



Research on the influence of aviation connectivity on the development of express delivery industry

Lin Yan, Shijinheng

School of Air Transportation, Shanghai University of Engineering Science, China

Abstract: *air transportation has become an important mode of transportation in China's express industry because of its fast, convenient, safe and efficient characteristics and can meet the needs of long-distance transportation. This paper selects ten representative cities to measure their aviation connectivity. Then identify the factors affecting the development of the express industry, collect relevant data to build a multiple regression model, and empirically study the impact of aviation connectivity on the development of the express industry.*

Keywords –air transport, express industry, affecting

Received 12 Sep, 2022; Revised 25 Sep., 2022; Accepted 28 Sep., 2022 © The author(s) 2022.

Published with open access at www.questjournals.org

I. INTRODUCTION

In recent years, with the accelerated development of e-commerce, the Internet has become more and more popular, and the express industry has grown rapidly. And because of the deregulation of China's civil aviation, the opening of airspace and the growing demand of people, China's air transport has also developed rapidly. This has expanded the scope of express transportation and shortened the time of express transportation. Therefore, air transportation and express industry have gradually become close. In this context, studying the impact relationship between aviation connectivity and the development of the express industry will help promote the rapid development of the express industry and the economy.

II. DEVELOPMENT STATUS OF CHINA'S EXPRESS INDUSTRY

The development of China's express delivery industry started in the 1980s and grew rapidly at the end of the 20th century and the beginning of the 21st century.

With the rapid improvement of China's economic development level, people have higher and higher requirements on the delivery time of express parcels. The current scope of express delivery is not limited to traditional documents and parcels. More and more high-added goods, small batches and personalized goods have become the business scope of express delivery. In this way, customers have higher requirements for the timeliness and security of express delivery. Many people prefer to pay more express fees to choose express companies that do better in timeliness and security.

Compared with other modes of transportation, aircraft has obvious characteristics such as high speed, safety and comfort. Therefore, in order to improve the timeliness and security of express delivery, express companies gradually turn to air express. The four international express giants are essentially air express companies. China's express industry started late, and the development of various express companies was uneven. Most of the express companies used ground transportation tools such as cars and trains. In recent years, more and more Chinese express companies have realized the importance of the time and safety of express delivery to customers, begun to use the belly compartment of passenger aircraft to transport express mails during long-distance transportation. This has greatly improved the speed and safety of express mail. Some private express companies have established their own airlines to provide more services to customers. In this way, China's express industry has entered the initial stage of air express.

III. OVERVIEW OF AVIATION CONNECTIVITY

In the airline network, connectivity is the connectivity of two airports, that is, the convenience of transportation. For the express industry, the better the air connectivity is, the less transit times and the higher the convenience.

3.1 factors affecting aviation connectivity

Aviation connectivity is mainly affected by the number of connections and the quality of connections. In existing studies, variables such as the number of routes, the number of flights, the frequency of flights, the number of seats on flights, and the scale of connected airports are usually taken as important factors affecting airport connectivity. Considering the existing research and real data conditions, this paper selects the number of flights to evaluate the number of connections, uses the economic development level of the destination to evaluate the quality of connections, and establishes the quantitative and quality indicators of aviation connectivity.

(1) Quantitative index

The number of flights is the most commonly used indicator to evaluate aviation connectivity. The greater the number of flights connected to an airport, the greater the possibility of external connection, and the greater the aviation connectivity of the airport. At the same time, the more nodes the airport connects to, the greater the connectivity of the airport in the network.

(2) Quality index

When using the number of flights to measure airport connectivity, all destination airports are regarded as homogeneous nodes. However, in fact, different destinations have different connecting values to the departure airport. On the one hand, the higher the level of regional economic development, the easier it is to attract more people and logistics. Therefore, connecting with airports in higher economic levels has more economic value. On the other hand, the transfer possibilities provided by different airports are also very different. The larger the scale of the airport, the more navigable points the airport can provide, the more transfer possibilities. Therefore, the GDP level of the destination city can be selected to evaluate the quality difference of aviation connectivity of each connecting destination.

3.2 measurement method of aviation connectivity

The connection between airports can be divided into direct connection and indirect connection. The indirect connection is divided into stop and transit. Considering the availability of data, this paper only selects the direct connection of the airport for analysis.

It can be defined that the departure airport is i and the destination airport is j ($j=1,2,3,\dots, m$), here m is the number of navigation points of airport i , and k represents direct connection from airport $i \rightarrow j$ (OD pair). The airport aviation connectivity calculation method is as follows:

$$C_i = \sum_{j=1}^m W_{jGDP}^k n^k \text{ (Formula 1)}$$

Among them, $W_{jGDP}^k = GDP_j / GDP_0$ measures the GDP level of the city where the destination airport j is located, and GDP_0 is the maximum of the city's GDP within the comparison range. W_{jGDP}^k is used to express the economic level of the destination connected to the departure airport i , showing the difference of the economic value of different navigation points of the airport. n^k is the number of flights on the direct connection k ($i \rightarrow j$). $W_{jGDP}^k n^k$ indicates the connectivity on the direct connection k . The aviation connectivity of airport i is obtained by adding the connectivity values between airport i and all navigation points j .

IV. AN EMPIRICAL ANALYSIS OF THE IMPACT OF AVIATION CONNECTIVITY ON THE EXPRESS INDUSTRY

4.1 China's urban aviation connectivity

In order to explore the impact relationship between aviation connectivity and express industry, according to the 2021 ranking list of China's urban express business income, and considering the city's airport ownership and data availability, 10 cities including Shanghai, Guangzhou, Shenzhen, Hangzhou, Chengdu, Wuhan, Tianjin, Ningbo, Changsha and Nanjing are selected as samples to calculate aviation connectivity.

The number of connected flights of each city in January 2022 is obtained through the official website of the Flight Regulation. In combination with the GDP data of each city, the aviation connectivity data of these ten cities is calculated according to Formula 1, as shown in Table 1:

Table 1 aviation connectivity of sample cities

City	Shanghai	Guangzhou	Shenzhen	Hangzhou	Chengdu	Wuhan	Tianjin	Ningbo	Changsha	Nanjing
aviation connectivity	11016.63	9367.16	6927.69	4692.47	7334.62	4539.17	3243.31	1050.37	4313.04	3389.73

The development of air passenger transport and air cargo transport will affect the airport routes and the number of flights, thus affecting aviation connectivity. The development of express industry is mainly affected by the development of air cargo transport. Therefore, in order to more accurately calculate the airport aviation connectivity that affects the express industry, this paper finds out the passenger throughput and cargo throughput of each city airport, divides the cargo throughput data by the total passenger and cargo throughput (here, the

passenger weight is converted by 90 kg), and obtains the approximate proportion of cargo and mail transportation in the total airport throughput, and then multiplies it with the previously calculated aviation connectivity. The aviation connectivity correction value that can more accurately represent the impact on express transportation is obtained, as shown in Table 2:

Table 2 correction value of aviation connectivity of sample cities

City	Shanghai	Guangzhou	Shenzhen	Hangzhou	Chengdu	Wuhan	Tianjin	Ningbo	Changsha	Nanjing
aviation connectivity	4691.06	3379.87	2244.50	1243.68	1088.82	683.78	406.13	122.74	449.18	626.45

4.2 selection of factors affecting the development of express industry

Different regions have different levels of specialization in the express industry, and the development of the express industry is not isolated. In addition to the impact of aviation connectivity, this paper believes that the development of the express industry is also affected by the living standards of residents and the scale of express service outlets.

(1) Living standard of residents

The development of express industry is closely related to the living standard of residents. With the improvement of residents' living standards, residents will tend to consume more, and many consumer goods come to residents' homes through express transportation. In this paper, per capita consumption expenditure is selected as an indicator to evaluate the living standard of residents.

(2) Scale of express service outlets

Express delivery business is handled and distributed through local post offices and express delivery points. And express delivery points are basically distributed around the post office. The post office is not only responsible for many express services, but also has a supervisory role in the express industry. Therefore, this paper uses the number of post offices to measure the scale of express service outlets in a city.

4.3 construction of multiple regression model

This paper constructs a multiple regression model to analyze whether the living standard of residents, the scale of express service outlets, and aviation connectivity have a positive and significant impact on the development of the express industry. The multiple regression model built in this study is as follows, and the calculation process is implemented with SPSS software. In addition to the above calculation results for aviation connectivity data, the data on express business income, living standard of residents, and scale of express service outlets are derived from the 2021 Statistical Yearbook issued by the China Urban Statistics Bureau.

$$Y = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \sigma$$

Here, Y represents the express business income. The variable X_1 represents the living standard of residents. The variable X_2 represents the scale of express service outlets. The variable X_3 represents aviation connectivity. α_0 is a constant term. $\alpha_1, \alpha_2, \alpha_3$ are regression coefficients. σ Represents an error term.

Through calculation, the multiple regression equation obtained in this paper is as follows:

$$Y = 155.219X_1 + 865.663X_2 + 2162.936X_3 - 5193016.832$$

Durbin-Watson test was carried out on the regression equation, and the DW statistic was 2.414, indicating that the residual of the regression equation obeyed normal distribution and had no autocorrelation. Then significance test and collinearity test were conducted. The significance test values of each variable were 0.049, 0.004 and 0.001, all less than 0.05, indicating that the independent variable had a significant impact on the dependent variable. The VIF values of each variable are 2.696, 1.875 and 3.999 respectively, which are less than 10, indicating that the model has no multicollinearity problem and is well constructed.

4.4 empirical analysis results

By building a multiple regression model and testing the results, this paper concludes that the living standard of residents, the scale of express service outlets, and aviation connectivity can all have a positive and significant positive impact on the development of the express industry. This conclusion objectively shows that there is indeed an impact relationship between aviation connectivity and the development of express industry. The stronger the urban aviation connectivity is, the more convenient the express transportation is. It will be more conducive to the development of the express industry, so that the income of the express industry will also be higher.

V. CONCLUSION

Air transport, as an important mode of transport, plays an increasingly important role in the express industry. China needs to actively promote the construction of urban aviation infrastructure, enhance the

connectivity of air transport network, improve the external connectivity of cities, enhance the transportation convenience with other cities, give full play to the role of air transport in promoting the development of urban express industry, and promote the rapid development of express industry and economy.

REFERENCES

- [1]. Wang Baoyi. Research on the Measurement of Regional Unbalance of China's Express Industry Development. *Statistics and Information Forum*, 2016, 31 (03): 60-67
- [2]. Zou Shuqi, Hou Yunxian. Empirical Study on Factors Affecting the Development of Express Industry. *Modern Trade Industry*, 2014, (01): 70-72
- [3]. Zhang Lan, Zhu Houqiang. Grey Correlation Analysis of Factors Affecting the Development of China's Express Industry. *Business Economics Research*, 2015, (29): 122-124
- [4]. Dang Yaru, Peng Lina. The hierarchy of air cargo network based on the centrality of complex networks. *Transport System Engineering Information*, 2012 (3): 109-114
- [5]. Guo Wenjiong, Bai Mingying. An Empirical Study on the Functional Grades of China's Urban Air Transport and the Characteristics of Air Connection. *Human Geography*, 1999,14 (1): 27-311