A Gray Relational Analysis of the Manufacturing, Logistics Industry and International Trade Industry in Tianjin

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Abstract: In this paper, the degrees of the association of the manufacturing, logistics industry and international trade industry in Tianjin are analyzed using a quantitative method. The author thinks that the degrees of the association of the manufacturing, logistics industry and international trade industry in Tianjin are strong, and nowadays, the impact of the logistics industry on the international trade industry is larger than the impact of the manufacturing on the international trade Industry. The development of the logistics industry in Tianjin can effectively promote the development of international trade. In recent years, although the development of the manufacturing industry in Tianjin has made remarkable achievements, the investment is still need to be put into the development of the manufacturing, in order to promote the healthy development of export-oriented economy in Tianjin.

Keywords: Manufacturing, Logistics industry, International trade, Gray relational analysis

Introduction

Tianjin city is the most important modern manufacturing base and the largest port city in the northern region of China. The development trends of manufacturing and logistics industry are in good shape. At the same time, Tianjin is the largest coastal open city in the northern region of China. And Tianjin has a significant advantage in the development of export-oriented economy. Therefore, the healthy development of manufacturing and logistics industry is of great significance to accelerate the healthy development of export-oriented economy in Tianjin.

1 The Basic Situation of the Development of the Manufacturing Industry in Tianjin

Tianjin is an important manufacturing base in the northern region of China. Tianjin has formed eight dominant pillar industries, including aerospace, petrochemical, equipment manufacturing, electronic information, biological medicine, new materials and new energy, defense technology and light industry of textile. In recent years, from both qualitative aspect and quantitative aspect, the development of manufacturing industry in Tianjin has made remarkable achievements. By the end of November in 2011, Tianjin brand manufacturing enterprises achieved the total sales revenue of 354.9 billion Yuan, profits and taxes reached 26.511 billion Yuan, accounting for the city's above-scale industrial enterprises of 18.68% and 13.05%, and exhibited the trend of yearly growth. Because of the availability of data, and the manufacturing added value accounted for the industrial value-added of more than 90%.\(^2\) so in this article, instead of manufacturing added value, the industrial value-added is taken as the basic index to reflect the development of manufacturing industry. In 2012, industrial value-added of 612.292 billion Yuan in Tianjin was achieved, increased 12.74% than that of 2011, the average annual growth rate of

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\(^1\) Tianjin channel of xinhuanet. The number of brand-name products is growing in Tianjin. http://www.tj.xinhuanet.com/news/2012-02/02/content_24633211.htm (in Chinese)

2004-2012 year was 21.24%, as shown in Figure 1.

![Figure 1 Industrial value-added and growth rates of Tianjin in 2004-2012](image)


2 The Basic Situation of the Development of Logistics Industry in Tianjin

As an important port city of Bohai Rim Region, and near Beijing, the capital city of China, Tianjin has obvious advantages in logistics development. At present, Tianjin focuses on creating an international port city, northern international shipping center and logistics center, and volume of freight handled in ports is both one of the main indicators which reflect the development of the logistics industry, but also is closely related to international trade, so in this paper, volume of freight handled in ports is chosen to be as a basic index to reflect the development of logistics industry. In 2012, Tianjin volume of freight handled in ports is 477 million tons, which achieves an increase of 5.21% over 2011, the average annual growth rate of Tianjin volume of freight handled in ports is 12.97% of 2004-2012 years, the construction of China northern international shipping center and logistics center is progressing steadily in Tianjin, as shown in Figure 2.
Tianjin is one of major coastal open cities of China, in recent years, with the development of Tianjin Binhai New Area, the development of export-oriented economy is sustainable and healthy in Tianjin. Except in 2009, affected by the international financial crisis, Tianjin's total value of imports and exports in foreign trade decreased, from 2004 to 2012, Tianjin's total value of imports and exports in foreign trade continues to expand. Not only the exports to the United States, Japan and South Korea and other traditional overseas market maintain steady growth, and in 2012, the total value of export of the ASEAN countries, Latin America and other emerging overseas markets achieved remarkable increase of more than 30%. In 2012, Tianjin's total value of imports and exports in foreign trade was $115.623 billion, increased by 11.83 percent compared with 2011. In 2004-2012 years, the average annual growth rate of Tianjin's total value of imports and exports in foreign trade was 22.43%, as shown in Figure 3.
Figure 3  Total value of imports and exports in foreign trade and growth rates of Tianjin in 2004-2012


4 An Analysis of the Manufacturing, Logistics Industry and International Trade Industry in Tianjin Based on Deng’s Grey Relational Degree

4.1 The basic calculation processes of Deng’s Grey Relational Degree

Sequence \(X_i\) is a system characteristic sequence, and the remaining sequences associated with its Deng’s Grey Relational Degree were calculated as follows:

4.1.1 The calculations of initial image sequence

\[ X'_i = X_i / x_i(1) = \left(x'_i(1), x'_i(2), ..., x'_i(n)\right), \quad i = 0, 1, 2, ..., m \]  

4.1.2 The calculations of difference sequence

\[ \Delta_i(k) = \left|x'_i(k) - x_i(k)\right| \]  

\[ \Delta_i = (\Delta_i(1), \Delta_i(2), ..., \Delta_i(n)), \quad i = 1, 2, ..., m \]  

4.1.3 The calculations of the maximum value and the minimum value of the range

\[ M = \max_{i} \max_{k} x_i(k), \quad m = \min_{i} \min_{k} x_i(k) \]  

4.1.4 The calculations of the coefficient of correlation

\[ \gamma_{0i}(k) = \frac{(m + \xi M)/\Delta_i(k) + \xi M}{\xi (0,1), \quad k = 1, 2, ..., n; i = 1, 2, ..., m} \]  

4.1.5 The calculations of the remaining sequences associated with its Deng’s Grey Relational Degree

\[ \gamma_{0i} = \frac{1}{n} \sum_{k=1}^{n} \gamma_{0i}(k), \quad i = 1, 2, ..., m \]  

Usually \(\xi = 0.5\)

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4.2 The calculations of the remaining sequences associated with the Deng’s Grey Relational Degree of international trade Industry in Tianjin

The basic data of the gray relational analysis of the manufacturing, logistics industry and international trade industry in Tianjin are listed in Table 1.

Table 1 The basic data of the gray relational analysis of the manufacturing, logistics industry and international trade industry in Tianjin

<table>
<thead>
<tr>
<th>Index/Year</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Value of Imports and Exports in Foreign Trade (USD 100 million)</td>
<td>420.19</td>
<td>533.87</td>
<td>645.73</td>
<td>715.50</td>
<td>805.39</td>
<td>639.44</td>
<td>822.01</td>
<td>1033.91</td>
<td>1156.23</td>
</tr>
<tr>
<td>Industrial Value-added (100 million yuan)</td>
<td>1436.73</td>
<td>1884.80</td>
<td>2292.73</td>
<td>2661.87</td>
<td>3418.87</td>
<td>3622.11</td>
<td>4410.85</td>
<td>5430.84</td>
<td>6122.92</td>
</tr>
<tr>
<td>Volume of FreightHandled in Ports (100 million tons)</td>
<td>2.06</td>
<td>2.41</td>
<td>2.58</td>
<td>3.09</td>
<td>3.56</td>
<td>3.81</td>
<td>4.13</td>
<td>4.53</td>
<td>4.77</td>
</tr>
</tbody>
</table>


In Table 1, Sequence \(^{1}\) is a system characteristic sequence, and the remaining sequences associated with its Deng’s Grey Relational Degree were calculated as follows:

The results of the calculations of initial image sequence are listed in Table 2.

Table 2 The results of the calculations of initial image sequence

<table>
<thead>
<tr>
<th>Index/Year</th>
<th>1.0000</th>
<th>1.2705</th>
<th>1.5368</th>
<th>1.7028</th>
<th>1.9167</th>
<th>1.5218</th>
<th>1.9563</th>
<th>2.4606</th>
<th>2.7517</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0000</td>
<td>1.3119</td>
<td>1.5958</td>
<td>1.8527</td>
<td>2.3796</td>
<td>2.5211</td>
<td>3.0701</td>
<td>3.7800</td>
<td>4.2617</td>
<td></td>
</tr>
<tr>
<td>1.0000</td>
<td>1.1699</td>
<td>1.2524</td>
<td>1.5049</td>
<td>1.7282</td>
<td>1.8495</td>
<td>2.0049</td>
<td>2.1990</td>
<td>2.3155</td>
<td></td>
</tr>
</tbody>
</table>

The results of the calculations of difference sequence are listed in Table 3.

Table 3 The results of the calculations of difference sequence

<table>
<thead>
<tr>
<th>Index/Year</th>
<th>0.0000</th>
<th>0.0413</th>
<th>0.0590</th>
<th>0.1499</th>
<th>0.4629</th>
<th>0.9993</th>
<th>1.1138</th>
<th>1.3194</th>
<th>1.5100</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0000</td>
<td>0.1006</td>
<td>0.2843</td>
<td>0.1979</td>
<td>0.1886</td>
<td>0.3277</td>
<td>0.0486</td>
<td>0.2615</td>
<td>0.4361</td>
<td></td>
</tr>
</tbody>
</table>

The results of the calculations of the maximum value and the minimum value of the range are listed in Table 4.

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The results of the calculations of the maximum value and the minimum value of the range are listed in Table 4.

<table>
<thead>
<tr>
<th></th>
<th>The maximum value of the range</th>
<th>The minimum value of the range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.5100</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

The results of the calculations of the coefficient of correlation are listed in Table 5.

<table>
<thead>
<tr>
<th></th>
<th>1.0000</th>
<th>0.9481</th>
<th>0.9275</th>
<th>0.8343</th>
<th>0.7923</th>
<th>0.4304</th>
<th>0.4040</th>
<th>0.3640</th>
<th>0.3333</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.0000</td>
<td>0.8824</td>
<td>0.7264</td>
<td>0.7923</td>
<td>0.8002</td>
<td>0.6973</td>
<td>0.9396</td>
<td>0.7427</td>
<td>0.6338</td>
</tr>
</tbody>
</table>

The results of the calculations of the remaining sequences associated with its Deng's Grey Relational Degree are listed in Table 6.

<table>
<thead>
<tr>
<th></th>
<th>Industrial Value-added</th>
<th>0.6513</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Volume of Freight Handled in Ports</td>
<td>0.8016</td>
</tr>
</tbody>
</table>

5 Conclusion

Firstly, the Deng's Grey Relational Degree of the industrial value-added, volume of freight handled in ports and the total value of imports and exports in foreign trade are greater than 0.6 in Tianjin. Previous studies have shown that, when distinguishing coefficient value is 0.5, if the Deng's Grey Relational Degree is greater than 0.6, then they can be considered a high degree of association. Therefore, the industrial value-added, and the total value of imports and exports in foreign trade are associated intensively, that is to say, the manufacturing industry, the logistics industry and international trade industry are associated obviously.

Secondly, because The Deng's Grey Relational Degree of the volume of freight handled in ports is greater than that of the industrial value-added with the total value of imports and exports in foreign trade in Tianjin, so it can be considered that the impact of the volume of freight handled in ports on the total value of imports and exports in foreign trade is greater than the impact of industrial value-added on the total value of imports and exports in foreign trade, that is to say, the impact of logistics industry on the total value of imports and exports in foreign trade is greater than the impact of manufacturing industry on the total value of imports and exports in foreign trade, which reflects that the international logistics related closely to the international trade. International transport of goods is an important carrier of international trade. The development of the logistics industry can effectively promote the development of international trade in Tianjin.

Thirdly, the degree of association of the industrial value-added and the total value of imports and exports in foreign trade in Tianjin is relatively small. China is a big manufacturing country and is not a powerful manufacturing country. The development of manufacturing industry still needs to be strengthened in Tianjin. The development of manufacturing industry is the key link for the development of countries and regions. The increasing of the investment in manufacturing industry can contribute to the improvement of the core competitiveness of manufacturing industry in Tianjin, and it is important to promote the healthy development of Tianjin’s export-oriented economy.
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References