical Yearbook

Figure 3: Time evolution of the foreign trade performance index of plastic products in the East, Central and West regions during 2010-2016

5.2. Spatial dimensional evolution



Data source: Calculated based on RESET database and China Statistical Yearbook

Figure 4: Spatial distribution of foreign trade performance index of plastic products in the East, Central and Western regions during 2010-2016

As shown in Figure 4, the spatial distribution of the average plastic products foreign trade index of 31 provinces, municipalities and autonomous regions in the three major zones of East, Central and West during the period of 2010-2016. First of all, from the overall perspective, the same as other indicators, the spatial distribution of the foreign trade performance index of plastic products shows that the eastern region is high and the central and western regions are low. However, we can also see some problems from the distribution chart. From the internal view of each region, although the overall foreign trade performance index of plastic products in the eastern region is high, the distribution of its internal provinces is very uneven. Among them, Shanghai and Tianjin's foreign trade performance index of plastic products is the highest, Liaoning Province is the lowest, the contrast is very obvious. And the foreign trade index of plastic products in Jilin Province and Hebei Province is similar and not much different. The foreign trade performance index of plastic products of the provinces and cities in the central and western regions is relatively evenly distributed in terms of values, among which, the

foreign trade performance index of plastic products of Inner Mongolia is the highest. The regions with high performance index of foreign trade in plastic products are Xinjiang, Tibet and Chongqing. These regions are geographically located along the edge of the location advantage, greatly promoting the scale of foreign trade and high-quality development.

6. Summary

From the above study, the spatial and temporal evolution of foreign trade of plastic products in various regions of China shows that the foreign trade of plastic products in the east, central and western regions is at a relatively independent stage of development, without forming effective economic cooperation and complementary advantages. The large-scale development of the plastic products industry in the central and western regions is not only conducive to reducing the production cost of products, but also conducive to providing backing for the development of high-tech basic industries in the eastern region. Therefore, the pattern of foreign trade of plastic products in China is slowly forming the trend of transferring from developed regions to less developed regions.

Acknowledgements

Zhang Wanying (1997-), female, Zhuang nationality, native of Sanmenxia, Henan Province, master's degree student of School of Economics and Management, Jilin Institute of Chemical Technology, research direction: chemical economy and trade; Zhang Lei (1982-), female, Han nationality, native of Jilin, Jilin, associate professor of School of Economics and Management, Jilin Institute of Chemical Technology, master's degree supervisor, doctor of economics, research direction: world economy; Supported by the Jilin Provincial Think Tank Fund for Philosophy and Social Sciences, "The Dilemma and Breakthrough Path of Jilin Province's Integration into 'One Belt, One Road'". (Project No. 2020JLSKZB044)

References

- [1] Gao Jing, Liu Jianchao. *Analysis and simulation prediction of influencing factors of plastic yield* [J]. *Rubber and Plastic Technology and Equipment*, 2021, 47(18): 40-45.
- [2] Ma Zhanfeng, Jiang Wanjun, Yang Sen. *China plastics processing industry (2019)* [J]. *China Plastics*, 2020, 34(05): 102-106.
- [3] Wu P, Xia Chuyu, He Chongchong. *Study on correlation matching of regional industrial structure trade structure--based on gray correlation algorithm* [J]. *System Science and Mathematics*, 2020, 40(11): 1950-1966.
- [4] Wang Hongqing, Zhang Ying. *Trade structure upgrading, environmental regulation and green technology innovation in different regions of China* [J]. *China Soft Science*, 2020(02): 174-181.
- [5] Zu Yi. *Analysis of China's plastic products exports and countermeasures* [J]. *Northern Economic and Trade*, 2020 (07): 21-23.
- [6] Zhao Fujun. *New features of China's export structure and the next direction of export upgrading* [J]. *Development Research*, 2018(06): 26-36.
- [7] Li L. *Research on the structure and international competitiveness of China's foreign trade* [J]. *Foreign trade and economics*, 2018(05): 24-27.
- [8] Wei Fengqin. *Positive early digestion of plastic late weakness* [N]. *Futures Daily*, 2016- 09-07(008).
- [9] Rakhman M S, Zaika O V. *Analyzing the Foreign Economic Activities of Ukraine and the Structure of Export-Import Operations with Plastic Pipes*[J]. *Business Inform*, 2020, 9(512):29-36.
- [10] Gai Zuoyou. *China's plastic machinery product structure needs to be adjusted* [N]. *China Packaging News*, 2008-05-28 (003)