An Empirical Study of Logistics Industry Clustering on Regional Economic Growth in Liaoning Province

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Abstract. Using the relevant data of Liaoning Province from 2010 to 2021, an econometric model is established with the C-D production function as the theory combined with the new economic theory, and dummy variables are introduced according to the three degrees of logistics industry agglomeration and the division of the three major economic zones in Liaoning Province, to explore the effect of logistics industry agglomeration on the promotion of regional economic growth under different degrees of agglomeration and economic zones. It is found that the clustering of logistics industry has a significant effect on the regional economic growth of Liaoning Province, and the effect of clustering varies with the degree of clustering, and as the degree of clustering grows, the degree of contribution changes with an inverted U trend; the effect of clustering varies with different economic zones, and the effect of clustering varies with the more economically developed regions. The more economically developed the region, the more obvious the promotion effect.

Keywords: Logistics industry agglomeration; location entropy; economic growth; econometric modeling; spillover effects.

1. Introduction

Liaoning Province is a city both coastal and extended, geographic location, location advantages are obvious, for the development of the third-party logistics industry provides sufficient elemental resources and broad market space. As a regional material distribution center, in order to improve operational efficiency, it is imperative to promote the development of logistics industry to drive economic development. To build a first-class international logistics hub in Northeast Asia and an open industrial organization and service center, and to fully serve the construction of the double cycle and the supply-side structural reform; to plan and rebuild logistics parks, logistics distribution centers, optimize the industrial structure of the port logistics, and to promote the process of logistics industry agglomeration is the guiding principle of the logistics industry of our province in the development of the "14th Five-Year Plan". Planning. The clustering of logistics industry has become an important influencing factor in breaking down the barriers of economic development and realizing sustainable economic growth.

2. Literature review

2.1 The impact of logistics industry agglomeration on related industries and economic intermediary indicators.

Cao Ruizhang (2015) studied the advantages of logistics industry agglomeration as well as the relationship between logistics industry agglomeration and manufacturing industry, and the study showed that it has a certain promotion effect on the manufacturing industry[1]. Liliana et al. (2016) used a case study as a background to test the role of the trend of logistics industry agglomeration on the efficient operation of the logistics industry[2]. Lan et al. (2016) used Bayesian networks to find that the infrastructure establishment and integrated urban development are closely related[3]. Tao Tingting (2017) used relevant theories to prove the role of logistics industry agglomeration on the efficiency of China's logistics industry [4]. Peter J H (2018) found that logistics industry agglomeration promotes the construction of industrial bases and transportation capacity [5]. Wang
X (2018) confirmed that logistics industry agglomeration has an important role in regional trade flows [6]. Shi Xuegang (2023) empirically demonstrated the direct impact of logistics industry agglomeration on total factor productivity in China[7].

2.2 Empirical study of logistics industry agglomeration for regional economic growth.

Li Jian (2016) found that regional economic growth cannot be separated from logistics industry agglomeration with the help of 31 provincial panel data in China [8]. Gong Xinshu (2017) confirms that logistics industry agglomeration has spatial spillover effects on the regional economy of the Silk Road Economic Belt[9]. Park Qinghua (2018) showed that there is an interaction between logistics industry agglomeration and local economic level in Hubei Province[10]. Guo Hu Bin (2021) empirically demonstrated the spatial variability of the role of logistics industry agglomeration on the regional economy with provincial data[11]. Li Yuhao (2023) tested the impact of logistics industry agglomeration on the economy in Anhui Province[12].

3. Liaoning Province logistics industry agglomeration status analysis

3.1 Measurement and analysis of logistics industry agglomeration.

Location entropy refers to the ratio of a city’s gross product of logistics industry or the number of people employed in logistics industry to the total number of people employed in all industries in the city to the ratio of the gross product of logistics industry or the number of people employed in logistics industry to the total number of people employed in all industries in Liaoning Province. The formula is as follows:

\[ LQ_i = \frac{e_i}{E} \]

LQ<sub>i</sub> denotes the degree of logistics industry agglomeration in city i, e<sub>i</sub> is the number of employment in logistics industry in city i, e is the total number of employment in city i, and E<sub>i</sub> is the number of employment in logistics industry in Liaoning Province, E is the total number of employment in Liaoning Province. The data are from Liaoning Statistical Yearbook 2011-2022.

Based on the logistics industry agglomeration degree LQ measured by the number of employment in the logistics industry, the location entropy coefficients of the logistics industry in each region of Liaoning Province from 2010 to 2021 and their developmental evolutionary patterns and characteristics can be obtained, See table 1, figure 1

Table 1 Entropy coefficients of logistics industry agglomeration location by region in Liaoning Province, 2010-2021

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<td>0.42</td>
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<td>Dan dong</td>
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<td>0.89</td>
<td>0.89</td>
<td>0.66</td>
<td>0.57</td>
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<td>0.90</td>
<td>1.25</td>
<td>0.86</td>
<td>0.73</td>
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</table>
3.2 Characterization of Logistics Industry in Liaoning Province.

The level of logistics industry agglomeration is divided into three levels: \( LQ < 1 \) for lack of agglomeration, \( 1 \leq LQ < 1.25 \) for initial agglomeration, \( 1 \leq LQ < 1.25 \) for moderate agglomeration; Liaoning Province is divided into three major economic regions for analysis. The first is the Shenyang Economic Zone, which contains the five cities of Shenyang, Anshan, Fushun, Benxi, and Liaoyang; the second is the Liaoning Coastal Economic Zone, which contains the six cities of Dalian, Dandong, Jinzhou, Yingkou, Panjin, and Huludao; and the third is the Northwest Liaozhuang Economic Zone, which contains the three cities of Fuxin, Tieling, and Chaoyang.

On this basis, the vector maps of 14 prefecture-level cities in Liaoning Province were visualized by using Arc GIS 10.8, and the average value of logistics industry agglomeration in each city of Liaoning Province from 2010 to 2021 was used to reflect the degree of agglomeration of each prefecture-level city, and the division of the three economic zones and geographic locations were demonstrated. See Fig. 2. Fig. 3.
From the overall situation, the location entropy coefficient of the logistics industry in the regions has a large volatility. Within the time series of the sample interval, the regions show a kind of rising and then falling and then gradually smooth development. There is spatial variability and patchiness in the logistics industry agglomeration in each city. Most of the cities are still in the stage of lack of agglomeration and preliminary agglomeration, and have not yet formed an effective degree of agglomeration; there are differences in the level and type of logistics industry agglomeration in the three major economic zones.

4. empirical analysis

4.1 Model setup

According to classical economic theory, the impact of total economic output is represented by the C-D production function:

\[ Y = AK^\alpha L^\beta \]  \hspace{1cm} (1)

The locational entropy coefficient \( LQ \) is introduced into the production function and is accounted for as a product, denoted as:

\[ Y = AK^\alpha L^\beta LQ^\gamma \]  \hspace{1cm} (2)

(2) In Eq. \( Y, A, K, L, LQ \) denote the total economic output, natural resources and technological conditions, the amount of capital inputs, labor inputs and location entropy coefficients, respectively, and the parameters \( \alpha, \beta, \gamma \) represent the elasticity and satisfy \( 0 < \alpha, \beta, \gamma < 1 \), and \( 0 < \alpha + \beta + \gamma < 1 \). Taking logarithmic numbers of the two sides and eliminating the anisotropic variance existing in the production function, it can be expressed as follows.

\[ \ln Y = \ln A + \alpha \ln L + \beta \ln K + \gamma \ln LQ \]  \hspace{1cm} (3)

Assuming that in the short run, the natural resources and technology levels of the regions remain constant, an econometric model combining the above theoretical models is developed as follows:

\[ \ln Y_{it} = \beta_0 + \beta_1 \ln LQ_{it} + \beta_2 \ln K_{it} + \beta_3 \ln L_{it} + \varepsilon_{it} \]  \hspace{1cm} (4)

Combining the relevant factors in the new economic growth theory, three variables, namely government intervention (GE), degree of openness to the outside world (FT), and level of industrial structure (INS), are introduced into the model as control variables. Obtain model I.

\[ \ln Y_{it} = \beta_0 + \beta_1 \ln LQ_{it} + \beta_2 \ln K_{it} + \beta_3 \ln L_{it} + \beta_4 \ln GE_{it} + \beta_5 \ln FT_{it} + \beta_6 \ln INS_{it} + \varepsilon_{it} \]  \hspace{1cm} (5)
4.2 Empirical testing and analysis of results

The panel data model of eviews 9.0 software was used to empirically test the relationship between logistics industry agglomeration and regional economy in Liaoning Province. Through the F-test and Hausman's test results, it was finally determined that the individual fixed effects model with fixed effects was used for parameter estimation. Before the regression of each variable root test, the test results show that all the variables in the logarithm of the non-existence of unit root, indicating that the variables in the model has stability; cointegration test results show that there is a cointegration relationship between the variables, indicating that the regression results have a certain degree of authenticity, and there is no false regression problem. The empirical test results of the three models are shown in Table 3.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model I</th>
<th>Model II</th>
<th>Model III</th>
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<tbody>
<tr>
<td>C</td>
<td>5.316161(5.298845)***</td>
<td>6.089213(8.742644)***</td>
<td>5.388980(5.332971)***</td>
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<tr>
<td>LnK</td>
<td>0.098433(3.826395)***</td>
<td>0.099009(3.79432)***</td>
<td>0.101250(3.892390)***</td>
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<tr>
<td>LnL</td>
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<td>0.152020(1.832417)*</td>
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<td>Lnins</td>
<td>0.065199(4.66354)*</td>
<td>0.060295(3.884266)***</td>
<td>0.066386(3.875696)***</td>
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<td>Lnge</td>
<td>0.059096(2.611312)***</td>
<td>0.003310(2.268437)*</td>
<td>0.764378(2.596094)***</td>
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<td>Lnft</td>
<td>0.074200(2.165500)***</td>
<td>0.036221(2.56271)***</td>
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<tr>
<td>LnLQ</td>
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<td>0.127505(2.945819)***</td>
<td>0.162571(2.886839)*</td>
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<tr>
<td>D1LnLQ</td>
<td></td>
<td>0.289128(2.115589)***</td>
<td>0.194650(3.066556)***</td>
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<td>D2LnLQ</td>
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<td>R-squared</td>
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<td>315.8985***</td>
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<td>Prob(F-statistic)</td>
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</table>

(Note: *** denotes significance at the 1%, 5%, and 10% levels, respectively, and t-statistic values of the regression coefficients for each variable are in parentheses.)

4.3 Robustness test.

The logistics industry agglomeration level LQ calculated by replacing the number of employed in the logistics industry with the output value of the logistics industry is regressed to test the stability of the conclusions. Only the core variables are listed below (Table 4).
5. Conclusions and recommendations

5.1 Conclusions

In Model I, the model, all variables are significant at 1% level, Logistics industry agglomeration (lnLQ) has a promoting effect on economic growth, and its marginal effect coefficient is 0.166356. For every 1% increase in the level of logistics agglomeration, the level of economy increases by 0.166356% on average, which indicates that there is a significant economic spillover effect of logistics industry agglomeration. Among other control variables, the marginal effect coefficients of capital input (lnK) and labor input (lnL) are 0.098433 and 0.352258 respectively, but the former is smaller than the latter, with smaller elasticity coefficients, which indicates that the province still relies on the input of the number of laborers, and that the effect of the demographic dividend has not weakened. The optimization and upgrading of industrial structure and the government's macro-control have a positive effect on the province's economic growth. The degree of openness to the outside world (lnFT) has a promoting effect, but not a big one.

In Model II, all the variables pass the significance test. the marginal coefficients of D1lnLQ, D2lnLQ, D3lnLQ are 0.127505, 0.289128, 0.212308 respectively. it indicates that different degrees of logistics industry agglomeration promote economic growth, the promotion effect is the most obvious in the stage of relative agglomeration (1<LnLQ<1.25), the promotion effect is the most obvious in the stage of lacking agglomeration (0<LnLQ<1) the promotion effect is the weakest. The contribution value of moderate agglomeration and relative agglomeration is higher than that of lack of agglomeration, indicating that the increase of logistics agglomeration has a more obvious effect on the development of the regional economy of Liaoning Province; at the same time, the contribution value of moderate agglomeration is smaller than that of relative agglomeration, indicating that the effect of the increasing degree of agglomeration on the growth of the regional economy has not been growing.

In Model III, all variables pass the significance test. the marginal coefficients of D4lnLQ, D5lnLQ, D6lnLQ are 0.162571, 0.194650, 0.127724 respectively. it shows that logistics industry agglomeration will have a promotional effect on the growth of different economic zones. The effect of logistics industry agglomeration on the growth of regional economy is most obvious in the coastal economic zone, followed by the northwest economic zone and finally the Shenyang economic zone. There is a significant spillover effect of logistics industry agglomeration on economic growth in all economic zones, but due to the differences in geographic location, level of economic development, and allocation of resources, the economic spillover effect will also vary in the three economic zones.

5.2 Policy recommendations.

5.2.1 Comprehensive and rational planning of logistics layout

In the Liaoning province logistics development and construction, the need for integrated planning, the construction of large-scale integrated logistics parks in the regional center of the city.
in the regional layout, closely around the five key logistics center city of Shenyang, Dalian, Jinzhou, Dandong, Yingkou, the functional positioning of the planning of a number of large-scale investment in logistics infrastructure, logistics parks and network nodes construction projects that play a significant role in the industrial upgrading. Functional positioning of the center of the city, focusing on planning a number of large-scale investment, a strong role in the role of industrial upgrading has a significant role in logistics infrastructure, logistics parks and network nodes construction projects. To form a "point to point" "point to line" "line to surface" reasonable space network radiation situation, the implementation of supply chain management mode of operation.

5.2.2 Joint Manufacturing Linkage Development

Measures such as establishing logistics facilities platforms in equipment manufacturing clusters, constructing the province's equipment manufacturing logistics public information platform, improving the degree of socialization of manufacturing logistics, and fostering the development of professional third-party logistics enterprises. Promote Liaoning to become a modern equipment manufacturing base with international competitiveness, and realize the win-win situation of manufacturing and logistics industry. Municipalities should focus on the development and equipment manufacturing industry compatible with the characteristics of the logistics industry, to create industrial parks and logistics industry linkage development.

5.2.3 Focus on the development of multimodal transportation

First, we should vigorously construct regional transportation hub projects. Emphasis will be placed on the construction of highway, railroad, port and aviation hub projects, focusing on the integration of modes of transportation and the comprehensive capacity between different modes of transportation, and further improving the efficiency of logistics intermodal transportation and transshipment. Second, we should actively promote the synergistic development of multiple modes of transportation. Container transportation, van transportation, special cargo transportation, multimodal transport and a series of new modes of transportation has become a logistics enterprise to improve logistics efficiency, improve the logistics service function of the inevitable requirements.

References


