Research on Rural Logistics Development Management: A Case Study of Liaoning Province

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Abstract. Under the implementation of the rural revitalization strategy, strengthening the research on rural logistics management is an important guarantee for promoting rural modernization and smooth domestic circulation. Based on the panel data of 14 prefecture-level cities in Liaoning Province from 2017 to 2022, this paper utilizes the entropy weight-TOPSIS method and the Dagum Gini coefficient decomposition method to reveal the dynamic evolution law of the level of rural logistics development in Liaoning Province based on the construction of the evaluation index system of rural logistics development. The results show that the overall rural logistics development in Liaoning Province shows a trend of stable improvement, but there are obvious regional differences, with relatively high development levels in the eastern region and relatively low in the central and western regions. The fluctuation trend of the Gini coefficient indicates that the influencing factors of inter-regional differences are complex, in which the hypervariable density plays a dominant role in the overall differences.

Keywords: rural logistics; management research; entropy weight TOPSIS; Dagum Gini coefficient decomposition method;

1   INTRODUCTION

The 20th Party Congress made a major deployment to implement the strategy of rural revitalization, which pointed out that we should adhere to the priority development of agriculture and rural areas, and solidly promote the revitalization of rural industries[1]. With the increasing degree of information modernization, the development of the logistics industry has gradually become standardized, but the imbalance and inconsistent pace between the regional development of rural logistics and the development of urban logistics have put the in-depth development of rural logistics in a difficult situation. There is a long-term and stable relationship between new urbanization, rural logistics and farmers' income, and new urbanization is an important factor in enhancing the development level of rural logistics, and there is a significant causal relationship between farmers' income and rural logistics[2]. As an extension of the modern logistics system, the development of rural logistics is of great significance in reducing the transaction costs of agricultural products, promoting the development of the rural economy, improving the modernization of the agricultural industry and the consumption level of

rural residents, accelerating the process of urban-rural integration, and it is an important guarantee for promoting rural revitalization. In view of this, based on the actual development situation in Liaoning Province, we further analyze the spatial and temporal characteristics of the development level of rural logistics and its spatial linkages in various regions of Liaoning Province, in order to contribute to the construction of a modern rural logistics development system and to promote the coordinated development of rural logistics and rural economy in Liaoning Province.

2   RESEARCH DESIGN

2.1   Construction of Evaluation Index System of Rural Logistics Development Level in Liaoning Province.

Rural logistics is a logistics and transportation system with the fundamental purpose of promoting rural economic development, rural logistics as the main body of operation, and information technology as the carrier by upgrading infrastructural facilities and strengthening government policy support as the support of development[3]. Considering that there are no perfect indicators for the construction of the rural logistics system, by drawing on the construction ideas of Guo and Zhang on the evaluation index system for the development of regional logistics and combining the current situation of the development of rural logistics in Liaoning Province and its actual characteristics, 11 specific indicators are selected from five dimensions, namely, infrastructure, scale of development, level of informationization, potential for development and human capital, to construct the Evaluation index system of rural logistics development level in Liaoning Province, as shown in Table 1 [4]-[5].

Table 1. Evaluation index system of rural logistics development level in Liaoning Province

Objectives	Evaluation Dimensions	Evaluation indicators	Indicator unit
Level of rural logistics development	Infrastructure	Ownership of civilian goods vehicles	10,000 vehicles
		Mileage of highways in the country	Kilometers
		Rural delivery routes	Kilometers
	Scale of Development	Freight turnover	Billion tons kilometers
		Transportation Expenditure	million tons
		Highway Freight Transportation	million tons
		Total post and telecommunications business	million tons
	Informatization Level	Number of Internet broadband access users	million
	Development Potential	Total retail sales of consumer goods in rural areas	million yuan
		Per capita disposable income of rural permanent residents	Yuan
	Human Capital	Number of employees in transportation, storage and postal services	million tons

2.2   Data Description.

Fourteen prefecture-level cities in Liaoning Province were selected for the study, and the study period was 2017-2022. The raw data of the relevant indicators were obtained from the China Statistical Yearbook, China Urban Statistical Yearbook, China Rural Statistical Yearbook, China Agricultural Statistical Yearbook, Liaoning Statistical Yearbook, as well as the National Bureau of Statistics and the Ministry of Agriculture and Rural Affairs, which released relevant reports. For the case of missing data in some years during the data collection process, linear interpolation was used to supplement the data.

3   ANALYSIS OF RESULTS

3.1   Results of Measuring the Level of Rural Logistics Development in Liaoning Province

Table 2 reveals the changes and development patterns of the rural logistics development level in each Liaoning province city from 2017 to 2022. From 2017 to 2022, the level of rural logistics development in each city in Liaoning Province has increased, proving that the overall development of rural logistics in the province tends to stabilize and improve during this time period. In Shenyang City, for example, the index was 0.416477 in 2017, rising to 0.781303 in 2022, an increase of nearly 0.365 basis points. Such changes are also reflected in Dalian, Anshan, Fushun, and other cities, but there are significant differences in the magnitude of the improvement in rural logistics development between cities. Analyzing these differences, an important factor may be the economic base and development strategy of each city. In addition, we found that in 2021 the growth rate of rural logistics development level in each city in Liaoning province is extremely low, even with negative growth like Shenyang Dalian. This may be due to the continued uncertainty of the Xinguan epidemic, which has led to a slowdown in overall economic growth, thus affecting rural logistics demand and development. It could also be due to the strict embargoes and travel restrictions implemented to control the outbreak, which may have inhibited logistics and transportation activities leading to disruptions in the supply chain, thus affecting the normal functioning of rural logistics.

Overall, from 2017 to 2022, the level of rural logistics development in Liaoning Province has generally shown a trend of steady improvement, but there are still considerable development differences between different cities, which requires the government to further strengthen its support for disadvantaged cities and narrow the development gaps between cities in its future policy formulation, in order to achieve a balanced development of rural logistics in the province.

Table 2. Rural Logistics Development Index in Liaoning Province（Source:Stata calculations yielded）

	2017	2018	2019	2020	2021	2022
Shenyang	0.416477	0.528682	0.605477	0.705645	0.586304	0.781303

Dalian	0.41049	0.473439	0.482869	0.484228	0.441572	0.522885
Anshan	0.166065	0.179541	0.196891	0.194516	0.169086	0.189353
Fushun	0.087795	0.109762	0.107576	0.114309	0.112844	0.127782
Benxi	0.071243	0.075312	0.082757	0.081554	0.08583	0.100704
Dandong	0.116342	0.125493	0.13118	0.146194	0.13361	0.154667
Jinzhou	0.137897	0.145135	0.163881	0.16134	0.16348	0.191957
Yingkou	0.145789	0.152234	0.152183	0.178979	0.169088	0.190313
Fuxin	0.081945	0.092242	0.09456	0.105207	0.100076	0.114871
Liaoyang	0.090377	0.09745	0.069891	0.08437	0.074985	0.099134
Panjin	0.094388	0.106647	0.125345	0.120884	0.114902	0.133928
Tieling	0.105186	0.118041	0.132006	0.134903	0.126048	0.142349
Chaoyang	0.121833	0.142549	0.151871	0.162381	0.13927	0.159577
Huludao	0.100111	0.120883	0.12569	0.128551	0.121718	0.148956

3.2 Regional Differences in the Level of Rural Logistics Economic Development in Liaoning Province and Its Decomposition

According to the Gini coefficient and decomposition method, the development index of rural logistics economic development level in Liaoning Province is measured, and the overall Gini coefficient of rural logistics economic development in Liaoning Province shows a fluctuating trend during the inspection period. According to the data in Table 3, the overall Gini coefficient increased from 0.316 to 0.359 in the fluctuation from 2017 to 2020 and then decreased to 0.350 in 2022.

Looking within each region, the level of differences within each region of Liaoning Province shows a differentiated evolutionary trend. Except for the central region of Liaoning Province, where the value of intra-regional variance shows an upward trend during the fluctuation process from 2017 to 2022, both the eastern and western regions of Liaoning Province show a downward trend during the fluctuation process during the examination period. This change in the trend of intra-regional differences may be influenced by several factors, such as changes in economic structure, economic transformation in the eastern and western regions, especially the growth of high-tech and service industries, which may lead to the rapid economic concentration in those regions, and thus the Gini coefficient shows a downward trend during the fluctuation.

Analyzing from inter-region. As can be seen from Table 3, the development difference between the eastern region of Liaoning Province and the western region of Liaoning Province is the most significant, with the Gini coefficient stabilizing above 0.346. From the trend of change, the change in the development difference between the eastern region of Liaoning Province and the western region of Liaoning Province is also the most obvious, rising from 0.346 in 2017 to 0.392 in 2022, by 13%. The trend changes between the other regions are smoother with little change. This may be due to the fact that the eastern part of Liaoning Province is close to the ocean and has more convenient maritime transportation, and the eastern part of Liaoning Province tends to have a more mature industrial base compared to the western part.

In terms of the contribution rate of regional differences, the highest contribution rate in its examination period is hypervariable density, with a mean value of 38.968; followed by intra-regional contribution rate, with a mean value of 33.825; and inter-

regional contribution rate is the smallest, with a mean value of 23.506. Obviously, the most important source of the overall differences in the level of rural logistics and economic development in Liaoning Province is hypervariable density, followed by intra-regional differences, and lastly, inter-regional differences. It indicates that the high-quality and balanced development of urban agglomerations should focus on solving inter-regional differences. Therefore, in the future strategy of rural logistics economic development in Liaoning Province, the government and relevant departments should prioritize focusing on solving the hypervariable density problem in order to promote balanced development among regions.

Table 3. Regional Gini Coefficients and Contribution Rates of Rural Logistics Development in Liaoning Province（Source:Stata calculations yielded）

year	Overall Gini coefficient	Intra-regional Gini coefficient Inter-regional Gini coefficient Contribution			Intra-regional Gini coefficient Inter-regional Gini coefficient Contribution			Intra-regional Gini coefficient Inter-regional Gini coefficient Contribution		
		East	Central	West	East-Central	East-West	Central-West	Intra-regional	Inter-regional	Hypervariable Density
2017	0.316	0.381	0.309	0.107	0.3467	0.3073	0.269	32.90	25.72	41.37
2018	0.33	0.386	0.34	0.09	0.3667	0.3068	0.2871	33.32	25.30	41.36
2019	0.351	0.38	0.379	0.109	0.3906	0.3064	0.3206	33.90	25.48	40.61
2020	0.359	0.375	0.396	0.092	0.4009	0.2947	0.3356	34.18	29.3	36.51
2021	0.334	0.351	0.371	0.099	0.3745	0.2790	0.3113	34.16	26.35	39.48
2022	0.35	0.357	0.393	0.098	0.3924	0.2827	0.33055	34.465	28.878	34.465

4   CONCLUSIONS

The level of rural logistics development in various regions of Liaoning Province generally shows a trend of stable improvement, but there are still more obvious regional differences. The inconsistent development of cities in terms of location conditions, economic foundation, and the construction of digital platform facilities makes the development level of rural logistics in the eastern part of Liaoning Province, with Dalian and Shenyang as the core, higher than that in other regions. The government should pay attention to the shortcomings of development, improve the level of rural logistics development, and promote coordinated development among regions.

The Gini coefficient of the level of rural logistics economic development in Liaoning Province shows a certain fluctuating trend, and the level of differences within each region also shows different evolutionary trends. The differences between the eastern and western regions are gradually narrowing, but there are still significant differences,

while the differences in the central region show a rising trend. The hypervariable density plays a dominant role in the overall differences, indicating that solving inter-regional differences is the key to promoting balanced development. The government can encourage enterprises to invest and prosper in regions with lower hypervariable densities by introducing relevant policies and regulations, tilting resources toward regions with lower hypervariable densities, and promoting the economic development of these regions.

5   FUTURE OUTLOOK

The data in this study covers the time period from 2017 to 2022, but the data within this time period may not fully reflect the long-term development trend and change patterns. In addition, this study takes 14 prefecture-level cities in Liaoning Province as the research object, but the results within this range may not fully represent the situation in other regions of the country, so the effectiveness of generalized extension may be limited.

In the future, the scope of the study can be expanded to include the development of rural logistics in other provinces or regions in the comparative analysis to gain a more comprehensive understanding and to identify commonalities and differences. In addition, qualitative and quantitative research methods can be combined to explore the influencing factors of rural logistics development in depth, so as to improve the persuasiveness and practicality of the research results. Trend analysis or forecasting models can also be used to predict the future trend of rural logistics development in Liaoning Province and other regions, which will provide a reference basis for governmental decision-making and business strategies.

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