Regional Import and Export Influencing Factors in Jiangsu Province, China Based on RBF Neural Network Analysis

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Abstract. With economic globalization, import and export trade has become a key factor affecting economic growth, and the sample data of Jiangsu province, as an important part of China's import and export trade, is a typical representative. This paper selects the annual data of Jiangsu Province from 2000 to 2021, determines the main influencing factors by rooting in past research theories, adopts the structure, characteristics and training algorithm of RBF (radial basis function) neural network, and applies the neural network to establish a multi-factor nonlinear time series forecasting model based on the mapping relationship between Jiangsu Province's import and export and its influencing factors. The conclusions are as follows: This paper builds a neural network around the data related to the import and export of foreign trade affecting Jiangsu Province from 2000 to 2021, and establishes an indicator system for the trend of foreign trade and the influencing factors of Jiangsu Province. The analysis finds that the highest accuracy is achieved when the neuron is 9. The degree of trade barriers, regional social financing scale, global economic growth rate and financial development efficiency are the main factors influencing the total amount of foreign trade import and export of Jiangsu province. Under the background of global trade being hindered by the epidemic and stagnant, the current situation of foreign trade development in Jiangsu Province should focus on breaking through from the above factors, considering domestic and international economic development, accelerating its financing scale and financial industry development, and promoting the steady development of foreign trade.

Keywords: RBF neural network model; econometric analysis; influencing factors; regional import and export.

1. Introduction

As globalization continues to advance, import and export trade has gradually become a major component of economic development and improvement of people's living standards in various countries, and the future trade structure and trade trends of countries in import and export are receiving more and more extensive attention from the world. At the same time, the repeated fluctuations of the epidemic brought about by the global macroeconomic recession, the deepening of trade barriers caused by the trade game between major countries, and the rise of emerging and late-developing countries led to a new round of global industrial transfer and other circumstances have brought a huge impact on the global import and export trade and its impact factors.

Under the trend of changing international situation and expanding contradictions, governments have advocated various economic strategies to stimulate domestic import and export trade, further optimize the structure of international import and export commodities, and the future trend of import and export has become more and more widely concerned by the world. Therefore, in the investigation of the influence of import and export trade factors to promote the healthy development of a country's economy and the future development of a virtuous cycle of multilateral trade, the domestic and international double cycle plays a vital role.

Current scholars in the field, based on relevant data over the years, have conducted a multi-level analysis of the factors affecting the total foreign import and export trade of a region from different perspectives. Some studies have favored comparisons from the perspective of linkages between countries, using relevant data to verify the strength of association that exists between imports and

exports and the influencing factors.Jin [1] selected the sample data from 2000 to 2019, used EViews software to use the total import and export volume as the explanatory variable, GDP, RMB exchange rate, actual utilization of foreign capital, tariff income and foreign exchange reserves as the explanatory variables, analyzed the two factors with the biggest impact on import and export trade, drew conclusions and put forward suggestions. Yang [2] from the macro level of the RMB exchange rate jump risk impact on China's import and export trade, based on GARCH-JUMP model, gray correlation analysis and BP neural network energy demand combination prediction method, the results show that the RMB exchange rate jump risk impact on import and export trade in the short term greater than the long term, the impact of import and export trade from positive to negative, to positive shift. Cai selected the quarterly data from 1995 to 2015, established China's import and export trade equation according to the incomplete substitution model, and analyzed the significant structural changes in China's import and export trade before and after the financial crisis, breakpoint structural changes in import trade, and smooth structural changes in export trade.

In addition, other scholars mainly focus on macroeconomic factors and other social factors that affect the total import and export trade in specific regions of China based on data analysis.Xu et al [4] used econometric methods to establish a model to study the factors influencing Zhanjiang import and export, analyzed the changes of total import and export volume with GDP and household consumption level, and found that GDP and household consumption level have a great impact on the import and export trade of Zhanjiang, and import and export has become an important factor for Zhanjiang's economic growth.Xun et al[5] based on the data of China's total exports and imports from 1993 to 2016, selected six economic indicators as the main influencing factors, established an econometric model, and came to the final model and conclusion that the main influencing factors affecting total exports and imports of foreign trade include China's gross domestic product (GDP), the amount of real utilized foreign capital, tariff revenue, foreign exchange reserves, education expenditure and the exchange rate of RMB against USD.

In addition to macroeconomic factors, other social factors, such as cultural distance, degree of product differentiation, initial trade volume, and already the new crown epidemic, can also have an impact on China's total export and import of foreign trade.Hu[6]used multiple linear regression model to analyze the factors affecting the total amount of imports and exports in Shaanxi Province, sought its quantitative relationship, made quantitative analysis of the data, and improved the model by putting forward corresponding countermeasures and suggestions according to the results of empirical analysis.Xu et al[7] et al. took the agricultural products trade between Xinjiang and the five Central Asian countries as the research object, and conducted a regression analysis of the trade between Xinjiang and the five Central Asian countries from 2000 to 2014 through the trade gravity model. It is concluded that the per capita GDP elasticity coefficient of Xinjiang and the five Central Asian countries is 1.59 and 0.69, and the economic aggregate GDP of both sides plays no significant role in bilateral trade.Zhou et al[8] deeply analyzed four factors affecting the total import and export trade of Sichuan province. Based on the historical data from 1996 to 2014, established a logarm-linear model, adopted gradual regression method to fit the model, and finally put forward relevant suggestions in combination with the conclusions of the model.Wei et al[9] use the time-varying stochastic frontier gravity model to measure the import trade potential, technological efficiency and influencing factors based on the import trade data of China and 17 CEE countries from 2011 to 2018, indicating that the import trade potential of China and CEE countries is large, and there is a great imbalance among different countries.

At present, the research on the impact of import and export trade is mainly focused on a single macro perspective at a large regional or national level, while there are fewer comprehensive studies on specific regions with specific conditions; in addition, most of the research is not highly accurate, and there is no in-depth research on the degree of influence of each indicator on import and export from a specific micro perspective.

Therefore, this paper takes Jiangsu Province, China, as an example, and mines the influence of macroeconomic factors on the total import and export of foreign trade in Jiangsu Province by

constructing an algorithm. The regional economy will be taken as the research object, and the main influencing factors will be determined by rooting in previous research theories under the comprehensive consideration of factors such as China's accession to the World Trade Organization and the U.S. subprime mortgage crisis, and the structure, characteristics and training algorithm of RBF neural network will be used to build a multi-factor nonlinear time series forecasting model by applying the neural network according to the mapping relationship existing between Jiangsu province's import and export and its influencing factors.

This paper constructs a system of key indicators by comparing various economic indicators, adding financial assessment indicators, force majeure factors and other explanatory variables to the previous model, and analyzing the specific degree of influence of each indicator on trade import and export by constructing a neural network model. By comparing the importance of different indicators, we can see which macro factors can be adjusted to improve the trade import and export situation to a greater extent, and at the same time provide ideas for studying the influence factors of import and export in other regions of China, and provide templates and suggestions for high-quality economic development.

Compared with previous studies based on macroeconomic models, this paper only makes a small number of corrections to the weights and thresholds for each sample, and conducts a cointegration analysis on the import and export trade of Jiangsu Province, in order to break through the limitations of previous studies and make the results of empirical analysis more convincing.

2. Construction of regional import and export influence factor index system

2.1 Comprehensive regional economic strength

The indicators of GDP, money supply, consumer price index, foreign trade infrastructure construction level and regional science and technology development level have a large load. These indicators explain to the greatest extent the level of economic development of a region, the level of industrial output, fiscal revenue, consumer power, basic security capacity, the level of scientific and technological innovation, the level of resource utilization, etc., and are important indicators of the overall strength of a region. The comprehensive economic strength of a region determines the direction, mode, scale and quality of its foreign trade. The stronger the comprehensive strength, the larger the scale, the weaker the trade dependence, the stronger the initiative of foreign trade, and the structure of import and export gradually tends to improve.

Therefore, in this paper, the following indicators are selected in this area: gross product (X_{11}), money supply (X_{12}), consumer price index (X_{13}), level of foreign trade infrastructure development (X_{14}) and level of regional scientific and technological development (X_{15})

2.2 Level of financial development

The improvement of the level of financial development makes the production efficiency increase and the transaction cost decrease, which expands the market demand for import and export, effectively raises the national income level and promotes trade development. At the same time, the development of import and export trade accelerates the speed of economic development and promotes the circulation of capital, which in turn accelerates the development of financial innovation, and trade liberalization creates good conditions for financial liberalization. From three geographical areas of Jiangsu province, there are differences in the process of financial reform and the scale of trade and the lag of real economic reform in northern, central and southern Jiangsu, and different cities have their own different planning and positioning in terms of the effect of credit support of capital to the trade field. Therefore, studying the realistic path of financial development in Jiangsu Province to promote the upgrading of foreign import and export trade structure can further strengthen the financial support for trade development and promote the coordinated development of trade and finance.

Therefore, the following indicators are selected in this paper: the scale of financial development (total deposits and loans of financial institutions/nominal GDP, X_{21}), the efficiency of financial

development (ratio of loans to deposits of financial institutions, X_{22}), the scale of regional social financing (X_{23}), the openness of financial markets (X_{24})

2.3 World Economic Situation

With the globalization of trade and the continuous high growth of China's economy and the improvement of its manufacturing capacity, China's trade surplus is expanding year by year. From the international perspective, the global economic growth rate, the trade surplus/deficit situation and the RMB exchange rate have also become important factors affecting the regional import/export situation. Among them, the change in the RMB exchange rate becomes the main factor affecting China's economy. A flexible RMB exchange rate can maximize the cushioning of the international economic environment to the huge impact on China's economic environment and also improve the exchange rate risk of China's import and export trade enterprises. When considering import and export, it is important to take into account the international economic development and make appropriate policies to stabilize the RMB exchange rate in order to promote stable economic growth.

Therefore, the following indicators are selected in this paper: global economic growth rate (X_{31}), the RMB exchange rate (X_{32}), trade surplus/deficit situation (X_{33})

2.4 International Social Environment and Policy Orientation

At the end of 2019, the new crown virus began to spread rapidly in the world, which not only made the global economy in trouble, but also increased the uncertainty of the construction of "One Belt, One Road", and made the international market environment more volatile, and the import and export of various countries were also affected to a great extent. At the same time, the trade war between China and the United States, the rapid devaluation of the RMB, the loose monetary policy of European countries and other international situations and the various economic initiatives and policies introduced by Chinese governments at all levels have also played a role in import and export to varying degrees. The various trade policies adopted by various countries towards China and the degree of China's protection for exporters are measured by the degree of trade barriers; due to the impact of irresistible environmental factors such as epidemics, the force majeure factor (0-1 model) is used.

Therefore, the following indicators are selected in this paper in this area: the degree of trade barriers (X_{41}), force majeure factors (X_{42})

In summary, the indicator system constructed in this paper is shown in Table 1.

Table 1 Table of basic indicators

Tier 1 Indicators	Secondary indicators	Unit	Reference
Comprehensive regional economic strength (X_1)	GDP (X_{11})	Billion	[10]
	Money supply (X_{12})	Yuan	
	CPI(X_{13})	Point	
	Foreign trade infrastructure development level (X_{14})	million tons	
	Regional level of scientific and technological development (X_{15})	individual	
Level of financial development (X_2)	Scale of financial development (X_{21})	\	[11], [12]
	Financial development efficiency (X_{22})	\	
	Regional social financing scale (X_{23})	Billion	
	Degree of financial market openness (X_{24})	billion	
State of the World Economy (X_3)	Global Economic Growth Rate (X_{31})	%	[13]

	Renminbi exchange rate (X_{32})	¥/$	
	Trade surplus/deficit situation (X_{33})	billion	
International Social Environment and Policy Orientation (X_4)	Degree of Trade Barriers (X_{41})	\	[14], [15]
	Force majeure factors (X_{42})	\	

3. ntroduction of ANN-RBF model

3.1 ANN method

ANN (Artificial Neural Network) is an information processing system based on some abstraction, simplification and simulation of the organization and operation mechanism of the human brain, using mathematical models to mimic the activity of a large number of processing units (neurons) for large-scale high-dimensional data processing and analysis.ANN transforms low-dimensional nonlinear mapping of high-dimensional data into human-understandable output.

An ANN contains input layer, implicit layer and output layer, each layer contains several neurons. Gradually adjusting the method of changing the weight of neurons connection, and achieving the purpose of processing information and simulating the relationship between input and output. The specific processing method is shown in Figure 1.This method does not need to know the exact relationship between inputs and outputs and a large number of parameters, but only non-constant parameters. ANN has obvious advantages over traditional data processing methods in dealing with fuzzy data, random data, and non-linear data, and is especially suitable for systems with large scale, complex structures, and unclear information.

ANN mainly includes the following three types: feedforward neural networks, recurrent neural networks and self-organizing competitive neural networks.

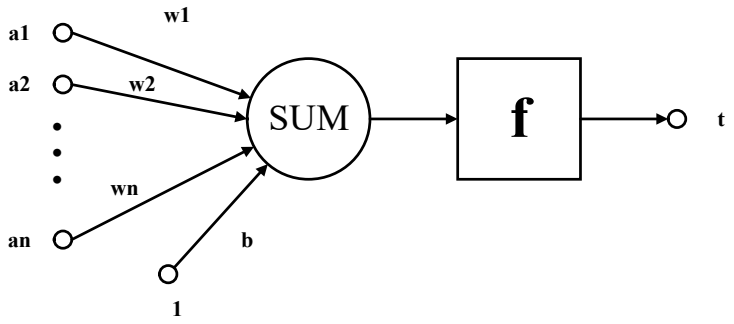

Figure 1 Schematic diagram of neurons

3.2 RBF method

Radial Basis Function Neural Network is a class of commonly used three-layer feed-forward neural networks (input layer $\xrightarrow{Non-linear}$ implicit layer $\xrightarrow{Linear\ function(Neuronal\ excitation\ function)}$ Output layer), based on the mechanism of local regulation and overlapping receptive domains in the bionic human brain cortex, the human brain neural network is abstracted and simplified into a mathematical model. The basic structure is shown in Figure 2. Compared with other types of artificial neural networks, RBF networks have features such as optimal completion of mapping functions, simple network structure, fast learning and training convergence, unique best approximation and no local minimal problem existence and strong generalization ability, powerful in data analysis and data prediction [16].

Overall, the RBF neural network model is able to establish an intrinsic link between a set of related but scattered indicators and obtain more accurate prediction results by inputting new indicator values.

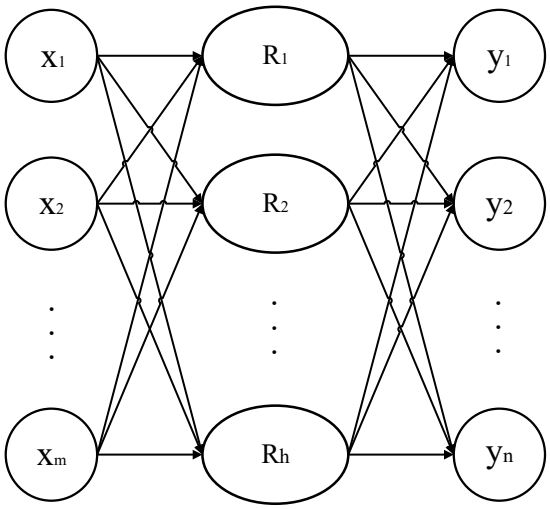

Figure 2 Schematic diagram of RBF neural network structure

The radial basis function commonly used in RBF neural networks is the Gaussian function$R_i(x) = exp(-\frac{||x-c_i||^2}{2\sigma_i^2}), i = 1,2,\ldots,n$ (the activation function commonly used in the hidden layer), which transforms the data into a high-dimensional space and takes a back-propagation approach to train the data for simulation. It has the advantages of (1) simple and analytic mathematical expression and easy theoretical analysis, (2) radial symmetry, and (3) good smoothness with the existence of derivatives of any order [17].

The RBF neural network is learned in two stages: the first stage determines the clustering centers and widths of the RBF neural network through unsupervised learning; the second stage solves the weights from the hidden layer to the output layer through supervised learning. The network itself sometimes corrects the parameters of both the implicit layer and the output layer according to the sample signal at the end of the second stage of learning to further improve the prediction accuracy of the network.

This can be described specifically as [18]

Step1:Find the center vector using K-means algorithm u_i

Step2:Use KNN(K Nearest Neighbor)rule to calculate σ ,the formula is as follows.

$$\sigma_i = \sqrt{\frac{1}{K}\sum_{k=1}^{K}||u_k - u_i||^2} \quad (1)$$

Step3:W can be obtained by using the least squares method, and the specific process is shown in Figure 3:

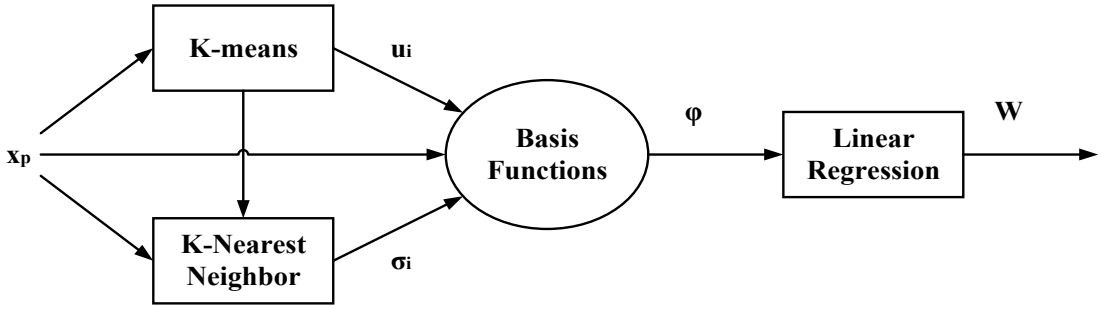

Figure 3 RBF learning process in the general case

4. The setting of test indicators

When using RBF neural network to set up the model, the economic theories and processing methods cited may have imperfections, and the limitations in cognition of the problem may lead to results with specificity and inaccuracy; in addition, the statistical data or other information used to estimate the parameters may not be very reliable, and the data selected may be more likely to use data from the period when the economy underwent drastic fluctuations or huge changes in the situation, and the data The formation is contingent and does not truly represent the economic relationship under study, or there will be sampling error by chance because the sample is too small. Therefore, it is necessary to judge the estimated parameters with tests to determine whether they are economically significant and whether they have sufficient statistical reliability.

The goodness-of-fitR^2 and root mean square error RMSE as the test indicators.

Using goodness-of-fitR^2 : As an absolute measure of how well the sample regression line fits the data, the sum of squares of the explanatory variables can be decomposed into explainable and unexplainable parts of the model according to the sum-of-squares decomposition formula in the presence of a constant term. If the weight of the part that can be explained by the model is larger (R^2 the closer to 1), the better the fit of the sample regression line ,$R^2 \in [0,1]$.

$$R^2 = 1 - \frac{MSE(\hat{y}, y)}{Var(y)} \tag{2}$$

The RMSE is a measure of the deviation between the observed value and the true value, which is related to the number of samples, and the RMSE is first squared and then squared, which magnifies the difference between the larger errors and provides a more intuitive representation of the deviation between the observed value and the true value of the data. In the measurement to make the value of RMSE ,$RMSE \in [0, +\infty)$,the smaller the significance, because its value reflects its maximum error is also relatively small.

$$RMSE = \sqrt{\frac{1}{m}\sum_{i=1}^{m}(y_{test}^{(i)} - \hat{y}_{test}^{(i)})^2} \tag{3}$$

5. Empirical calculations

5.1 Data collection and subject identification

From 2012 to 2021, the total import and export volume of China's Jiangsu Province grew from RMB 345.98 billion to RMB 521.36 billion. Even with the rampant epidemic, the scale of imports and exports in Jiangsu, a major foreign trade province, accounted for 13.3% of China's imports and exports in 2021, a percentage value that continues the inertia of previous years and is an important sign of Jiangsu's position as a major province of China's open economy. The rapid development of foreign trade in Jiangsu Province has played a very important role in driving China's economic growth.

Since the foreign import and export trade of Jiangsu Province is influenced by international situation and policies, the study of the influencing factors of import and export of Jiangsu Province is of great practical significance to explore the relationship between foreign trade and economic growth, and can also provide typical samples and methods to study the analysis of import and export factors of other regions, so as to better promote economic growth.

Therefore, this paper collects data from Jiangsu Province, China, from 2000 to 2021 based on the China Economic and Social Development Statistics Database, National Bureau of Statistics, Jiangsu Provincial Bureau of Statistics and other platforms, and mines the influence of macroeconomic factors on the total import and export of foreign trade in Jiangsu Province by constructing an algorithm. The regional economy will be taken as the research object, and the main influencing factors will be determined by rooting in previous research theories under the comprehensive consideration of China's accession to the World Trade Organization and the U.S. subprime crisis, and the structure,

characteristics and training algorithm of RBF neural network will be used to establish a multi-factor nonlinear time series forecasting model by applying the neural network according to the mapping relationship existing between Jiangsu province's import and export and its influencing factors. Descriptive statistics of indicators were obtained as shown in Table 2.

Table 2 Indicator data table

Indicator Name/Unit	Max	Min	Mean	MID
GDP (X_{11}) / billion	116364.20	8853.69	50008.18	45111.54
M2(X_{12})/billion	2382899.56	134610.26	953979.19	788721.35
CPI(X_{13})/point	105.40	99.20	102.30	102.25
Cargo throughput of coastal ports (X_{14})/million tons	39461.36	1099.76	18628.62	17462.56
Number of research institutions (X_{15})/one	27828.00	1784.00	12918.00	8291.00
Total deposits and loans of financial institutions / Nominal GDP (X_{21})	3.18	1.68	2.38	2.43
Ratio of loans to deposits of financial institutions (X_{22})	0.96	0.69	0.75	0.73
Social financing scale (X_{23}) / billion	34453.00	792.08	11781.75	9840.22
FDI (X_{24}) / USD billion	357.60	64.24	225.40	251.28
Global Economic Growth Rate (X_{31})/%	5.41	-5.20	3.46	4.29
Renminbi exchange rate (X_{32})/￥/$	8.28	6.05	7.13	6.87
Jiangsu Province Trade Surplus Data (X_{33}) / USD billion	-41.37	-1635.16	-815.52	-846.46
TC index (the difference between a country's import and export trade as a share of total import and export trade) (X_{41})	0.15	0.03	0.08	0.08
Force majeure factors (X_{42})	1.00	0.00	0.18	0.00

5.2 Algorithm operation based on test index

Based on SPSS and other software, this paper substitutes GDP, M2, CPI, coastal port cargo throughput, number of research institutions, financial institutions' deposit and loan, social financing scale, trade surplus data as well as global economic growth rate, RMB exchange rate, and China TC index of Jiangsu province of China from 2000 to 2021, by adjusting the number of hidden layer neurons from 9-26, step 1, respectively. The algorithm accuracy test was performed using RMSE and R^2 , and the results were obtained as shown in Table 3.

Table 3 Algorithm accuracy check table

Number of hidden layer neurons	RMSE	R2
6	9.41185	0.97364
7	9.42161	0.97735
8	11.21025	0.95207
9	4.40966	0.98417
10	8.34822	0.96185
11	8.34821	0.95404
12	8.34821	0.95482
13	9.17227	0.96408
14	9.22694	0.96584
15	9.22694	0.96574
16	9.22694	0.96550
17	9.22694	0.96567
18	9.10723	0.96884

19	9.10723	0.96884
20	9.10723	0.96884
21	9.10723	0.96884
22	9.10723	0.96884
23	9.10723	0.96884
24	9.10723	0.96884
25	9.10723	0.96884
26	7.37389	0.99640

As can be seen from Table 3, when the number of hidden layer neurons is set to 9, the algorithm converges at this time and the results are more desirable. At this time, the RMSE is only 4.4097, and the fluctuation is still smaller compared with the other groups 7~9 under the premise of amplifying the gap between larger errors, which indicates that the deviation between the observed and true values of this group of data is smaller and the accuracy of the operation results is higher. At this time, the R^2 value is 0.9842, which is closer to 1 compared to the results of 0.95~0.98 of other groups, indicating that the regression line of this group of samples fits the data to a better extent, and the part of the model that can be explained accounts for a larger proportion. Although the R^2 of group 9 is not as high as that of group 26, considering the effects of RMSE and R^2 together, the arithmetic results of group 9 are considered to be more in line with the required model requirements.

5.3 Selecting the optimal group for contribution analysis

According to the results of the algorithm accuracy test, the 9th operation result is selected in this paper, and the radial basis function of SPSS software neural network is used to standardize the importance analysis of each indicator, and the scale strain and covariate rescaling are taken to be standardized, and the histogram analysis is conducted from the obtained results to obtain the influence of each factor on the total import and export, as shown in Table 4.

Table 4 Importance of standardization of each indicator

Tier 1 Indicators	Secondary indicators	Importance	Importance of Standardization
Comprehensive regional economic strength (X_1)	GDP (X_{11})	0.058	50.9%
	Money supply (X_{12})	0.064	56.0%
	CPI(X_{13})	0.061	54.9%
	Foreign trade infrastructure development level (X_{14})	0.055	48.2%
	Regional level of scientific and technological development (X_{15})	0.048	42.0%
Level of financial development (X_2)	Scale of financial development (X_{21})	0.065	56.9%
	Financial development efficiency (X_{22})	0.079	69.7%
	Regional social financing scale (X_{23})	0.083	73.0%
	Degree of financial market openness (X_{24})	0.067	58.5%
State of the World Economy (X_3)	Global Economic Growth Rate (X_{31})	0.083	72.7%
	Renminbi exchange rate (X_{32})	0.066	58.3%

	Trade surplus/deficit situation (X_{33})	0.070	61.2%
International Social Environment and Policy Orientation (X_4)	Degree of Trade Barriers (X_{41})	0.114	100.0%
	Force majeure factors (X_{42})	0.025	22.3%

The specific analysis results are shown in Figure 4~Figure 7.

Figure 4 Regional comprehensive strength (X_1) indicators

As shown in Figure 4, it can be seen that the influence of the secondary indicators under the regional comprehensive strength (X_1) on the foreign trade import and export of Jiangsu Province is not very different, and the standardized importance fluctuates between 0.4 and 0.6. Among them, money supply (X_{11}) and CPI (X_{12}) have a relatively large influence on import and export, with standardized importance reaching 56% and 55% respectively, indicating that the circulation of money and the consumption ability of local residents have a strong influence on foreign import and export trade. In contrast, the standardized importance of the regional level of technological development (X_{15}) is only 42%, indicating that technological development has a relatively weak influence on the trade import and export of a region. Overall, the degree of influence of each indicator on import and export shows a positive correlation.

Figure 5 Level of financial development (X_2) indicators

As shown in Figure 5, it can be seen that the indicators included in the level of financial development (X_2) have a significant influence on the trade import and export of Jiangsu Province, with the standardized importance fluctuating between 0.55 and 0.75, which shows that the development of the financial sector plays an important role in promoting foreign trade import and export. Among them, the influence of financial development efficiency (X_{22}) and social financing scale (X_{23}) is relatively more significant, with standardized importance reaching 0.70 and 0.73, indicating that the development of the scale of financial institutions and the expansion of social financing have a greater positive impact on import and export trade, and the correlation of the other two indicators is also good, with standardized importance close to 0.60. Therefore, in order to develop import and export trade, attention should be paid. Therefore, if we want to develop import and export trade, we should pay attention to the scale expansion and structure optimization of the financial industry.

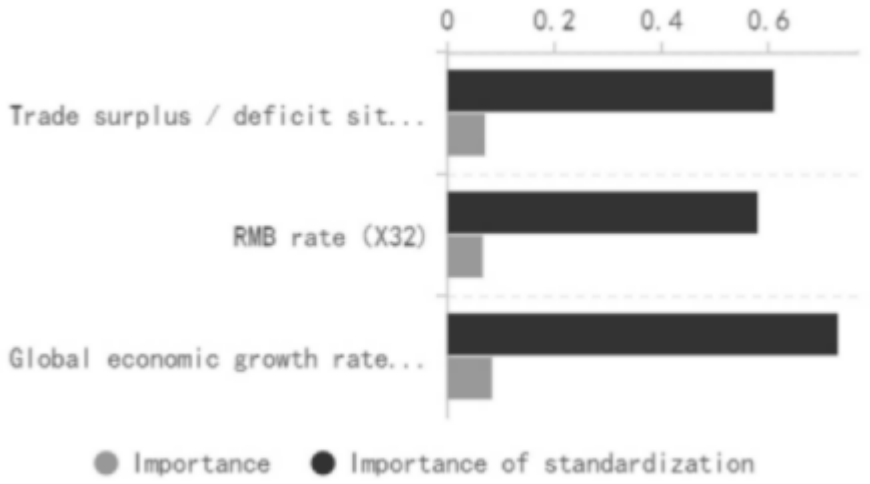

Figure 6 World Economic Situation (X_3) Indicators

As shown in Figure 6, considering the world economic situation, the impact of relevant indicators and trade import and export of Jiangsu Province still shows a strong positive correlation, which shows that the import and export are closely related to the real-time dynamic changes of the whole world, the economic situation and the comprehensive strength and influence of a region in relation to the whole world. Among them, the standardized significance of the global economic growth rate (X_{31}) reaches 0.73, and this indicator has a significant impact on trade import and export, which shows that economic development still plays a leading role in the development of trade in each region, and the economic prosperity brings about the expansion of trade scale of import and export. The trade surplus and deficit (X_{33}) and the RMB exchange rate (X_{32}) also show a strong influence, which shows that a country's position in the international arena also plays a role in the trade development of the region.

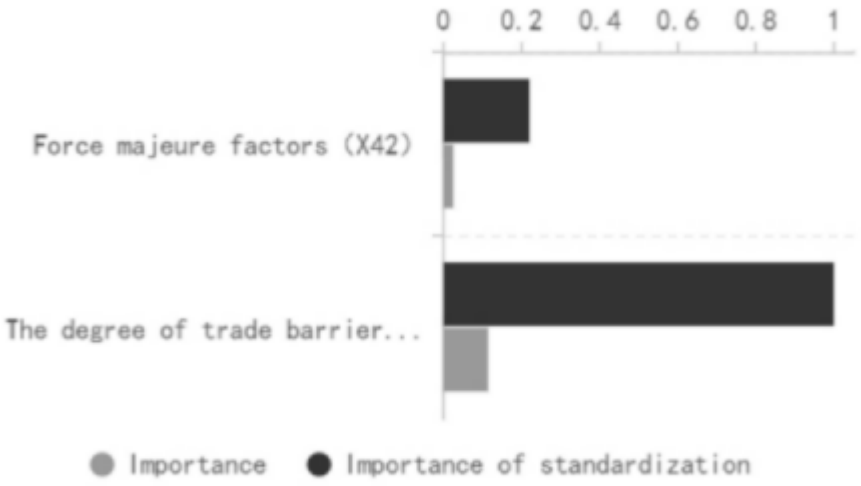

Figure 7 International Social Environment and Policy Orientation (X_4) Indicators

As shown in Figure 7, from the international social environment and policy-oriented indicators, the force majeure factor (X_{42}) has a weak ability to influence exports and imports, and considering the strong timeliness of the selected data, the events that have a significant impact on the economy during this time period are mainly concentrated after the end of 2019, which accounts for a relatively small impact on the sample. The TC index taken the measure of the degree of trade barriers, on the other hand, is overly correlated with the volume of import and export trade, and thus appears to have too much standardized importance. For this indicator, due to the existence of its uncertainty and correlation factors, as well as the incompleteness of the construction of the indicator system, its share of the situation should be weakened in the construction of the neural network.

6. Conclusion

In order to investigate the influencing factors of import and export trade, this paper takes Jiangsu province of China as an example, takes into account the international background environment such as China's accession to the World Trade Organization, the U.S. subprime mortgage crisis, and the new crown epidemic, determines the main influencing factors by rooting in previous research theories, adopts the structure, characteristics and training algorithm of RBF neural network, and applies the mapping relationship between the import and export of Jiangsu province and its influencing factors. A multi-factor nonlinear time series prediction model was developed based on the mapping relationship between the import and export of Jiangsu Province and its influencing factors.

Firstly, this paper constructs the algorithm index system from four dimensions: comprehensive regional economic strength, financial development level, world economic condition and international social environment and policy orientation around the influencing factors related to import and export trade, and collects the relevant data from 2000 to 2021. Then, we used the radial basis function in SPSS software to calculate and analyze all the data, and used RMSE and R2 to check the accuracy of the algorithm by adjusting the number of hidden layer neurons. Finally, the most accurate set of data was selected from them for the important analysis of the impact of each indicator on trade import and export.

The conclusions are as follows.

(1) When the neuron is 9, the result is optimal, the RMSE is only 4.4097, and the goodness-of-fit reaches 0.9842

(2) Through further analysis of this data set, it is concluded that the indicators of the degree of trade barriers (X41), the scale of regional social financing (X23), the global economic growth rate (X31), and the efficiency of financial development (X22) are more important in influencing the region's trade exports and imports, with the importance of 0.114, 0.083, 0083, and 0.079, respectively.

This paper constructs a neural network around the data related to the foreign trade import and export of Jiangsu Province from 2000 to 2021, and finds that the degree of trade barriers, the scale of regional social financing, the global economic growth rate and the efficiency of financial development are the main factors affecting the total foreign trade import and export of Jiangsu Province. In the context of global trade stagnation due to the epidemic, the current situation of foreign trade development in Jiangsu Province should focus on the above factors to break through, consider the domestic and international economic development, accelerate its own financing scale and financial industry development, and promote the steady development of foreign trade.

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