Analysis on the Relationship between Transportation and Economic Development

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Abstract— Transportation is the field that studies the construction of various kinds of infrastructure such as railway, highway, waterway and air transportation, as well as the layout, maintenance and overhaul of transportation. The economic development needs the transportation industry to match with it. The connection between transportation and economic development is not only direct, but also has many indirect connections. On the basis of analyzing the correlation index between transportation and economic development, this paper combines the relationship between transportation and economic development with the national economic development review and the comparison of regional economic development location. Finally, the detailed relationship between transportation and national economy is found after the demonstration of dynamic changes of passenger and freight transport.

Keywords-component; Traffic engineering; SPSS; economic development; grey correlation analysis

1. INTRODUCTION

In the context of regional economic integration, China's economy has been growing steadily. Transportation has shown an excellent development trend in recent years, and the industry has developed rapidly. However, the following problems are internal and external of the system, especially for such a huge system, how to carry out unified planning and management, this problem has been restricting the orderly development of the transportation system, so that the transportation sector presents the imbalance of development. Because of the lack of a unified master plan for transportation management, there are conflicts and overlaps in policy guidance. However, the industry is closely related to economic and financial services, and its development is closely related to economic development and economic exchanges. To a certain extent, a better transportation system can promote regional economic development to a certain extent. Therefore, the research on the relationship between transportation and economic development has important theoretical and practical significance. At present, the research on the relationship between transportation and economic development is mostly from the macro perspective and the perspective of resource allocation.

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2. INDICATORS OF THE RELATIONSHIP BETWEEN TRANSPORTATION AND ECONOMIC DEVELOPMENT

Transportation industry is the basic industry of national economy, and its development level directly affects the speed of economic development. Since China's economy has entered a period of rapid development, all industries and regions are expanding rapidly. However, due to regional imbalance, especially the imbalance of transportation infrastructure and transportation service level, the regional development shows the characteristics of different speed. The close relationship between transportation industry and economic development is obvious. The development of economy will stimulate the change of passenger and freight volume to a certain extent, and the development of corresponding industry change mechanism needs to match with economic development. In general, the relevance of transportation industry and economic development can be shown from multiple indicators. Only by fully understanding the complex relationship between transportation and economic development, can we better explore the significance of how to use transportation to promote the rapid development of national economy. From a more micro point of view, only from the perspective of transport structure to carry out the correlation analysis with economic development is slightly weak, can not better match with the development and change of regional economy. More indicators need to be considered for correlation analysis.

2.1 Index Construction Principle

1) The research object of the evaluation index is to select the index that can express the object, to ensure the breadth and depth of the coverage, and to excavate from multiple angles and directions, so that the selected index is objective and true.[1].

2) The selection of evaluation indicators must ensure the availability of data, must ensure a scientific basis, at the same time to highlight the main function area construction concept and guiding ideology and other factors, but also to consider the key factors in Synergetics, unified construction.[2].

3) The index design should be clearly and accurately defined, the quantity units should be consistent, and the scope of the selected index data should be consistent, so as to lay the foundation for the subsequent data collection and analysis.

2.2 Selection Basis Of Transportation Index

As a large system, transportation is rich in content. With the development of economy, the emphasis of the whole system in different stages will have new changes. Therefore, based on the principles of scientificity, accuracy and objectivity of index construction, the practicability and persistence of index selection can not be ignored. When selecting the index, we should fully understand its connotation and comprehensively and scientifically analyze the real situation of traffic development in the survey year. At the same time, it also needs to be combined with various reference cases selected in the study of transportation and economic development at home and abroad. In order to achieve the possibility of guiding such indicators to communicate at home and abroad, and the persistence reflects the vertical comparison of years, and the practicability reflects the horizontal comparison between different regional indicators. These are the most basic basis for selecting traffic indicators. The transportation system provides

services for the passenger and freight demand. The passenger volume, passenger turnover, freight volume, freight turnover and other indicators reflect the regional passenger and freight transportation demand based on the existing transportation facilities.

2.3 Selection Basis of Economic Development Evaluation Index

There is a certain similarity between the economic development evaluation index and the selection principle and the traffic index. The index and the development also need to follow the principles of scientificity, authenticity and universal comparability. These principles will make the evaluation of the economic development index in different time periods and the economic development evaluation in the next time period can be quickly correlated, and the economic development index needs to reflect the overall level of economic development in the year and region. Therefore, gross national income is selected as the evaluation index of economic development.

2.4 Index System Construction

Taking GDP index elements and transportation index elements as two groups of indexes, the transportation index selects four indexes: passenger volume (10000 people), passenger turnover (100 million person kilometers), freight volume (10000 tons) and freight turnover (100 million ton kilometers). The economic development index selects the gross national income (100 million Yuan) as the research index. The relevant data of the five major indicators in the 2018 statistical yearbook are used for analysis and summary.The comparative relationship between transportation indicators and GDP is shown in Table I.

TABLE I. COMPARISON OF TRANSPORTATION INDICATORS AND GDP DATA

particular year	*gross national income*	*Passenger volume*	*Passenger turnover*	*the volume of freight transport*	*rotation volume of freight transport*
2014	644791	2032218	28647	4167296	181668
2015	686449	1943271	30058	4175886	178356
2016	740598	1900194	31258	4386763	186629
2017	824828	1848620	32812	4804850	197373

Referring to the above data, this paper uses SPSS combined with the grey system theory to analyze the correlation between the above transportation related elements and the gross national income, establishes the grey correlation analysis index model, and determines its reference sequence and comparison sequence.

Set X_0 as the reference sequence and X_i as the comparison sequence of related factors.

The basic formula is as follows:

$$X_i^2 = X_i / X_i(1) = \left(X_i^1(1), X_i^1(2), \hat{}, X_i^1(n) \right) i = 0,1,2, \hat{}, m \tag{1}$$

$$\wedge_i(k) = \left(X_0^2(k) - X_i^2(k) \right) \wedge_i = \left(\wedge_i(1), \wedge_i(2), \wedge, \wedge_i(n) \right) \tag{2}$$

The formula for calculating the maximum difference and minimum difference correlation data of two extreme values is as follows:

$$M = \frac{\max}{i} \frac{\max}{k} \wedge_i (\mathrm{k}), \mathrm{m} = \frac{\min}{\mathrm{i}} \frac{\min}{\mathrm{k}} \wedge_{\mathrm{i}} (\mathrm{k}) . \tag{3}$$

3. ANALYSIS OF THE RELATIONSHIP BETWEEN TRANSPORTATION AND ECONOMIC DEVELOPMENT

The transportation industry plays a key role in the economic development. At the same time, the economic growth will also drive the development of the transportation industry. With the change of the proportion of production factors, new changes have taken place in the structure of transportation industry. At present, no matter from the construction of railway, highway, inland waterway, regular flight route and pipeline mileage, or from the passenger volume and freight volume, the mileage of Railway (especially high-speed railway) and flight route has increased more. Similarly, the proportion of passenger transport services in these two parts is also increasing, showing a relatively strong trend. Especially with the fastest development of air transport, the development of national economy also presents the characteristics of regional development, which has mutual influence with the imbalance of the transportation industry. How to promote the balanced development of the region, from the perspective of the transportation industry, make use of the close relationship between it and economic development, on the premise of promoting the development of the industry itself, it can be achieved in a certain range In order to improve the living conditions of the domestic economy and make due contributions to economic development, we should increase the gross national product to a certain extent. From the perspective of industry development, transportation development can also indirectly promote the development of upstream and downstream industries, such as upstream infrastructure industry, raw material industry, steel supply, tire supply, downstream maintenance related industries. In general, from the direct and indirect consumption of transportation and economic development, we need to study the relationship between transportation and economic development scientifically and systematically, which can be divided into two types: long-term and short-term.

According to the correlation analysis in the above grey system theory, the data from 2013 to 2017 are intercepted to analyze the correlation between economic indicators and traffic indicators. Taking economic indicators as the reference sequence and traffic indicators as the comparison sequence, the relationship between passenger volume, freight volume, passenger turnover, freight turnover and gross national income indicators is calculated, and the correlation coefficient is obtained by calculation The number sequence is as follows：

$$r_{01} = (1,0.7859,0.4777,0.2883)$$
$$r_{02} = (1,0.8328,0.5711,0.3637)$$
$$r_{03} = (1,0.5502,0.4437,0.3773)$$
$$r_{04} = (1,0.6226,0.3868,0.2841)$$

According to the above analysis, the average value of correlation coefficient is calculated by the grey correlation coefficient series. The correlation degree between passenger volume and gross national income is 0.6380, the correlation degree between passenger turnover and gross national income is 0.6919, the correlation degree between freight volume and gross national income is 0.5928, and the correlation coefficient between freight turnover and gross national income is 0.5734。The results show that the gray correlation degree between the relevant indicators is relatively moderate, and the research indicates that the correlation between the four transportation indicators and the gross national income is applicable. In addition, it is worth noting that, compared with freight transport, both passenger transport and turnover volume contribute more to the growth of gross national income than freight transport. Therefore, in the next development process, more attention should be paid to the relationship between passenger transport and economic development. On the basis of this theory, it is necessary to increase the investment in transportation sector It plays an important role in economic development.

3.1 Overview of Transportation and National Economic Development

With the development of the national economy, people's living standards have driven the development of the transportation industry. The passenger volume and passenger transport cycle show an unprecedented development trend since the reform and opening up. At present, the growth rate of passenger volume and passenger turnover has exceeded the average level of 30 years since the founding of the people's Republic of China.

However, due to the imbalance of economic development, the development of transportation and regional economy presents different regional effects in different regions. Especially in the eastern region, the demand for passenger flow is significantly greater. Due to the improvement of infrastructure and service level, the growth rate of passenger demand is significantly higher than that in the western underdeveloped region, which makes the eastern region's transportation service providers face more and more pressure. As one of the most basic human activities, transportation is an independent production sector of the national economy, which provides time and space services for passenger and cargo transportation. There are two kinds of research on transportation: qualitative and quantitative. In view of the huge size of the industry and the rapid pace of change. Qualitative analysis to make a more comprehensive analysis, using the internal development of the industry from the perspective of objective demand analysis is more common. It is common to study the interaction between transportation research and economic development, and it is also the foothold of the whole industry development research.

3.2 Location Impact of Transportation and Regional Economic Development

The relationship between economic development and social development is close. Although the national economy develops very rapidly, the problem of unbalanced regional economic development still exists. From the above correlation coefficient, we can see that in the four indicators selected by the transportation industry, the correlation coefficient with the gross

national income is greater than 0.5, and the average correlation of the four indicators reaches 0.6. We can think that economic development is more related to the development of the transportation industry, and the correlation between transportation and social development is also closely linked. Of course, social development includes political factors, social factors, cultural factors and so on. Economic connection is the basic part, and regional economic integration will be the inevitable trend of urbanization.

In most cases, people will think that the relationship between transportation and regional development is causal, but this relationship is not completely parallel. There is no fixed cause and effect between them, but more interaction between them. It can be shown by the following aspects: first, the demand of transportation will increase when the region develops to a certain extent, and the development of the industry is to improve the supply capacity to meet the demand. On the other hand, when transportation comes first, the transportation industry can drive the development of regional economy through its own development, so as to stimulate demand with supply. TOD development is a typical representative of transportation industry guiding urban development. Third, in some special cases, transportation can adjust the demand to a certain extent through the adjustment of the supply level, so as to optimize the demand structure and finally achieve the purpose of regulating economic development. Therefore, we believe that the development of regional economy and transportation should interact with each other. Its development conforms to and serves the development needs of regional economy. At present, the more popular research trend is the combination of two different cognitions, that is to say, the reason for the economic development of urban transportation, and at the same time, it is bound to become a result of the combination of urbanization and regional economic development.

4. EXAMPLES OF THE IMPACT OF DYNAMIC CHANGES IN PASSENGER TRANSPORT COMPOSITION ON ECONOMY

Based on the analysis of a large number of passenger source composition data, we can get the conclusion of the dynamic change of passenger transport composition. But similarly, the transportation industry itself is a high-tech industry, the use of scientific and technological achievements will be the first application in the industry, scientific and technological achievements will become the propeller of the transportation industry. With the development of science and technology and the advent of achievements, the structure of transportation will change dynamically. On this basis, the efficiency of traffic management will continue to increase. For example, the rapid development of high-speed railway industry makes the passenger volume increase in the railway field to a certain extent. Similarly, the vigorous development of civil aviation transportation industry in recent years has also promoted the development of air freight, which has brought about partial changes in the structure of the freight industry.

In the two major sectors of transportation, we can see from the previous analysis that the correlation between passenger volume, passenger turnover and gross national income is higher than that between freight volume, freight turnover and gross national income. In recent years, the growth rate of passenger transport has surpassed that of freight transport. In other words, the impact of economic development on passenger transport is slightly greater than that of freight

transport. In passenger transport, the status of road private car travel, railway high-speed rail travel, civil aviation intercity travel and other transportation modes is increasingly prominent.

4.1 Analysis of Economic Impact of Passenger Transport Structure Change

In the passenger transport, the main modes of travel are road transport, railway transport, air transport and waterway transport. However, at present, railway transport and civil aviation and air transport are the most commonly used modes for long-distance transport, and railway transport is the preferred mode for Intercity transport. However, with the development of urban rail transit, the urban rail transit represented by subway has been built into a network in some cities, and the subway lines have not only been limited in the city, but also extended to the intercity lines. The punctuality, efficiency and low departure frequency of subway will drive some intercity passengers to transfer from the original railway travel to the CityRail transit travel mode in the past. Similarly, with the gradual expansion of high-speed rail construction, more and more cities begin to connect to the high-speed rail network, and some of the passengers who used to travel by air will change their preferences. Besides the changes of transportation facilities, these choices are more determined by the level of regional economic development and consumption structure.

4.2 Analysis of The Impact of Freight Structure Change on Economy

The rapid development of e-commerce has put forward higher requirements for the circulation demand of goods, mainly in terms of quantity, effectiveness and safety. Therefore, it also promotes the development of freight transport. In order to better meet these requirements, different transportation modes with different characteristics are needed to meet these freight services. Originally a relatively single mode of transport has developed into the coexistence of five modes of transport, from the economy, effectiveness and other aspects of complementary advantages to form a comprehensive mode of transport, combined transport of multiple modes of transport, the development of multimodal transport is to promote the development of the industry. On the contrary, the benign competition and cooperation within the industry promote the economic development from the macro level, and stimulate the transport demand from the micro level, so as to drive the consumption of freight products.

Generally speaking, for freight transportation, waterway and railway can provide stable transportation supply, and also can transport goods in large quantities for customers with lower effectiveness requirements at a lower cost. At the same time, high-speed rail freight and civil aviation freight with strong development speed and momentum in recent years also account for an increasing proportion in the market year by year, providing high-quality services for customers with higher effectiveness requirements It's our business.

4.3 Impact of Transportation Optimization Strategy on Economic Growth

With the rapid development of high-speed railway in recent years, China's freight structure and passenger transport structure have undergone significant changes, and the service capacity of the industry has reached an unprecedented high level. This is in line with the general law of transportation development in the world. In recent years, most cities in China have developed rapidly in the process of industrialization. With the rapid development of economy, the change of passenger source structure promotes the comprehensive change and development of industrial structure. The competition of transportation will tend to a more reasonable direction.

The advantage of the so-called non-zero sum game is shown in the transportation industry. Cooperation and competition coexist in the transportation system towards a good momentum of development.

Taking the railway as an example, it constantly adjusts the operation time, optimizes the pricing strategy, improves the transportation speed, increases the passenger carrying capacity, improves the service level, and increases the service efficiency. In addition to bringing the extremely fast occupation speed of the transportation market share, it better meets people's travel needs, and improves the whole transportation system to a certain extent. Of course, the promotion of this coordination ability is also a new requirement under the background of the new situation of building a moderately prosperous society in an all-round way and the implementation of the scientific outlook on development. How to further develop the transportation industry and what kind of road to take are based on it. How to develop the social economy? The society puts forward a series of concepts such as circular economy, green economy, ecological economy, and knowledge economy, which makes the transportation industry also need to take energy consumption, sustainable development, overall construction, and intellectual property as the important factors of the research system. The characteristics of the transportation industry itself are the consumption of resources and the use of technology. The consumption of resources is closely related to the development of economy, and the use of technology will have a strong demand for new technology. In short, today's transportation industry has a typical role in promoting economic development, and is expected to directly and indirectly promote the rapid development of local economy in the future, and improve the overall level of transportation.

4.4 Construction of Regional Economic Development Index Evaluation System

Regional economic development index refers to the comprehensive development of all aspects of economic development in a region or a period. There is a relationship between economic development index and traffic development index. The development index of regional economy must include more elements, such as human resources, technical elements, capital elements and transportation conditions. Traffic development indicators should also consider more comprehensive and representative indicators as far as possible, such as highway passenger volume, waterway passenger volume, railway passenger volume and civil aviation passenger volume as the research basis. In addition to considering the index factors, we should also choose the number of examination years, and its reasonable and effective year value is helpful to the accuracy of quantitative relationship.

After a period of observation of the region, we can find that the impact of traffic volume of different structures on social and economic development is reflected in different aspects of different industries. The composition of the economic development index is more complex, and if all kinds of transportation industry development index as an independent variable, then the total amount of economic development as a dependent variable is bound to reflect a positive relationship of quantitative development and change.

5. CONCLUSION

For the study of the factors affecting the sustainable development of regional economy, we can take the factors of economic sustainable development and local regional development as a

systematic framework to comprehensively study, and consider the interaction between them. Therefore, in the process of evaluating the development of regional economy and total traffic volume, we should consider many factors. This paper analyzes the correlation between the traffic volume, passenger traffic turnover, freight volume, freight turnover index and the domestic total income index, uses the combination of SPSS model and fuzzy evaluation method, calculates with the data of the past four years, and obtains the conclusion that there is a strong correlation between the two Preliminary conclusion. To sum up, China's transportation industry is developing continuously, and the overall economic development of the country and region needs the assistance of the transportation industry to have a solid foundation for development.

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