

Research on the Coordinated Development of Logistics Industry and New Urbanization in Anhui Province

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Abstract

The coordinated development of logistics industry and new urbanization can effectively promote their development and improve the imbalance between logistics industry and new urbanization in Anhui Province. This paper collects the data on the development level of logistics industry and the construction level of new urbanization in Anhui Province from 2015 to 2021, uses the entropy weight method to process the data and establishes a coupling coordination model to study the coupling coordination of the two, so as to evaluate the coordinated development level of urbanization development and logistics industry in Anhui Province. Through the analysis results, the following conclusions can be drawn: although the coordination degree between logistics industry and new urbanization in Anhui Province has been greatly improved in recent years, the development of logistics industry lags behind the new urbanization logistics industry and provides insufficient power for the development of new urbanization. In view of this, the paper finally proposes a series of measures to promote the coordinated development of logistics industry and new urbanization in Anhui Province.

Keywords

Logistics Industry; New Urbanization; Coupling Coordination Model; Entropy Weight Method.

1. Introduction

Anhui is located in the Yangtze River Delta in East China, with unique geographical advantages. Anhui is a major region in the Yangtze River Delta, the economic hub of the country, and the intersection of major regions and regions in China. With the rapid development of network commerce, logistics industry has become an important part of the economic development of developed countries and regions. The development degree of logistics industry reflects the comprehensive supporting ability and social service degree of a country and region's economy, and is one of the important indicators of its economic development level [1]. Logistics is an important pillar industry of China's economic development, with great radiation and connection. However, its development has an obvious lag effect, which means that logistics activities can only play a good role in promoting it after a long period of time. Therefore, we

should constantly strengthen the city's logistics network and other infrastructure. Further strengthen the logistics, improve the logistics efficiency and logistics technology of enterprises to promote economic development. Anhui's road, railway, waterway and air transportation system has laid a solid foundation for the development of its logistics industry.

At present, the logistics industry and the development of new urbanization are the new direction of economic research, and the theoretical system of this aspect needs to be improved. Many scholars only study the one-way impact of one aspect on the other when studying the two aspects. In fact, in the context of the new normal of economic development, urbanization and logistics have developed into a mutually inclusive trend. This paper will study the interaction between the two, and evaluate the coordinated development level of urbanization and logistics industry in Anhui Province by establishing a coupling degree model, so as to provide a feasible method for the coordinated development of logistics industry and new towns in Anhui Province, and provide suggestions for other studies in this regard. At present, China is in the transition period of economic growth. The position and role of logistics industry in the national economy are more prominent, and it can further promote the development of urban economy and the transformation of circulation mode, which has certain reference significance for the construction of new urbanization.

Firstly, the paper collected and summarized the indicator data of the comprehensive development level of logistics industry in Anhui Province and the indicator data of the degree of new urbanization construction through literature review, and then conducted field research and collected relevant data, established a coupling and coordinated development model, and used Matlab and other software to analyze, process and evaluate the data indicators.

2. Basic Situation of Logistics Industry Development in Anhui Province

Since the 13th Five Year Plan, the province has comprehensively implemented a series of measures to reduce costs and improve efficiency, which has enhanced the logistics capacity of Anhui Province and its logistics competitiveness. The construction of logistics infrastructure has become increasingly sound, the logistics service system has been further improved, and the logistics enterprises have made significant achievements in improving quality and reducing costs. According to the figures released by the Price Bureau of Anhui Province, the total logistics volume of the province was 8082.26 billion yuan, an increase of 15.1% over the same period of last year, with a growth rate of more than 5.9 percentage points. It is predicted that the logistics capacity of Anhui Province will be significantly improved in 2025, which will play a more important role in the national logistics network. The improvement of logistics capability in Anhui Province not only means the improvement of logistics efficiency, but also the great improvement of logistics service level [2].

3. Basic Situation of New Urbanization Development in Anhui Province

In recent years, the urbanization of Anhui Province has developed rapidly. More and more rural people have joined the urban registered residence, and the urbanization rate has been further improved; The growth rate of urban registered residence population and permanent population is obvious; The process of urban-rural integration has been promoted, the economy has developed rapidly, and urban-rural interaction has realized the adjustment and upgrading of industries; Cities and towns expanded, and land urbanization was fast. However, there are some problems in the development of urbanization in Anhui Province, such as too fast land urbanization, but the rural population has not integrated into the city; Unreasonable planning and management of new urbanization urban construction; The construction of a new type of urbanization that emphasizes human orientation has not fully implemented social security in fact, and has not guaranteed the fundamental interests of the people; Urban infrastructure is

not perfect, and people's sense of happiness is not high. These problems have led to the fact that the level of urbanization in Anhui has been lower than the national average, and the imbalance of urbanization development is still serious.

3.1. Population Urbanization

Population urbanization refers to the process of population transfer from rural to urban areas, and the transformation of agricultural population into non-agricultural population [3]. Table 1 shows the process of population urbanization in Anhui Province. The target level of population urbanization consists of four indicators, namely, the proportion of urban population, the proportion of non-agricultural population, the proportion of tertiary industry employment and urban population density. Although the population flow in Anhui Province has led to the population flowing into the developed areas in the east and southeast, Anhui Province has a large population, the proportion of agriculture has gradually decreased, and the level of agricultural production technology has increased, the level of mechanization has improved, and the number of farmers required has decreased; The development of the secondary and tertiary industries in cities and towns attracts farmers to work in cities and towns; In addition, in recent years, the urban household registration policy has been liberalized, and a large number of graduates have transferred to urban registered residence. The urbanization of registered residence has gradually improved. Although agriculture still plays a leading role, its proportion in the three major industries has gradually decreased. Driven by the trade in the Yangtze River Delta, it has undertaken the transfer of the tertiary industry and has developed rapidly. Due to the development of urbanization, the urban population has grown slowly, and with the development of the service industry, the urban population density in Anhui Province has gradually increased.

Table 1. Urbanization rate of permanent population and registered residence population in Anhui Province from 2010 to 2020

Index Year	Registered residence population		Permanent population	
	Registered residence population (10000 persons)	Urbanization rate of registered residence population (%)	Permanent population (10000 persons)	Proportion of permanent population (%)
2010	6827	22.71	5957	43.20
2011	6876	22.93	5972	44.80
2012	6902	22.89	5978	46.30
2013	6929	22.92	5988	47.87
2014	6936	22.69	5997	49.31
2015	6949	27.58	6011	50.97
2016	7027	29.52	6033	52.62
2017	7059	31.07	6057	54.29
2018	7083	32.65	6076	55.65
2019	7119	34.65	6092	57.02
2020	—	—	6105	58.33

3.2. Economic Urbanization

Economic urbanization is manifested in the process of population transfer from labor-intensive industries to capital intensive industries, industrial restructuring and the development, transfer and upgrading of the secondary and tertiary industries [4].

In recent years, the sustainable economic growth of Anhui Province has promoted its urbanization development level. Anhui's GDP has been growing rapidly, and the growth rate remains relatively high. The proportion of the primary industry showed a downward trend, the secondary industry had little change, and the proportion of the tertiary industry showed an overall growth trend. Anhui Province has promoted the development and integration of urban and rural industries by receiving industries transferred from surrounding developed provinces and cities, and has walked out of a new path of urbanization development, with remarkable decision-making effects. Although the development level of urbanization in Anhui Province is improving, the development mostly relies on labor intensive industries. Innovation and R&D capabilities are the weak points of Anhui Province, and may restrict the further development of urbanization in the future. Therefore, while ensuring the most basic employment, we should vigorously promote the development of technology industry and promote the high-quality development of economic urbanization with innovative development. See Figure 1 and Figure 2 for specific data.

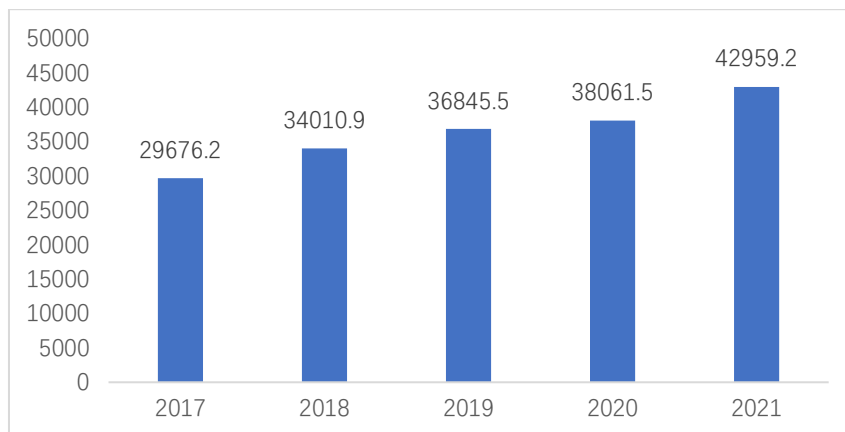


Figure 1. GDP of Anhui Province from 2017 to 2021

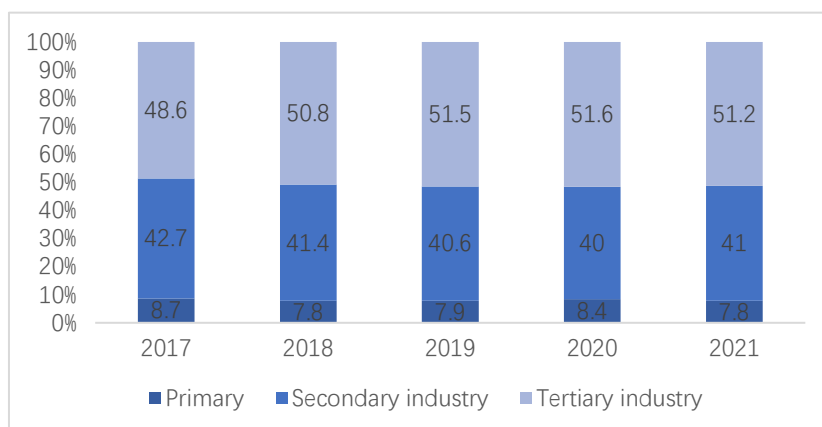


Figure 2. The proportion of added value of the three major industries in the provincial GDP from 2017 to 2021

3.3. Land Urbanization

The process of land urbanization is fast. With the development of urban construction, many rural unowned wastelands in Anhui Province have been utilized and developed, which has solved the problem of waste of land resources and promoted the rational allocation and use of land resources. But at the same time, with the development of new urbanization, the promotion of infrastructure construction, and the expansion of urban construction, the land demand of type urbanization cannot be well met. On the other hand, after the rural population has transferred to cities and towns, rural land has been abandoned, and the transfer and

withdrawal mechanism of homestead has not been implemented in backward and remote areas. The land element itself is immobile and has a large spatial constraint. In addition, the land market construction level in Anhui Province is relatively low, which makes it impossible to achieve cross regional allocation of land use indicators according to the needs of urban and rural development. The process of land urbanization has reached a bottleneck.

4. Measurement of Logistics Industry Development and New Urbanization Construction Level in Anhui Province

4.1. Index Construction

Table 2. Logistics industry and new urbanization indicators

System	Index	2015	2016	2017	2018	2019	2020	2021
Logistics industry	Total retail sales of consumer goods (100 million yuan)	6108593	6343078	7541145	7988093	8602847	9143979	10031546
	Number of urban non-private logistics employees (person)	222641	229305	242102	245180	237028	208343	208633
	Investment in logistics fixed assets (100 million yuan)	1469.76	1841.42	2036.45	2083.09	2397.63	2651.78	2826.80
	Contribution rate of logistics industry (%)	3.6	3.4	3.2	5.5	5.3	4.9	4.8
New urbanization	Tertiary industry as a percentage of DP (%)	44.5	46.7	48.6	50.8	51.5	51.6	51.2
	Per capita disposable income (RMB/person)	26936	29156	31640	34393	37540	39442	43009
	Number of participants in work-related injury insurance (person)	5288777	5445933	5655081	6035228	6390581	6838599	7180480
	Number of participants in basic endowment insurance for urban employees (persons)	6108539	6343078	7541145	7988093	8602847	9143979	10031546

Based on the previous analysis and reference of existing research, and following the principles of scientific representation, availability, systematicness and other indicators, the logistics

industry indicator system selected in this paper is composed of four indicators, and the new urbanization indicator system is also composed of four indicators. See Table 2 for details.

4.2. Data Source

The data used in this paper are mainly from the Statistical Bulletin of National Economic and Social Development of Anhui Province, Anhui Statistical Yearbook, Anhui Statistical Yearbook 2022, National Bureau of Statistics, and Huajing Information Network in 2019-2021.

4.3. Measurement Method

This paper uses entropy weight method to calculate the comprehensive index of logistics and new urbanization level. The specific steps of entropy weight method are as follows:

4.3.1. Data Standardization

The extreme value method is used to standardize the indicators of the logistics system and the new urbanization system. The standardized formula is as follows:

$$\text{Positive indicators: } X'_{ab} = \frac{X_{ab} - \min X_{ab}}{\max X_{ab} - \min X_{ab}} \quad (1)$$

$$\text{Negative indicator: } X'_{ab} = \frac{\max X_{ab} - X_{ab}}{\max X_{ab} - \min X_{ab}} \quad (2)$$

Where, X_{ab} and X'_{ab} represents the original data and standardized data of the b (b=1, 2, 3, 4, 5, 6, 7, 8) index in year a (a=1, 2, 3, 4, 5, 6, 8); $\max X_{ab}$ and $\min X_{ab}$ represents the maximum and minimum values of column b.

4.3.2. Calculation of Index Weight

The entropy weight method is used to calculate the weight of logistics industry and new urbanization indicators. The specific steps are as follows:

(1) Calculate the index proportion. The calculation formula of the proportion (P_{ab}) of item b (column) index in year a (row) is as follows:

$$P_{ab} = \frac{X'_{ab}}{\sum_{a=1}^n X'_{ab}} \quad (3)$$

(2) Calculate the index entropy. The entropy value (E_b) of index b is calculated as follows:

$$E_b = -k \sum_{a=1}^n P_{ab} \ln P_{ab} \quad (4)$$

Where, $k = 1/\ln n$, N is the number of years (rows); $0 \leq E_b \leq 1$; when $P_{ab} = 0$, let $P_{ab} \ln P_{ab} = 0$.

(3) Calculate the index entropy redundancy. The entropy redundancy (D_b) of index b is calculated as follows:

$$D_b = 1 - E_b \quad (5)$$

(4) Calculate weights. The weight (W_b) of index b is calculated as follows:

$$W_b = \frac{D_b}{\sum_{b=1}^m D_b} \quad (6)$$

4.3.3. Calculation of Comprehensive Evaluation Index

The comprehensive evaluation index (S_b) is calculated by the method of weighted sum of weight and index. The calculation formula is as follows:

$$S_b = \sum_{b=1}^m W_b \times X'_{ab} \quad (7)$$

4.3.4. Result Analysis

Formulas (1) - (7) are used to calculate the comprehensive score of logistics industry and new urbanization development level in Anhui Province from 2015 to 2021. The results are shown in Figure 3. In 2015-2019, the development of new urbanization lagged behind that of the logistics industry, but the development speed of new urbanization was significantly higher than

that of the logistics industry, so the logistics industry began to lag behind the new urbanization after 2019.

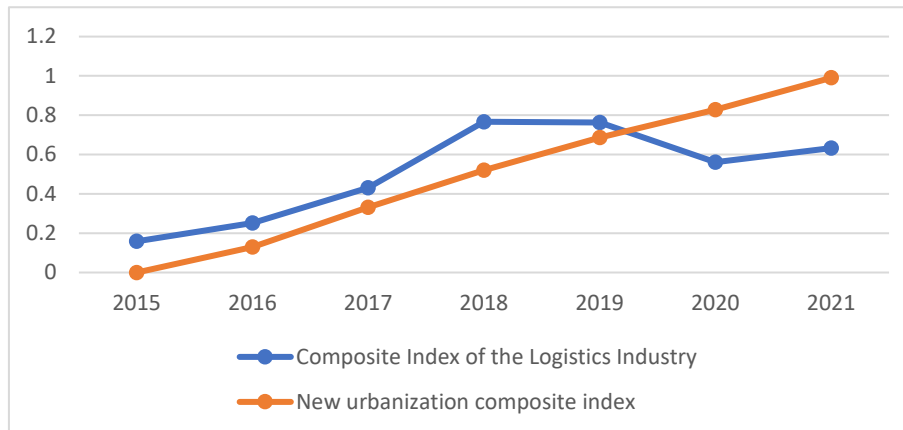


Figure 3. Comprehensive index of logistics and new urbanization in Anhui Province from 2015 to 2021

5. Research on the Coupling and Coordination of Logistics Industry and New Urbanization in Anhui Province

5.1. Introduction to Coupling Coordination Model

Coupling degree refers to the interaction between two or more systems, realizing the dynamic correlation of coordinated development, and reflecting the degree of interdependence and mutual restriction between systems [5]. The degree of coordination refers to the degree of benign coupling in the coupling interaction relationship, which can reflect the quality of coordination [6]. In the application of the coupling coordination model, three key values need to be calculated in turn, namely, the coupling degree C value, the coordination index T value, and the coupling coordination degree D value. Finally, the coupling coordination degree is divided according to the standard according to the size of the D value. C. The specific calculation formula of C, T and D values is shown in Formula (8) - (9):

$$C_a = \frac{2\sqrt{U_a^1 U_a^2}}{|U_a^1 + U_a^2|}, \quad a = 1, 2, \dots, n \tag{8}$$

$$T_a = \lambda_1 U_a^1 + \lambda_2 U_a^2, \quad a = 1, 2, \dots, n \tag{9}$$

$$D_a = \sqrt{C_a T_a}, \quad a = 1, 2, \dots, n \tag{10}$$

C_a in equation (8) indicates the coupling degree of logistics industry and new urbanization in Anhui Province in year a, which is the degree of interaction between the two subsystems. The larger the value is, the closer the relationship between the systems is. Among them, $C_a \in [0, 1]$.

In equation (9), T_a is the coupling coordination index; λ_1, λ_2 is the undetermined coefficient, which represents the relative importance of the two subsystems. Considering that the logistics industry and new urbanization are equally important in the national economy, this paper takes $\lambda_1 = \lambda_2 = 0.5$. D_a in equation (10) is the coupling and co scheduling of the two systems of the first sample, which represents the coupling and coordination degree between the systems involved in the study [7].

The research and division of coupling coordination degree has been relatively complete and rich. We can divide the D value into 10 regions from 1 to 1, and divide them into 10 types: extreme imbalance, serious imbalance, and high-quality imbalance, as shown in Table 3.

Table 3. Classification of coupling coordination degree

rade	D value	Classification
Dysfunction	0-0.09	Extreme maladjustment
	0.1-0.19	Severe maladjustment
	0.2-0.29	Moderate maladjustment
	0.3-0.39	Mild maladjustment
	0.4-0.49	On the verge of maladjustment
Coordinated development	0.5-0.59	rudging coordination
	0.6-0.69	Primary coordination
	0.7-0.79	Intermediate coordination
	0.8-0.89	ood coordination
	0.9-1.0	High quality coordination

5.2. Result Analysis

Formula (8) - (10) can be used to calculate the coupling degree and coupling coordination between logistics industry and new urbanization in Anhui Province from 2015 to 2021. The results are shown in Table 4, Figure 4 and Figure 5.

Table 4. Calculation Results of Coupling Compatibility

Year	Coupling degree©	Coordination index(T)	Coupling co scheduling(D)	Coordination level	Coupling coordination degree
2015	1	0.01	0.1	2	Severe maladjustment
2016	0.997	0.15	0.386	4	Mild maladjustment
2017	0.99	0.393	0.624	7	Primary coordination
2018	0.952	0.758	0.849	9	ood coordination
2019	0.985	0.836	0.907	10	High quality coordination
2020	0.993	0.745	0.86	9	ood coordination
2021	0.993	0.882	0.936	10	High quality coordination

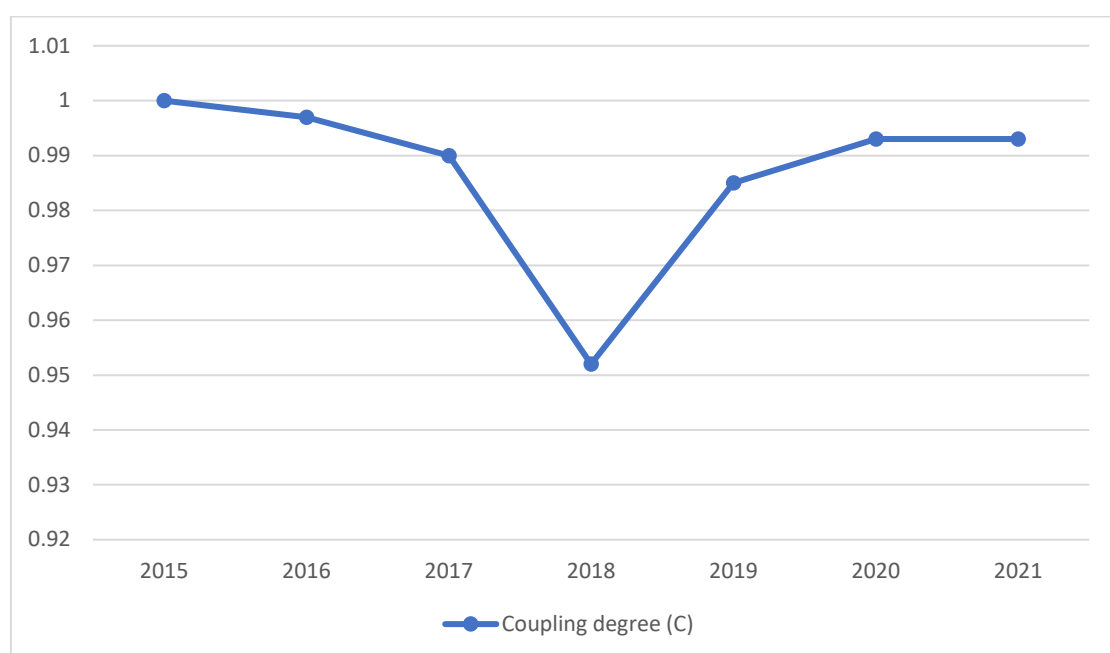


Figure 4. The coupling degree of logistics industry and new urbanization in Anhui Province from 2015 to 2021

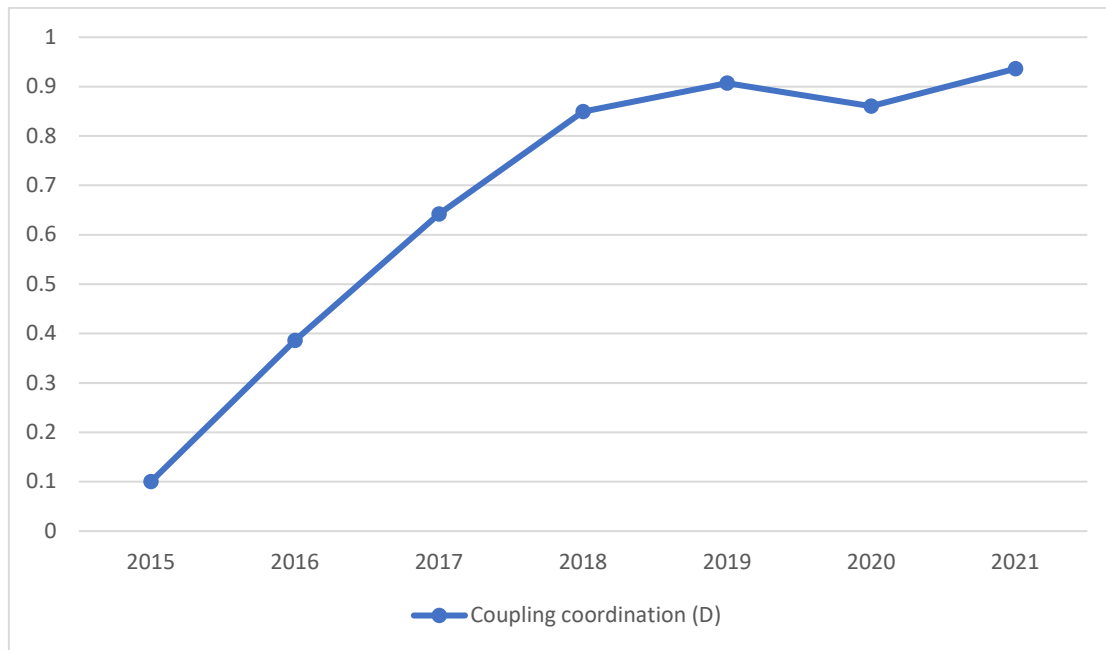


Figure 5. Coordination of logistics industry and new urbanization in Anhui Province from 2015 to 2021

It can be seen from Figure 5 that the coupling degree between logistics industry and new urbanization in Anhui Province has been above 0.95, which is a high level of coupling, and also shows that there is a great correlation between their development. It can be seen from Figure 6 that the coupling degree and coordination degree of logistics and new urbanization in Anhui Province have been improving from 2015 to 2019, but decreased from 2019 to 2020, and then continued to increase. From the perspective of coordination status, the coordination status of the two improved from serious imbalance to mild imbalance, primary coordination, good coordination to high-quality coordination from 2015 to 2019. From 2020 to 2021, we will return to high-quality coordination from good coordination. Anhui Province has been actively promoting the development of the logistics industry, and has also issued relevant documents such as the Implementation Plan of the Special Action for Cost Reduction and Efficiency Enhancement of the Logistics Industry in Anhui Province (2016-2018) to improve the backward status of logistics, enhance the comprehensive strength of logistics, and make the coordination between the logistics industry and the new urbanization increase year by year. However, the logistics industry in Anhui Province has been in a later and new urbanization state since 2019, the logistics industrialization has insufficient impetus for the development of new urbanization.

6. Conclusion and Suggestions

This paper selects Anhui provincial panel data from 2015 to 2021, uses the entropy weight method to process the data to calculate the comprehensive scores of Anhui logistics industry and new urbanization, then uses the obtained data to build a coupling coordination model, and uses the model to calculate the coupling degree and coupling coordination degree of the two. Through the analysis results, we found that: (1) The overall development level of logistics and new urbanization in Anhui Province showed an upward trend from 2015 to 2021, but compared with the logistics industry, the new urbanization has a higher growth rate, and after 2019, the comprehensive level of new urbanization exceeded the logistics industry. (2) The coupling degree between logistics development and new urbanization development in Anhui Province has always been above 0.95, which shows that the two systems have a strong correlation. (3) The logistics industry in Anhui Province is not in harmony with the

development of new urbanization. The development of new urbanization depends on the development of logistics industry.

In order to promote the coordinated development of logistics and new urbanization in Anhui Province, the following suggestions are put forward: (1) The government departments continue to issue documents to promote the development of the logistics industry, make full use of relevant resources, adjust measures to local conditions, improve the construction of logistics infrastructure to provide guarantee for the development of the logistics industry, stimulate the development potential of the logistics industry in Anhui Province, and effectively guide the further development of the logistics industry. (2) The government departments should also continue to promote the construction of new urbanization, adjust measures to local conditions, put people first, combine the resources and actual conditions of the province, innovate and develop, and continue to maintain the development status of new urbanization.

Acknowledgments

This work was supported by the provincial undergraduate innovation training project of Anhui University of Finance and Economics, "*Research on the Coordinated Development of Logistics Industry and New Urbanization in Anhui Province*" (S202110378522).

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