Universe
Scientific Publishing

Measurement of Foreign Trade Resilience in China and Analysis of Provincial Differences

Shanshan Wang

Horgos Business School of Yili Normal University, Yili 835000, China.

Abstract: Foreign trade resilience, as a horse-drawn carriage that drives the economy, is also critical to the optimisation and upgrading of China's industrial structure. This paper develops an index system to assess China's foreign trade resilience, computes the trade resilience value of various regions in China from 2010 to 2021 using the entropy weight method and analyses regional differences, and then analyses the regional space using theil index and decomposition method: (1) There is a significant disparity in the development of foreign trade resilience among China's provinces, and trade resilience is clearly imbalanced. (2) Although the imbalance in resilience development in China and other regions has improved, it has not been significantly alleviated, and it is primarily due to intra-regional differences. (3) The contribution rate of the western and eastern regions to the imbalance is nearly equal among the four regions, and the imbalance in the eastern region has worsened since 2018.

Keywords: Foreign Trade Resilience; Theil Index; Spatial Differences

Introduction

In 2021, China's goods trade import and export scale surpassed 6 trillion US dollars for the first time, and the total value of trade import and export reached 6.05 trillion US dollars, up 21.4% year on year. China's economic and trade development faces numerous challenges against the backdrop of rapid political transformation and a deepening global value chain. To begin with, emerging developing countries have altered the traditional "core-periphery" trade economic structure; trade protectionism is on the rise; competition among major countries is becoming increasingly fierce; and China's foreign trade and investment are increasingly vulnerable to international sanctions. Second, in comparison to developed countries, China's industrial structure still has some flaws, with a relatively low proportion of high-tech industries. Finally, as a result of the epidemic and political changes, China's domestic demand weakened gradually. Strengthening regional exchanges and cooperation, as well as mutual promotion among industries, will thus be an effective way to stimulate supply chain innovation, boost domestic demand, and improve China's trade stability. The meeting of China's Political Bureau in April 2022 clarified the basic requirements for the economy's safe development. One of the main goals of China's trade stability and healthy economic development is its participation in the new round of international division of labour and promotion of trade resilience.

With the ongoing globalisation and changing international trade environment, China's foreign trade faces a variety of risks and challenges, and various risk shocks have resulted in the "bullwhip effect" of foreign trade, which limits China's economic development. The healthy and sustainable development of the trade economy, as one of the troika driving economic growth, plays a critical role in reducing external risks, maintaining steady economic growth, and maintaining the stability of China's new "double cycle" development pattern. Under the new development pattern, strengthening China's foreign trade resilience can not only improve production efficiency and core competitiveness of Chinese enterprises, but also help to stabilise China's share of the international trade market and optimise the industrial structure, enhancing the competitiveness of Chinese products and their position in the trade structure and reducing external risk exposure. Simultaneously, improving China's trade resilience through "internal and external echo" on the basis of industrial innovation can also promote high-quality development of foreign trade under the new development pattern. However, current research on foreign trade resilience is insufficient. As a result, an in-depth examination of China's foreign trade resilience in the new situation can not only provide theoretical support for the development of foreign trade in various regions of China, but can also help to enrich research on China's economic resilience.

1. Literature review

The term “resilience” was coined by American ecologist Holling(1973), who stated that improving an economic system’s ability to resist risks can reduce the degree of impact, shorten the time of impact, and optimise the economic structure. Resistance, resilience, and organisational remodelling are the three types of trade resilience identified by academics. According to Martin (2012), by strengthening these three aspects of trade, we can ensure the stability of the trade economy in a volatile international environment and provide protection for the optimisation and upgrading of domestic industries. However, the empirical research literature on China’s foreign trade resilience is still insufficient at the moment. The existing literature has conducted a descriptive analysis of trade resilience in a specific period based on external shocks. He Canfei and Chen Tao (2019) compared the export trade performance of different regions in China following the financial crisis and concluded that product diversification, emergency taxation, and processing trade mode were effective ways to improve trade resilience. External shocks, according to Bems (2008), have a “bullwhip effect” on trade.

According to Li Jiqiang and Pan Wenqing (2016)’s study on the measurement and difference of foreign trade resilience in China, factors such as production conditions, institutional conditions, and cultural conditions will cause differences in regional trade development level. According to Li Feng (2018), improving the conversion efficiency of trade information and the level of enterprises participating in the value chain is an important direction of trade development. Liao Han, Hu Xiaolei, and colleagues (2021) assessed China’s foreign trade resilience in terms of global supply chains and intermediate products. Ying wang and Li Shuting (2022) examined the ability of resistance, recovery, and reconstruction in foreign trade and discovered that government, market, digital trade, science and technology education, and structure are the most influential factors.

To summarise, most scholars have examined the impact of specific shocks on trade resistance and resilience, and based on this, they have conducted an empirical analysis on the influencing factors of trade resilience, which can neither describe the long-term development trend of trade resilience nor distinguish trade resilience differences across regions. As a result, from 2010 to 2021, this paper constructs an index system of regional trade resilience in China based on two levels of internal and external conditions, observes and studies the overall level of trade resilience, and further analyses the differences in foreign trade resilience across regions.

2. The index system of foreign trade resilience

2.1 Sample selection and data sources

From 2010 to 2021, this paper examines the trade resilience of 31 Chinese provinces (autonomous regions and municipalities directly under the Central Government). The research data is derived from provincial statistical bulletins and the Statistical Yearbook of China in 2022, as calculated by the Department of Free Trade Zone and Special Regional Development of the China Customs General Administration, with missing data filled in through interpolation.

2.2 Build an index system

According to Martin(2015), Zong Huiming (2021), He Canfei (2021) and other related studies, referring to the provincial characteristics of China and the actual situation of foreign trade, we need to consider standardization and scientificity, comprehensiveness and systematicness, operability and convenience when constructing the index system, and measure foreign trade resilience from two dimensions: resistance and resilience and reconstruction ability. In order to reflect the resistance and resilience, indicators such as economic base, transportation convenience and foreign trade development degree are selected. In order to reflect the ability of the trading system to integrate resources to adapt to the new external environment after the impact, this paper selects economic support, e-commerce support and government support to measure the ability of trade reconstruction. China foreign trade resilience index index evaluation system is shown in the table below:

Table 1 China foreign trade resilience Index System

Index I	Index II	Index III	Indicator explanation	Index property
Resistance and resilience	economic base	Per capita GDP	The higher the per capita GDP, the better the regional economic foundation and the stronger the resilience of trade resistance.	+
		Urbanization rate	The higher the urbanization rate, the better the economic foundation.	+
	Transportation convenience	Distance between provincial capital and its largest trading country	The closer to the largest trading country, the more trade options and the lower the trade cost.	+
		Number of first-class ports	The more ports there are, the better the transportation foundation of foreign trade and the lower the trade cost.	+
	Development of foreign trade	total volume of imports and exports	The greater the total volume of import and export trade, the greater the regional trade resistance.	+
		Proportion of export to total import and export	The higher the proportion of exports in the total import and export, the greater the trade surplus and the stronger the trade competitiveness.	+
		The proportion of the trade volume of the top three trading partners in the total trade volume	The greater the proportion of the trade volume of the top three trading partners in the total trade volume, the higher the concentration of trade objects, the fewer alternatives and the weaker the trade resistance.	-
		Total foreign investment	The higher the total amount of foreign investment, the worse the ability to resist external risks.	-
Reconfiguration ability	financial support	Year-end loan balance of financial institutions	The higher the loan balance, the greater the ability of enterprises to obtain financing and the faster the speed of trade reconstruction.	+
		per capita disposable income	The higher the disposable income, the stronger the power of trade reconstruction and the stronger the ability of trade reconstruction.	+
	E-commerce support	Number of comprehensive experimental areas in cross-border electronic commerce	The more comprehensive experimental zones in cross-border electronic commerce, the greater the policy support for e-commerce and the higher the trade resilience.	+
	Government support	Number of comprehensive bonded areas	The more comprehensive bonded areas there are, the lower the trade cost and the greater the trade restructuring power.	+
		Financial expenditure on science and technology	The more financial expenditure on science and technology, the less trade dependence and the greater reconstruction power.	+

3. China foreign trade resilience Index and Analysis of Provincial Differences

3.1 Method selection

3.1.1 Entropy method

Because the measurement unit and statistical caliber of data are not uniform, the dimensions and positive and negative directions of each index are also inconsistent, so it is impossible to make direct comparative analysis. Therefore, the data should be normalized before analysis.

Positive indicators: $h_{ij} = \frac{x_{ij} - \min(x_{ij}, x_{2j}, x_{3j}, \ldots\ldots, x_{mj})}{\max(x_{ij}, x_{2j}, x_{3j}, \ldots\ldots, x_{mj}) - \min(x_{ij}, x_{2j}, x_{3j}, \ldots\ldots, x_{mj})}$

Reverse indicator: $h_{ij} = \frac{\max(x_{ij}, x_{2j}, x_{3j}, \ldots\ldots, x_{mj}) - x_{ij}}{\max(x_{ij}, x_{2j}, x_{3j}, \ldots\ldots, x_{mj}) - \min(x_{ij}, x_{2j}, x_{3j}, \ldots\ldots, x_{mj})}$

Information entropy: Because there is 0 in the normalized data, the logarithm of the normalized data should be taken when calculating the entropy value. Therefore, this paper makes the normalized data fall within the interval of [1,2] through the data translation method. The formula is:

$$y_{ij} = y'_{ij} + 1$$

Get the processed data set.

$$Y_{ij}(i = 1,2,\cdots,n; j = 1,2,\cdots,m)$$

3.1.2 The entropy weight method to calculate the index weight.

Assuming the proportion of the j index of the ith sample in the sum of all samples of the index, namely:

$$p_{ij} = \frac{y_{ij}}{\sum_{i=1}^{n} y_{ij}}$$

Calculate the proportion of all indicators of all samples. Assuming is the entropy value of indicator J, the calculation formula is as follows:

$$e_j = -\frac{1}{\ln n}\sum_{i=1}^{n} p_{ij} \ln p_{ij}$$

According to the information entropy theory, the greater the entropy value of an index, the smaller the information it contains and the smaller its entropy weight. The smaller the entropy value, the greater the information utility value contained in the index, and the greater its entropy weight. Assuming is the entropy weight of index J, its calculation formula is:

$$w_j = \frac{1 - e_j}{\sum_{j=1}^{m} (1 - e_j)}$$

So as to obtain the index weight matrix

3.1.3 TOPSIS carries out comprehensive evaluation

For the standardized data set

$$Y_{ij}(i = 1,2,\cdots,n; j = 1,2,\cdots,m)$$

The weighted data matrix is obtained by weighting the entropy weight matrix, and is denoted as Z.

$$Z = (z_{ij})_{n\times m} = (y_{ij}w_j)_{n\times m} = \begin{bmatrix} z_{11} & \cdots & z_{1m} \\ \vdots & \ddots & \vdots \\ z_{n1} & \cdots & z_{nm} \end{bmatrix}$$

Define the maximum value: $Z^{+} = (Z_1^{+}, Z_2^{+}, \cdots, Z_m^{+}) = (\max\{z_{11}, z_{21}, \cdots, z_{n1}\}, \max\{z_{12}, z_{22}, \cdots, z_{n2}\}, \cdots \max\{z_{1m}, z_{2m}, \cdots, z_{nm}\})$

Define minimum value: $Z^{-} = (Z_1^{-}, Z_2^{-}, \cdots, Z_m^{-}) = (\min\{z_{11}, z_{21}, \cdots, z_{n1}\}, \min\{z_{12}, z_{22}, \cdots, z_{n2}\}, \cdots \min\{z_{1m}, z_{2m}, \cdots, z_{nm}\})$

Define the distance between the evaluation value vector of the i(i=1,2, …,n) th sample index and the maximum value (optimal value, positive ideal solution)

$$D_i^{+} = \sqrt{\sum_{j=1}^{m} (z_{ij} - Z_j^{+})^2}$$

Define the distance between the evaluation value vector of the i(i=1,2, …,n) th sample index and the minimum value (worst value, negative ideal solution)

$$D_i^{-} = \sqrt{\sum_{j=1}^{m} (z_{ij} - Z_j^{-})^2}$$

Finally, the relative closeness between the evaluation value vector of the I-th sample (province) and the positive ideal solution is calculated $S_i = \frac{D_i^{-}}{D_i^{+} + D_i^{-}}$

The bigger S_i is, the higher the evaluation of the sample (province) and the higher the comprehensive ranking.

4. Theil index and its decomposition.

Theil index (also known as Theil entropy index) can calculate and reveal the internal differences, and is widely used in the economic field. The foreign trade resilience index of China from 2010 to 2021 was calculated in detail by theil index, and the development trend of for-

eign trade resilience in China and various regions was comprehensively analyzed from the perspective of time evolution.

$$T_t = T_{wt} + T_{bt} = \sum_{j=1}^{m} \frac{p_{jt}}{p_t} \left(\sum_{i \in z} \frac{p_i}{p_{jt}} \frac{x_i}{\overline{x_{jt}}} \ln \frac{x_i}{\overline{x_{jt}}} \right) + \sum_{i=1}^{m} \frac{p_i}{p_t} \frac{x_i}{\overline{x_t}} \ln \frac{x_i}{\overline{x_t}}$$

Where: then T_t is theil index in the whole region of China in T year, T_{bt} is theil index in the region in T year, and T_{wt} is theil index in China foreign trade resilience in T year. I stands for province, J stands for four regions, T stands for year, P is the total population of urban employees, and X stands for foreign trade resilience index.

4.1 China foreign trade resilience Index

Based on the above model calculation, the weight distribution of China foreign trade resilience index is shown in the table below:

Table 2 Weight of foreign trade resilience Index in China

Primary index	Secondary index	Index III	Index weight
Resistance and resilience	Regional economic base	Per capita GDP	7.497
		Urbanization rate	1.873
	Location and transportation base	Distance between provincial capital and its largest trading country	9.13
		Number of first-class ports	10.338
	Development of foreign trade	total volume of imports and exports	20.208
		Proportion of export to total import and export	4.089
		The proportion of the trade volume of the top three trading partners in the total trade volume	3.282
		Total foreign investment	0.734
Reconfiguration ability	financial support	Year-end loan balance of financial institutions	8.672
		per capita disposable income	9.29
	E-commerce support	Number of comprehensive experimental areas in cross-border electronic commerce	6.864
	Government support	Number of comprehensive bonded areas	5.942
		Financial expenditure on science and technology	12.081

By constructing China foreign trade resilience index system and using entropy method, the trade resilience of 31 provinces (cities, districts) (autonomous regions and municipalities directly under the Central Government) in China from 2010 to 2021 is comprehensively calculated. The results are shown in the table below:

Table 3 foreign trade resilience Index of 31 Provinces in China from 2010 to 2021

province	2011	2013	2015	2017	2019	2021
Beijing	0.2150	0.2390	0.2410	0.2680	0.3840	0.3171
Tianjin	0.0930	0.1050	0.1500	0.2120	0.2240	0.1919
Hebei	0.0860	0.1000	0.1120	0.1310	0.2520	0.1547
Shanghai	0.2180	0.2320	0.2090	0.2950	0.3360	0.3882
Fujian	0.1550	0.1690	0.1760	0.1870	0.3180	0.2258
Shandong	0.1740	0.1950	0.2080	0.2810	0.4210	0.2521
Guangdong	0.4030	0.4460	0.4810	0.6290	0.8640	0.5087
Hainan	0.0960	0.1020	0.1020	0.1080	0.1690	0.1066
Jiangsu	0.2670	0.3050	0.3340	0.4420	0.6110	0.4517
Zhejiang	0.2180	0.2440	0.3180	0.3950	0.6230	0.3875
Liaoning (Province)	0.1000	0.1160	0.1150	0.1810	0.3040	0.2172
Jilin (Province)	0.0990	0.1050	0.1100	0.1150	0.2340	0.1301
Amur	0.1030	0.1060	0.1120	0.1120	0.2240	0.1191
Anhui (Province)	0.1000	0.1130	0.1300	0.2140	0.2990	0.1749
Shanxi	0.0740	0.0830	0.1020	0.1030	0.1610	0.1387

Jiangxi	0.0920	0.1030	0.1190	0.1350	0.2670	0.1185
Henan	0.1560	0.2030	0.2310	0.3150	0.4060	0.2016
Hubei	0.1240	0.1350	0.1510	0.1730	0.2990	0.1571
Hunan	0.0610	0.0770	0.1170	0.1390	0.2710	0.1310
Inner Mongolia	0.0690	0.0760	0.0890	0.0980	0.2150	0.1151
Guangxi	0.0860	0.0970	0.1150	0.1200	0.1980	0.1103
Chongqing	0.1030	0.1180	0.1270	0.1940	0.2140	0.1356
Sichuan	0.0960	0.1090	0.1160	0.1800	0.2810	0.2098
Guizhou	0.0390	0.0540	0.0680	0.0820	0.1480	0.0807
Yunnan	0.0650	0.0870	0.0920	0.1040	0.1710	0.1331
Tibet	0.0340	0.0400	0.0370	0.0460	0.0560	0.0916
Shaanxi	0.0870	0.1020	0.1100	0.0880	0.1620	0.1032
Gansu	0.0500	0.0590	0.0580	0.0570	0.1180	0.3678
Qinghai	0.0350	0.0430	0.0700	0.0490	0.1120	0.1168
Ningxia	0.0430	0.0860	0.0890	0.0940	0.1520	0.0632
Xinjiang	0.0840	0.0940	0.1130	0.1180	0.1210	0.1202
Mean	0.1169	0.1336	0.1485	0.1827	0.2779	0.1942

The calculation results show that the average value of China's foreign trade resilience index is increasing from 2010 to 2021, indicating that China's foreign trade continues to optimise and develop, and its ability to resist risks is gradually improving. Guangdong 0.568, Jiangsu 0.398, Zhejiang 0.357, Shanghai 0.274, and Beijing 0.272 were the top five provinces in terms of foreign trade resilience from 2010 to 2021. Guangdong, Jiangsu, Zhejiang, Shanghai, and other places are located in China's coastal or core areas, with good geographical location and convenient transportation, making them ideal for trade exchanges between domestic and foreign markets. Beijing, as the country's economic and political centre, actively develops high-end manufacturing industry, increases product value, and advances in scientific and technological innovation and high-end manufacturing industry, providing Beijing with more trade opportunities and competitive advantages.

Border areas (with the exception of Tibet) and inland areas with developed trade and transportation (such as Henan and Shaanxi) have a higher trade resilience index than the rest of the central and western regions. Trade convenience has greatly improved, owing primarily to the state's financial and policy support, as well as international transportation hubs such as dry ports and airports. Simultaneously, border areas rely on geographical advantages to conduct trade with neighbouring countries. Trade costs and trade risks are reduced as a result of the trade pilot zone's preferential policies. Furthermore, some western regions, such as Shanxi, Ningxia, and Guizhou, actively responded to the "Belt and Road Initiative," promoting their own trade resilience through featured products, policies, or location advantages, and trade resilience increased significantly.

4.2 Classification of foreign trade resilience in China.

According to the comprehensive index ranking of resistance, resilience and reconstruction ability, the situation of 31 provinces and cities in China is classified into 9 types, as shown in the table:

Table 4 Comprehensive Index Classification of foreign trade resilience Resistance, Resilience and Reconstruction Ability in China

Type	Area	explanation
Building height and resisting height type	Beijing, Shanghai, Jiangsu, Zhejiang, Guangdong, Henan	The reconstruction ability index is ranked 1-10, and the resistance and recovery ability index is ranked 1-10.
High-rise and medium-sized resistance	Anhui, Fujian, Shandong	The reconstruction ability index is ranked 1-10, and the resistance and resilience index is ranked 11-21.
Constructing high and resisting low type	Hubei	The reconstruction ability index is ranked 1-10, and the resistance and resilience index is ranked 21-31.
High-resistance type	Liaoning and Sichuan	The reconstruction ability index is ranked 11-21, and the resistance and resilience index is ranked 1-10.

Medium-sized and medium-sized	Tianjin, Hebei, Shanxi, Jilin	Reorganization ability index is ranked 11-21, and resistance and resilience index is ranked 11-21.
Constructed anti-low type	Inner Mongolia, Jiangxi, Hunan and Chongqing	Reorganization ability index is ranked 11-21, and resistance and resilience index is ranked 21-31.
Low structure and high resistance	Gansu	Reorganization ability index ranks 21-31, and resistance and resilience index ranks 1-10.
Low structure and medium resistance	Yunnan, Tibet, Qinghai, Xinjiang	Reorganization ability index ranking 21-31, resistance and resilience index ranking 11-21.
Low-resistance type	Heilongjiang, Guangxi, Hainan, Guizhou, Shaanxi, Ningxia	Reorganization ability index ranking 21-31, resistance and resilience index ranking 21-31.

Based on the above classification, we can divide the provinces and cities into the eastern region, the central region, the western region, and the northeast region, and then conduct a detailed analysis of each region:

Most provinces in the eastern region are classified as “high-resistant” or “medium-resistant,” indicating that they are resistant to foreign trade and have a high capacity for reconstruction. This could be due to the high level of economic development, solid economic foundation, and industrial support in these areas, which make them attractive to foreign investment. In the event of a risk impact, foreign trade resilience improves and trade reconstruction capability improves.

The provinces in the central and northeast regions are primarily “building high and resisting medium,” “building middle and resisting low,” and “building high and resisting low,” indicating that foreign trade resistance and recovery are general and reconstruction ability is relatively weak.

The provinces in the western region are mostly “high-resistant” and “low-resistant to medium-sized” and “low-resistant to low-type,” indicating that foreign trade resistance and recovery are weak in these areas, as is reconstruction ability. This could be due to the relatively low level of economic development and industrial support in these areas, as well as the overall lack of foreign trade resilience due to geographical reasons.

(D) Spatial difference decomposition of China foreign trade resilience.

In order to analyze the sources of the overall differences of foreign trade resilience in China in detail, the theil index of China and four major economic regions are calculated, and the overall differences, intra-regional and inter-regional differences, and the contribution rates within and between regions are analyzed.

Table 5 foreign trade resilience theil index in Different Regions of China

Year	whole country	eastern region	Middle part	northeast	the west	Within the region		Interregional	
						theil index	Contribution rate%	theil index	Contribution rate%
2010	3.625	2.412	1.999	1.1	2.47	2.234	61.632	1.391	38.368
2011	3.618	2.411	1.996	1.099	2.475	2.237	61.839	1.381	38.161
2012	3.604	2.407	2.009	1.099	2.458	2.237	62.087	1.366	37.913
2013	3.6	2.411	2.008	1.1	2.453	2.24	62.217	1.36	37.783
2014	3.581	2.397	1.991	1.1	2.45	2.229	62.248	1.352	37.752
2015	3.589	2.409	1.994	1.099	2.448	2.237	62.324	1.352	37.677
2016	3.63	2.429	2.024	1.122	2.496	2.263	62.354	1.366	37.646
2017	3.632	2.426	2.026	1.125	2.497	2.263	62.315	1.369	37.685
2018	3.603	2.414	1.996	1.115	2.478	2.236	62.065	1.367	37.935
2019	3.588	2.416	1.979	1.108	2.464	2.214	61.693	1.374	38.307
2020	3.6003	2.4205	2.0007	1.1193	2.4785	2.2397	62.2027	1.36053	37.7975
2021	3.5991	2.4218	2.0005	1.1216	2.4803	2.2398	62.2254	1.35921	37.7747

Between 2010 and 2021, China's foreign trade resilience showed a fluctuating trend overall. Theil index results revealed a downward trend in differences between groups, as well as an inverted U-shaped change pattern within groups. During the period 2010-2015, the contribution rate of intra-group differences to overall differences increased, while the contribution rate of inter-group differences to overall differences decreased. Although the overall and regional differences in foreign trade resilience in China are gradually decreasing, the differences within regions are increasing, exacerbating the foreign trade resilience imbalance. Since 2016, China's foreign trade resilience Index and intra-group theil index have both risen and then fallen, while the inter-group theil index has shown the opposite trend. As a result, while differences in foreign trade resilience in China have gradually decreased in recent years, differences within regions remain the key to resolving the trade resilience equilibrium.

Theil index has improved overall in each of the four major economic regions, but the rate of improvement has been slow, particularly in the central region. Various regions are resuming trade, primarily as a result of the epidemic. The western region has the highest il index of the four major economic regions. In the future, we should focus on the development of the western region, make up for its shortcomings, and strengthen cooperation and exchanges between regions to close the gap within the region. Prior to 2014, however, the il index in the eastern region displayed changing characteristics, first declining and then fluctuating and rising. As a result, the eastern region should strengthen trade with countries along the "Belt and Road Initiative" and broaden its range of trading partners in the future to mitigate the impact of trade risks.

5. Conclusions and suggestions

The China Foreign Trade Resilience Index index system is compiled from two perspectives of foreign trade resilience. This paper calculates and analyses the value of trade resilience and its regional differences in China from 2010 to 2021 using the entropy weight method, and analyses the regional space using the il index sum decomposition method, and draws the following conclusions: (1) Overall, China's trade resilience is improving, but the imbalance caused by regional differences has not been clearly alleviated. (2) Trade resilience index is higher in border areas (except Tibet) and inland areas with developed trade and transportation (such as Henan and Shaanxi) than in other central and western regions. (3) In terms of the four major economic regions, the il index has improved overall in each region, but the rate of improvement has been slow, particularly in the central region. The western region's trade resilience is gradually becoming more balanced, but a breakthrough path in some areas remains difficult to find.

We propose the following recommendations to close the gap in China's foreign trade resilience and improve China's overall foreign trade resilience: (1) To promote regional cooperation and exchange, all regions should strengthen cooperation and exchange, share successful experiences and best practises, and improve trade resilience overall. Establish a cross-regional cooperation mechanism, conduct joint research, and collaborate on projects to improve overall trade resilience. (2) By optimising policy support and resource allocation, the government should increase policy support and resource input to the central and western regions in order to promote trade resilience development in these regions.Simultaneously, it is necessary to ensure the fairness and effectiveness of policies, avoid excessive resource concentration, and prevent the trade resilience imbalance from worsening. (3) In order to promote technological innovation and industrial upgrading, all regions should strengthen the cultivation and promotion of scientific and technological innovation capabilities, as well as promote industrial upgrading and transformation.Regional trade resilience and competitiveness will be improved by increasing R&D investment, cultivating innovative enterprises, and introducing talents. (4) Increase support for personnel training and education. The government and higher education institutions should increase their support for personnel training and education in the central and western regions, as well as work to improve talent quality and skill level.This will assist the central and western regions in improving trade resilience and promoting long-term economic development. (5) In order to promote regional coordinated development, the government should develop and implement regional coordinated development strategies that promote the balanced development of different regions.By encouraging complementary cooperation and resource sharing among regions, we can close the trade resilience gap and achieve stable and sustainable national economic development.

References

[1] Holling CS. Resilience and stability of ecological systems[J].Annual Review of Ecology and Systematics, 1973, 4(1): 1-23.

[2] Martin R. Regional economic resilience, hysteresis and recessionary shocks[J]. Journal of Economic Geography, 2012, 12(12): 1-32.

[3] He CF, Chen T. External demand shocks related diversification and export resilience door China industrial economy, 2019 (7): 61-80.

[4] Liao H, Hu XL, Liu SQ. Analysis of China's supply chain resilience under adverse external shocks [J]. Enterprise Economy, 2021,40 (10): 50-59.

[5] Giovannijdlevchenko Aa Mejean. Fims destinations and aggregate fluctuations[J]. Econometrica, 2014, 82(4) : 1303-1340.

[6] Bems Rjohnson Rcyikm. The role of vertical linkages in the propagaion of the global downtur of 2008 [R/0L]. http:www.imf.org/extemal/np/res/seminars/2010/ paris/pdf/keymu. pdf.

[7] Yang JJ, Fan CL. The impact of China manufacturing on the "great stability" of the global economy-an empirical test based on the value chain [J]. China Social Sciences, 2015 (10): 92-113.

[8] Wang XS, Zhai GY, Xie SX. China's trade overshoot: performance, causes and countermeasures [J]. Management World, 2014 (1): 27-39.

[9] Wang Y, Li ST. China foreign trade resilience Measurement and Influencing Factors [J]. Journal of North University for Nationalities, 2022(06):127-136.

[10] Li Q, Pan WQ. How national value chain embeds into global value chains: the perspective of added value [J]. Managing the world, 2016(07):10-22+187.

[11] Li F. Does domestic specialization promote regional coordinated development? [J]. Research on Quantitative Economy, Technology and Economy, 2018, 35 (12): 81-99.

[Fund Project] The open project of Kazakhstan Research Center "Research on the Economic Development Model of Kazakhstan in Response to the belt and road initiative Initiative (2021HSKSTYJYB001)".

[Author's Brief Introduction] Shanshan Wang(1989-), Horgos Business School of Yili Normal University, research direction: regional economy, industrial economy and digital economy.