

Analysis on the Factors Influencing the International Competitiveness of Shanxi Agricultural Products

Yaqi Jin^{1*}, Yulan Du²

¹ Nanjing University of Science and Technology, Nanjing, Jiangsu 210094, China

² Nanjing University of Science and Technology, Nanjing, Jiangsu 210094, China

*Corresponding author. Email: 1026851021@qq.com

ABSTRACT

With the further improvement of China's opening to the outside world, the export volume of agricultural products in Shanxi Province has also shown a rising state, which not only promotes the development of Shanxi's economy to a certain extent, but also benefits the growth of its agricultural industry. This article analyzes the current situation of Shanxi's agricultural exports from 2003 to 2018, and analyzes the factors affecting the international competitiveness of agricultural products, and puts forward corresponding countermeasures and suggestions for improving the international competitiveness of Shanxi's agricultural products. The purpose is to further enhance its international competitiveness.

Keywords: Agricultural product international competitiveness, factor analysis

1. INTRODUCTION

Since ancient times, agriculture has played an important role in social and economic development and is the basis for a country to flourish. Global economic development data over the years can also prove that agriculture occupies an important position in the economic construction of a country and plays a major role in promoting economic development [1]. Because the strategic position of agriculture is so important, improving the international competitiveness of agricultural products has become one of the important tasks of governments in various countries. According to Porter's "Diamond Model" theory [2], the factors affecting international competitiveness can be roughly divided into several categories, such as demand, supply, related industries, government and external environment, so the methods to enhance international competitiveness are also related to the above categories of factors. Shanxi Province is located in the central region of China. The specific location is shown in Figure 1. It is located on the border of the Loess Plateau and belongs to a temperate monsoon climate zone. There are two major rivers, the Yellow River and the Haihe River. The above conditions provide a suitable climate, sufficient water source and a broad cultivation area for the development of agriculture. Although Shanxi Province is not a major agricultural province in China, it is an important province for its characteristic agricultural development. Due to the influence of different soils and planting habits, different agricultural development areas have been produced in the province. Export is one of the three major drivers of economic development in a province, and is a major factor that must be considered to improve the level of economic development. Agriculture is also one of the important influencing factors of a province's foreign export trade, and its role cannot be ignored [3]. At present, the international

competition of agricultural products trade is becoming more and more fierce, and cultivating the international competitiveness of agricultural products has become an issue that cannot be ignored in the development of agricultural foreign trade in Shanxi Province. What is the status quo of the development of international trade of agricultural products in Shanxi Province at this stage? What are the factors that affect the international competitiveness of agricultural products? Where can we make improvements? The above three issues are the core content of this article.



Figure 1 Shanxi's position in China.

2. SHANXI PROVINCE'S AGRICULTURAL PRODUCTS EXPORT TRADE AND AGRICULTURAL INDUSTRY DEVELOPMENT STATUS

2.1. Status of Agricultural Export Trade

2.1.1. Analysis of agricultural exports

According to Figure 2, it can be seen that the export volume of agricultural products in Shanxi Province has generally shown an upward trend from 2003 to 2018. In 2002, the

export growth rate reached 79%. In 2003, the export growth rate was the highest in a year, with an increase rate of 123%. The reason for the large increase in the past two years may be related to China's accession to the World Trade Organization. China's successful accession to the World Trade Organization in 2001 marked the opening of a new chapter in its opening to the outside world, which is conducive to China's all-round and multi-level participation in international cooperation and competition, and created a good foreign trade environment for commodity exports [3]. The increase in provincial agricultural exports has created conditions. After 2004, the growth rate of agricultural exports in Shanxi Province was relatively stable, although occasionally decreased, the fluctuation range was not large.

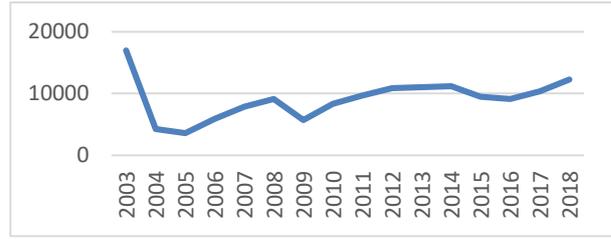
2.1.2 Analysis the Export Structure Agricultural Products

Looking at the Shanxi Provincial Statistical Yearbook [4], we can see that the structure of its agricultural product exports is mainly concentrated in the following three types: animal products, plant products, and food and wine vinegar. Animal and vegetable oils and fats are not exported every year, so no statistics are made here. Observing Figure 3, we can conclude that the export volume of the three types of agricultural products is gradually increasing, of which the largest proportion is plant products, and its fluctuation range is also the largest among the three types. The fluctuation may be due to natural disasters, etc. The impact of the external environment has reduced the yield and quality of plant products, resulting in a significant reduction in the export volume. Food, vinegar, and beverages belong to the deep-processing industry of agricultural products. The added value of their products is higher, and they also contribute to the upgrading of product structure.

2.2 Development status of agricultural industry

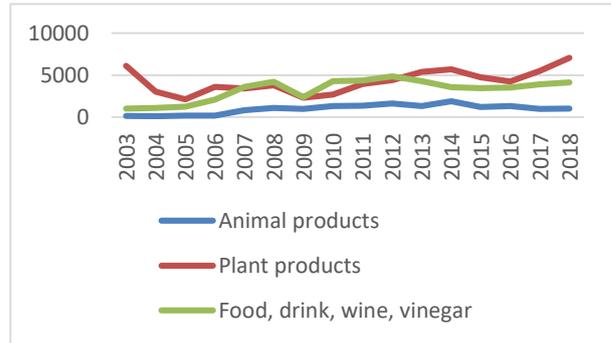
2.2.1 Analysis on the Status Quo of the Number of Employees in Agricultural Industry

According to Figure 4, from 2003 to 2018, the number of people engaged in agriculture in China has shown a downward trend. The number of employees has dropped from more than 300 million people at the beginning to more than 200 million people later, a decrease of 50%. As shown in Figure 5, the number of agricultural employees in Shanxi Province fluctuated within a range from 2003 to 2013, and it rose from 2014 to 2017. After 2017, the number of agricultural employees dropped significantly, with a drop of 4%.



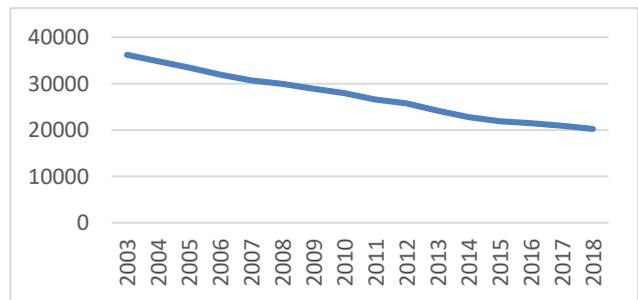
Data source: "Shanxi Provincial Statistical Yearbook"

Figure 2 Export value of agricultural products.



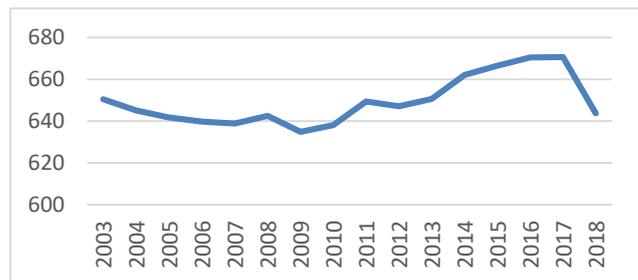
Data source: "Shanxi Provincial Statistical Yearbook"

Figure 3 Distribution of export structure



Data source: "China Statistical Yearbook"

Figure 4 Number of Chinese agricultural employees

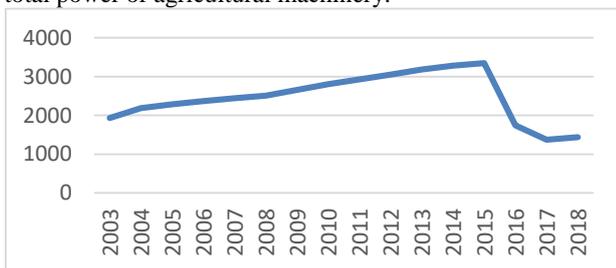


Data source: "Shanxi Provincial Statistical Yearbook"

Figure 5 Number of agricultural employees in Shanxi Province

2.2.2 Numerical analysis of total power of agricultural machinery

The total power of agricultural machinery refers to the total power of various power machinery used in agricultural production in a region, which reflects the level of agricultural technology development in a region. Figure 6 shows the change trend of the total power of agricultural machinery in Shanxi Province from 2003 to 2018. Before 2015, the total power of agricultural machinery in Shanxi showed an upward trend, and the growth rate reached 73% in the twelve years from 2003 to 2015. After 2015, its amount has shown a downward trend. One of the reasons for the change is that the decline in the number of agricultural workers in Shanxi Province has led to a decline in the amount of machinery used, which has led to a decline in the total power of agricultural machinery.



Data source: "Shanxi Provincial Statistical Yearbook"

Figure 6 Total Power of Agricultural Machinery in Shanxi Province

3. EMPIRICAL ANALYSIS

According to Porter's "Diamond Model" theory [2], this paper selects 10 indicators as factors affecting the international competitiveness of Shanxi's agricultural products, extracts public factors from these 10 indicators through factor analysis, and then uses indicators representing international competitiveness as dependent variables, public factors are used as independent variables for regression analysis, and then the 10 indicators are brought back into the regression equation to obtain the degree of influence of each indicator on the international competitiveness of Shanxi's agricultural products.

3.1. Data Selection and Organization

According to Porter's "Diamond Model" theory, select agricultural planting area (X1), total power of agricultural machinery (X2), number of agricultural employees (X3), agricultural production material price index (X4), fertilizer application (X5) and average Education years (X6) as an influencing factor on the supply of agricultural products; residents' disposable income (X7) as an influencing factor on demand; the affected area (X8) as an influencing factor on the external natural environment; government expenditure on agriculture and forestry affairs (X9) as an influence on

government policy support Factor; freight volume (X10) as a factor in related industries [5]. This paper studies the impact of changes in the supply and demand of agricultural products from 2003 to 2018 on the international competitiveness of Shanxi's agricultural products. All data are derived from the Shanxi Statistical Yearbook [4] and China Statistical Yearbook [6]. Due to the different measurement standards of the data, using SPSS software to standardize all data before modeling is conducive to the establishment of research models.

3.2. Correlation Coefficient Matrix Analysis

In factor analysis, the existence of the correlation coefficient matrix is to judge whether the selected index meets the requirements of factor analysis, which is the premise of doing factor analysis. We use spss23.0 version to perform standardized dimensionality reduction processing on the selected original indicator values, and we can get the following correlation coefficient matrix, see Table 1. From Table 1, we can see that the correlation between the various indicators is high, and common factors can be extracted. This set of indicators is suitable for factor analysis.

3.3. KMO Test and Bartlett Spherical Test

The function of KMO(Kaiser-Meyer-Olkin) test is mainly used for multivariate statistical analysis to determine whether the selected index is suitable for factor analysis, while Bartlett test is based on the correlation coefficient matrix between variables [7]. When the correlation between variables is large, it is suitable for extraction Common factors to simplify the indicators. Use spss23.0 version to perform KMO test and Bartlett sphere test to get the results shown in Table 2. It can be seen from the test results that the value of KMO is 0.748 > 0.6, and the value of KMO can be factored as long as it is greater than 0.5. Therefore, it can be seen that this set of indicators is suitable for factor analysis, and the associated probability of Bartlett's sphericity test is less than 0.05, it indicates that the null hypothesis is not true, and the indicators in this group are correlated, which is suitable for factor analysis. The indicators selected in this article have passed two tests at the same time, which proves that this set of indicators is suitable for factor analysis.

3.4. Determine the Number of Common Factors

Principal component analysis is used to determine the number of common factors. The factor with the characteristic value greater than 1 is selected as the common factor, and the total amount of information about the reflect of the common factor to the original data exceeds 85%. Through the analysis of spss23.0, Table 3 can be obtained. The table shows that three common factors can be selected, and the explanatory power of these three common factors exceeds 93%.

3.5. Common Factor Analysis

Table 4 shows the interpretation strength of the extracted common factors for each indicator. It can be seen from the table that the information extracted by the price index of agricultural production materials is 82.3% and the affected area is 79.7%, the information extracted by the other 8 indicators exceeds 90%, indicating that the selected three common factors are appropriate of.

3.6. Factor Loading Matrix

The load matrix(Table 5) is mainly used to analyze the carrying degree of the extracted common factors to the selected index information. According to Table 5, the common factor F1 mainly bears most of the information of X1, X3, X5, X7, X8, X9, X10, the common factor F2 mainly bears most of the information of X2 and X6, and the common factor F3 mainly Undertakes most of the information of X4.

3.7. Results of Factor Analysis

Using spss 23.0 to calculate factor score coefficients, the following component score coefficient matrix is obtained, and the factor score expression can be derived from this matrix.According to the results in Table 6, we can get the specific expression of factor score, as shown below:

$$F_1 = 0.181X_1 - 0.034X_2 - 0.179X_3 + 0.154X_4 + 0.133X_5 + 0.155X_6 + 0.167X_7 + 0.112X_8 + 0.123X_9 + 0.195X_{10} \tag{1}$$

$$F_2 = 0.081X_1 - .0039X_2 - 0.073X_3 + 0.664X_4 + 0.02X_5 + 0.006X_6 + 0.03X_7 + 0.559X_8 - 0.075X_9 + 0.15X_{10} \tag{2}$$

$$F_3 = -0.061X_1 + 0.699X_2 + 0.004X_3 - 0.178X_4 + 0.304X_5 + 0.014X_6 - 0.092X_7 + 0.127X_8 + 0.116X_9 - 0.272X_{10} \tag{3}$$

3.8 Regression analysis

Trade competitiveness (Y) is one of the important indicators to measure international competitiveness [8]. It represents the share of a country' s net exports of a certain product in its total imports and exports of that product, and its value range is between (-1,1). The closer the value of trade competitiveness is to 1, the greater the international competitiveness of a certain product of the country, and the closer to -1, the lower its international competitiveness [9]. Here we use trade competitiveness as an indicator to measure the international competitiveness of agricultural

products in Shanxi Province. Since F1, F2, and F3 are the public factors of the selected indicators, use these three public factors to do regression analysis on trade competitiveness, and then put 10 indicators into the regression equation [10], you can get the competitiveness of each indicator influence level. The regression equation is as follows:

$$Y = \alpha_0 + \alpha_1 F1 + \alpha_2 F2 + \alpha_3 F3 \tag{4}$$

t (0.516) (0.697) (-0.388) (0.281)

It can be seen that all three common factors have passed the test.

Take the formula 123 index into (4) to get:

$$Y = 0.077588X_1 + 0.187853X_2 - 0.095315X_3 - 0.200312X_4 + 0.170365X_5 + 0.109641X_6 + 0.078907X_7 - 0.103141X_8 + 147427X_9 - 0.001283X_{10} \tag{5}$$

According to the regression equation (5), the following conclusions can be obtained:

- ① On the supply side: agricultural planting area (X1) and average years of education (X6) are directly proportional to trade competitiveness. Expanding the acreage of agricultural products will increase the total output of agricultural products, thereby increasing the supply on the market, which is conducive to expanding market share and increasing the international competitiveness of agricultural products. The increase in the number of years of education per capita will improve the development level of agricultural technology, which is conducive to the cultivation of new varieties, thereby forming a characteristic industrial chain and increasing the added value of products. The number of agricultural workers (X3) and the affected area (X8) are inversely related to trade competitiveness. Natural calamities will impair the growth of crops, thereby affecting unit crop yields.
- ② On the demand side: the improvement of residents' disposable income (X7) and trade competitiveness present a positive relationship. Because the increase in residents' disposable income will increase the demand for products, thereby increasing the demand for agricultural products, and promoting its trade competitiveness [11].
- ③ Government policy support: government expenditure on agriculture and forestry (X9) promotes trade competitiveness. The increase in government subsidies will increase farmers' enthusiasm for planting and increase the degree of mechanized use of agricultural products.
- ④ In terms of related industries: freight volume (X10), total power of agricultural machinery (X2) and fertilizer application (X5) play a positive role in enhancing trade competitiveness. Traffic facilitation has always been a powerful driving force for the development of all walks of life. The more convenient the transportation, the more conducive to the transportation of goods, reducing time costs and reducing losses. The increase in the power of agricultural machinery represents an increase in the degree of mechanization in agricultural production, which is

conducive to improving agricultural planting efficiency and reducing unit production costs [12]. The price index of agricultural means of production (X4) shows a reverse relationship with trade competitiveness. This is because the increase in the price of agricultural materials will increase the unit production cost of crops, which will increase the supply price of crops, which has an impact on the trade competitiveness of crops negative effects.

4. SUGGESTIONS AND CONCLUDING REMARKS

Based on the above analysis, we can put forward some policy recommendations to improve the international competitiveness of Shanxi's agricultural products: ① In terms of supply: Shanxi Province can increase investment in education and reserve talents for improving agricultural technology [13]. It is also possible to establish an agricultural research institute and encourage it to cooperate with universities to ameliorate existing crop varieties, better develop special agricultural products [14], and make for its core competitiveness; the government should establish a natural disaster early warning mechanism and strengthen environmental monitoring. At the same time, a farmer registration manual should be established so that when abnormal situations occur, farmers can be notified in time to take relevant measures to resist risks and reduce lose due to

changes in the natural environment; ② In terms of demand: increase the income level of residents, gradually increase the minimum wage standard, and increase the purchasing power of residents; ③ In terms of government policy support: Shanxi Province can increase subsidies for farmers to purchase agricultural machinery and increase the utilization rate of agricultural machinery, thereby reducing the unit cost of agricultural products. It is also possible to increase preferential policies for agricultural and sideline product processing enterprises, cultivate industrial clusters of characteristic agricultural products, exert the cluster effect, and increase their international competitiveness [15]; ④ Related industries: strengthen research on cold chain transportation technology to reduce the wastage of fresh agricultural products, increasing the speed of product transportation and expanding the scope of product transportation will help increase market share and enhance its international competitiveness.

At present, the government is actively taking a series of measures to improve the international competitiveness of agricultural products. In addition, agricultural producers and agricultural enterprises are actively strengthening their own construction, improving the original production methods, and improving the production efficiency and quality of products. In the future, the international competitiveness of Shanxi's agricultural products is bound to be greatly improved.

Table 1 Correlation coefficient matrix

| | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X8 | X9 | X10 |
|-----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| X1 | 1 | -0.056 | -0.986 | -0.396 | 0.825 | 0.971 | 0.977 | -0.324 | 0.924 | 0.883 |
| X2 | -0.056 | 1 | -0.031 | 0.013 | 0.44 | 0.022 | -0.1 | 0.326 | 0.147 | -0.28 |
| X3 | -0.986 | -0.031 | 1 | 0.376 | -0.879 | -0.978 | -0.983 | 0.337 | -0.962 | -0.873 |
| X4 | -0.396 | 0.013 | 0.376 | 1 | -0.305 | -0.423 | -0.411 | 0.537 | -0.462 | -0.287 |
| X5 | 0.825 | 0.44 | -0.879 | -0.305 | 1 | 0.878 | 0.807 | -0.221 | 0.921 | 0.609 |
| X6 | 0.971 | 0.022 | -0.978 | -0.423 | 0.878 | 1 | 0.962 | -0.399 | 0.952 | 0.828 |
| X7 | 0.977 | -0.1 | -0.983 | -0.411 | 0.807 | 0.962 | 1 | -0.44 | 0.948 | 0.918 |
| X8 | -0.324 | 0.326 | 0.337 | 0.537 | -0.221 | -0.399 | -0.44 | 1 | -0.445 | -0.363 |
| X9 | 0.924 | 0.147 | -0.962 | -0.462 | 0.921 | 0.952 | 0.948 | -0.445 | 1 | 0.777 |
| X10 | 0.883 | -0.28 | -0.873 | -0.287 | 0.609 | 0.828 | 0.918 | -0.363 | 0.777 | 1 |

Table 2 KMO test and Bartlett spherical test results

| | | |
|--|-------------------------------|---------|
| KMO sampling appropriateness number | | 0.748 |
| Bartlett sphericity test | Approximate chi-square | 253.561 |
| | Degree of freedom | 45 |
| | Significance | 0 |

Table 3 Factor eigenvalues and contribution rate

| Ingredient | Initial eigenvalue | | | Extract the sum of squared loads | | |
|------------|--------------------|-----------|----------------|----------------------------------|-----------|----------------|
| | Total | Variance% | Accumulation % | Total | Variance% | Accumulation % |
| 1 | 6.769 | 67.692 | 67.692 | 6.769 | 67.692 | 67.692 |
| 2 | 1.55 | 15.497 | 83.189 | 1.55 | 15.497 | 83.189 |
| 3 | 1.045 | 10.448 | 93.637 | 1.045 | 10.448 | 93.637 |
| 4 | 0.422 | 4.223 | 97.86 | | | |
| 5 | 0.13 | 1.302 | 99.162 | | | |
| 6 | 0.037 | 0.371 | 99.532 | | | |
| 7 | 0.027 | 0.272 | 99.805 | | | |
| 8 | 0.014 | 0.135 | 99.94 | | | |
| 9 | 0.004 | 0.038 | 99.978 | | | |
| 10 | 0.002 | 0.022 | 100 | | | |

Table 4 Common factor variance

| | Initial | Extract |
|------------|---------|---------|
| X1 | 1 | 0.973 |
| X2 | 1 | 0.967 |
| X3 | 1 | 0.994 |
| X4 | 1 | 0.823 |
| X5 | 1 | 0.965 |
| X6 | 1 | 0.968 |
| X7 | 1 | 0.993 |
| X8 | 1 | 0.797 |
| X9 | 1 | 0.973 |
| X10 | 1 | 0.911 |

Table 5 Load matrix

| | Component matrix | | | Rotated component matrix | | |
|------------|------------------|--------|--------|--------------------------|--------|--------|
| | Ingredient | | | Ingredient | | |
| | 1 | 2 | 3 | 1 | 2 | 3 |
| X1 | 0.974 | 0.022 | 0.156 | 0.97 | -0.174 | -0.033 |
| X2 | 0.004 | 0.888 | -0.422 | 0.009 | 0.103 | 0.978 |
| X3 | -0.986 | -0.091 | -0.117 | -0.981 | 0.175 | -0.046 |
| X4 | -0.484 | 0.313 | 0.701 | -0.212 | 0.875 | -0.111 |
| X5 | 0.868 | 0.447 | -0.108 | 0.855 | -0.141 | 0.463 |
| X6 | 0.981 | 0.057 | 0.044 | 0.95 | -0.25 | 0.055 |
| X7 | 0.987 | -0.063 | 0.125 | 0.962 | -0.246 | -0.09 |
| X8 | -0.463 | 0.626 | 0.435 | -0.225 | 0.811 | 0.296 |
| X9 | 0.975 | 0.122 | -0.089 | 0.915 | -0.322 | 0.179 |
| X10 | 0.872 | -0.2 | 0.332 | 0.893 | -0.111 | -0.318 |

Table 6 Component score coefficient matrix

| | Ingredient | | |
|------------|------------|--------|--------|
| | 1 | 2 | 3 |
| X1 | 0.181 | 0.081 | -0.061 |
| X2 | -0.034 | -0.039 | 0.699 |
| X3 | -0.179 | -0.073 | 0.004 |
| X4 | 0.154 | 0.664 | -0.178 |
| X5 | 0.133 | 0.02 | 0.304 |
| X6 | 0.155 | 0.006 | 0.014 |
| X7 | 0.167 | 0.03 | -0.092 |
| X8 | 0.112 | 0.559 | 0.127 |
| X9 | 0.123 | -0.075 | 0.116 |
| X10 | 0.195 | 0.15 | -0.272 |

REFERENCES

[1] Zhang Xinyu. Research on the International Competitiveness of my country's Agricultural Products Foreign Trade (1978-2016) [D]. Yunnan University of Finance and Economics, 2017.

[2] Michael Porter: "Competitive Strategy", translated by Chen's novels, China Publishing House,1997.

[3] Wang Shihao. Analysis of Shandong Province's Agricultural Product Export Competitiveness and Research on Its Influencing Factors [D]. Shandong Normal University, 2020.

- [4] Shanxi Provincial Statistics Bureau. Shanxi Statistical Yearbook[J]. Beijing: China Statistics Press, 2003~2018.
- [5] Liu Yanyun. Research on the international competitiveness of agricultural products in Shandong Province and its influencing factors [D]. Anhui Agricultural University, 2016.
- [6] National Bureau of Statistics. China Statistical Yearbook[J]. Beijing: China Statistics Press, 2003~2018.
- [7] Plateau. Research on the Influencing Factors of Heilongjiang Province's Agricultural Products Export Trade to Russia [D]. Harbin University of Commerce, 2020.
- [8] Li Huaping, Liu Yan. Research on the international competitiveness of Shanghai's financial service trade and its influencing factors under the background of the Free Trade Zone [J]. National Circulation Economy, 2020(06) 112-118.
- [9] Gao Li, Zhao Shuya, Wu Lei. Analysis of factors affecting the international competitiveness of Henan's tourism service trade[J]. Hubei Agricultural Sciences, 59(04) (2020) 170-176.
- [10] Lan Qingxin, Dou Kai. Research on the Factors Influencing the International Competitiveness of China's Digital Cultural Industry[J]. Guangdong Social Sciences, 2019(04) 12-22+254.
- [11] Zhang Yaoyu. International competitiveness analysis and countermeasures of my country's agricultural industry under the background of the One Belt One Road[J]. Fortune Today, 2019(22) 13.
- [12] Chen Zhiheng, Sun Tongtong. Analysis of the factors affecting the international competitiveness of American agricultural products[J]. Academic Exchange, 2019(10) 99-113+192.
- [13] Li Gucheng, Guo Lun, Gao Xue. The impact of rising labor costs on the international competitiveness of my country's agricultural products[J]. Journal of Hunan Agricultural University (Social Science Edition), 19(05) (2018) 1-10.
- [14] Jin Juewen, Mu Yueying, Han Yijun, Zhao Xia. International competitiveness analysis of Chinese characteristic agricultural products[J]. Agricultural Outlook, 16(04) (2020) 127-134.
- [15] Zhang Jing, Wu Laping. Comparison of the international competitiveness of the world's agricultural export countries and analysis of influencing factors[J]. Jiangsu Agricultural Sciences, 46(22) (2018) 353-358.