

Research On The Impact Of Shanghai Airport Aviation Business Volume On Urban Economy

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Abstract:

The paper first conducts a theoretical analysis of the relationship between airports and urban economic development, summarizing and elaborating on the impact mechanism of airports on urban economic development. Then the paper selected the aviation business volume of Shanghai Airport in the past decade and the economic development data of Shanghai in the past decade for standardization processing and used entropy weight method to perform calculations. Finally, the paper explores the relationship between airport aviation business volume and urban economy through linear regression method, and draws relevant conclusions.

Keywords –aviation business volume, urban economy, entropy weight method, regression analysis

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I. Introduction

Airport is a node in the national transportation system, one of the prerequisites for promoting regional economic development, and also a gateway and window for the region to access the international market. The airport can enhance the investment attraction capacity of the region and also serve as a transportation hub for transporting goods, which can itself promote economic development and employment in the region. The passenger and cargo volume brought by airport operation, as well as various employment opportunities, can bring considerable profit and income, and can quickly change the closed state of the city. As of 2023, there are a total of 254 transportation airports in China, and the development of airports can effectively serve the overall opening up of the country and promote regional economic development.

II. The Impact Mechanism Of Airports On Urban Economic Development

The explicit impact of airports on urban economy

(1) Multiplier effect. This refers to the economic phenomenon where a change in a certain variable in economic activity leads to a chain reaction in the overall economic aggregate.

The multiplier effect of airports can be divided into two aspects. One is the multiplier effect within the aviation economy dominated by airports, which refers to the investment multiplier generated by industries related to the aviation transportation economy generated by airport construction and operation. In the process of airport infrastructure construction and maintenance, a large amount of manpower and material resources are required, which will directly consume a large amount of raw materials such as wood, metal, cement, etc., which will drive the production and income of these local production departments and increase employment. In the process of airport operation, various airlines and enterprises based on the airport need to purchase aircraft, supporting electronic navigation equipment, etc. in order to provide air transportation services. This will significantly increase the sales volume of enterprises providing related products, thereby driving their sales revenue. The

second is the chain multiplier effect between airports and other industries in the region, which means that the input-output of airports affects the investment multiplier generated by other industries in the region. Enterprises that provide aircraft and supporting electronic equipment require some basic industrial sectors, such as the non-metallic industry, ferrous metal industry, and non-ferrous metal industry, to provide relevant raw materials. Through a top-down supply and demand relationship, the production of materials and products in society increases. In addition, the increase in income and employment in these sectors within the region leads to an increase in the total income of employed individuals, thereby improving their consumption level. They will have higher demands and demands for cultural and entertainment life, education and healthcare, and other aspects. These demands will increase the supply of related industries, indirectly increasing the income and employment opportunities of other industries. Finally, the increase in income and employment in various industries will stimulate the demand for air travel, thereby stimulating airport investment and construction. This interaction will multiply the income of various industries, generate a multiplier effect, and the regional economic level will also improve accordingly.

(2) Agglomeration effect. This refers to the economic effects generated by the concentration of various industries and economic activities in space, as well as the centripetal force that attracts economic activities closer to a certain area.

The improvement of transportation conditions can effectively promote the efficient and efficient flow of economic factors and the rational allocation of resources, therefore it is crucial for the development of the social economy. As a large-scale transportation infrastructure, an airport is a hub for various types of information and resources, and also a place for the spontaneous integration of these information and resources. This integration is reflected in the aggregation function of the airport. The airport has transformed from a simple transportation network node into an important platform for regional industrial resource exchange and technical service exchange. In operation, it stimulates the generation of new supply and demand through the industrial chain, promoting the layout of industries around the airport, and forming industrial clusters. Among the industries clustered around the airport, transportation and warehousing departments, air transportation activity supporting service departments, and upstream and downstream industries that directly provide services or products are the main ones. In the process of industrial agglomeration, the civil aviation transportation industry affects the entire industrial system through the industrial chain of each industry, promoting the adjustment and upgrading of regional industrial structure.

(3) Radiation effect

On the basis of the benefits generated by the agglomeration effect mentioned above, airports will no longer exist solely as a geographical location. While the agglomeration effect is generated, it will also exert a radiation effect, attracting more new labor and investment resources to flow into the region. The increase in airport routes and flight frequencies will further expand the scale of the airport, improve the comprehensive transportation system, and make the connection between the airport and ground transportation closer. This will attract more passengers and goods to transport or transfer from farther away to the airport. When an airport can attract a larger range of aviation passenger and cargo sources, it will also have a driving effect on the economy of a larger region. Therefore, the larger the scale of an airport, the stronger its radiation capacity, and the larger the range of areas it can reach. At the same time, as a specific airport continues to expand in size, its radiation range will also continue to expand outward.

The implicit impact of airports on urban economy

Airport is a large-scale infrastructure with social welfare, which has a certain social impact on the regional economy. An airport is an important gateway and window for a city or even a region. The construction and development of an airport have improved the city's image and the regional comprehensive transportation system, greatly enhancing the comprehensive strength of the region. Optimizing transportation services, enhancing city image, enhancing soft power, attracting investment, and indirectly affecting regional economy. Moreover, the airport brings convenient transportation, narrowing the distance between cities and people, and to some extent promoting communication between cities and people. This communication will promote the dissemination of culture and enrich the cultural content within the region.

III. The Current Situation Of Shanghai Airport And Urban Economic Development

Current Development Status of Shanghai Airport

Shanghai Pudong International Airport was completed and put into operation in 1999, located at the easternmost point of Shanghai city, adjacent to the sea to the east, and 30 kilometers away from the People's Square in the center of Shanghai, about an hour's drive. Pudong International Airport is currently one of the several hub airports with the largest flight volume in China. There are currently 107 airlines operating here, including over 30 engaged in full cargo aircraft business.

Shanghai Hongqiao International Airport was built in 1907, 13.3km away from Shanghai People's Square. It is an important large-scale hub airport in China, mainly operating domestic flight services, while continuing to retain the alternate landing function for international flights. The passenger throughput and cargo throughput of Shanghai Pudong Airport and Hongqiao Airport from 2010 to 2019 are shown in Table 1.

Table 1 passenger throughput and cargo throughput of Shanghai Airport from 2010 to 2019

Time	Shanghai Pudong International Airport		Shanghai Hongqiao International Airport	
	Passenger throughput (person)	Cargo throughput (tons)	Passenger throughput (person)	Cargo throughput (tons)
2010	40578621	3228080.8	31298812	480438.1
2011	41447730	3085267.7	33112442	454069.4
2012	44880164	2938156.9	33828726	429813.9
2013	47189849	2928527.1	35599643	435115.9
2014	51687894	3181654.1	37971135	432176.4
2015	60098073	3275231.1	39090865	433600.1
2016	66002414	3440279.7	40460135	428907.5
2017	70001237	3824279.9	41884059	407461.1
2018	74006331	3768572.6	43628004	407154.6
2019	76153445	3634230.4	45637882	423614.7

Current Situation of Urban Economic Development in Shanghai

Shanghai is an important engine that supports and leads the transformation, upgrading, and development of the Yangtze River Delta region. It is the core functional area of the Yangtze River Delta urban agglomeration and one of the important metropolitan areas in China. Shanghai's economic growth rate is leading among major cities in the world, and its total size ranks among the top cities in the world. As the largest economic center city in China, Shanghai has a superior geographical location, strong economic foundation, and abundant talent resources,

making it one of the most important trade ports in the world. The GDP, industrial production value, and disposable income of urban and rural residents in Shanghai from 2010 to 2019 are shown in Table 2.

Table 2 GDP, gross industrial product, disposable income of urban and rural residents in shanghai

Time	GDP (100 million yuan)	Gross Industrial Product (100 million yuan)	Per capita disposable income of urban residents (yuan)	Per capita disposable income of rural residents (yuan)
2010	16872.42	6456.78	32584	13702
2011	19195.69	7230.57	36230	15644
2012	20101.33	7159.36	40188	17401
2013	21602.12	7232.69	43851	19208
2014	23560.94	7362.84	47710	21192
2015	24964.99	7109.94	52962	23205
2016	27466.15	7145.02	57692	25520
2017	30133.86	8303.54	62596	27825
2018	32679.89	8694.54	68034	30375
2019	38155.32	9670.68	73615	33195

IV. Empirical Analysis Of The Impact Of Shanghai Airport Aviation Business Volume On Urban Economy

Indicator Selection

This article selects passenger throughput and cargo throughput to measure the development level of airport aviation business, in order to fully reflect the level of airport operation development. When constructing the urban economic evaluation index system in this article, a total of four indicators are developed based on two levels: economic aggregate and economic benefits. The economic aggregate indicator selects GDP and gross industrial product to measure the overall strength of the economy, while the economic benefit indicator selects per capita disposable income of urban residents and per capita disposable income of rural residents to measure the development vitality of the economy.

Entropy weight method for determining weights

When calculating the weights of each indicator in this article, the entropy weight method is used, which directly utilizes the information of actual data to obtain more objective and scientific weights.

The calculation steps are:

(1) Standardization of indicators:

Due to the non-uniform measurement units of various indicators, before using them to calculate comprehensive indicators, it is necessary to standardize them, that is, convert the absolute values of the indicators into relative values, in order to solve the problem of homogenization of different indicator values.

The indicators in the paper are all positive indicators, and the processing method is as follows:

$$x_{ij}^* = \frac{x_{ij} - x_{\min}}{x_{\max} - x_{\min}} \quad (\text{formula 1})$$

Due to the fact that there must be at least one value of 0 in the standardized results of the indicators, in order to avoid situations where the logarithm cannot be taken in the future, this article adds 0.001 to the above equation. Therefore, the minimum value obtained is 0.001, which will not result in situations where the logarithm cannot be taken.

(2) Calculate the contribution of indicators:

$$p_{ij} = \frac{x_{ij}}{\sum_{i=1}^n x_{ij}}$$

Represents a set of data for the j th indicator of the i -th system. When j remains unchanged, the higher the degree of difference in the system, the greater the proportion of this indicator in the system, and the more information it contains.

(3) Calculate the entropy value of each indicator:

$$E_j = -\ln(n)^{-1} \sum_{i=1}^n p_{ij} \ln(p_{ij})$$

(4) Calculate the coefficient of difference for each indicator:

$$d_j = 1 - E_j$$

(5) Calculate the weights of various indicators:

$$w_j = \frac{d_j}{\sum_{j=1}^m d_j}$$

(6) Calculate the final evaluation value of each indicator:

$$Reg_i = \sum_{j=1}^m w_j \times x_{ij} \quad (\text{formula 2})$$

Reg_i is the final evaluation value of the sample, x_{ij} is the standardized value of the indicator, and w_j is the weight coefficient of the indicator j .

Measurement of Aviation Business Volume at Shanghai Airport

According to Table 1, the passenger throughput and cargo throughput of Pudong Airport and Hongqiao Airport are added together to obtain the total aviation business volume of Shanghai Airport from 2010 to 2019. Then standardize the indicators according to formula 1, and use the entropy method to calculate the weights. Finally, according to formula 2, the evaluation values of aviation business volume in Shanghai from 2010 to 2019 are shown in Table 3.

Table 3 measurement of aviation business volume at shanghai airport from 2010 to 2019

2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
0.2020	0.1299	0.0711	0.1090	0.3228	0.4725	0.6379	0.9029	0.9272	0.8996

Measurement of Shanghai's Urban Economic Development

According to Formula 1, standardize the economic indicator data of Shanghai from 2010 to 2019 in Table 2, and then use the entropy method to calculate the weights. Finally, according to Formula 2, the evaluation value of Shanghai's urban economic development from 2010 to 2019 is calculated as shown in Table 4.

Table 4 measurement of urban economic development in shanghai

2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
0.001	0.136	0.187	0.255	0.337	0.390	0.480	0.662	0.788	1.001

Regression analysis

In order to explore the impact of Shanghai Airport aviation business volume (x) on urban economy (y), this article establishes a univariate linear regression model for analysis. The regression equation obtained through one-way regression using SPSS software is as follows:

$$y=0.041+0.818x$$

The judgment coefficient R of the regression equation is 0.918, which is very close to 1, with a goodness of fit of 0.842. The standard goodness of fit is 0.823, indicating that the linear regression model has a high fit to the sample. $F=42.76$, $p=0.000<0.05$, indicating that the linear relationship of the regression equation is significant.

According to the regression equation, whenever the aviation business volume of Shanghai Airport increases by 1%, it will increase the urban economy by 0.818%.

V. CONCLUSION

From the research in the paper, it can be seen that the development of airport aviation business has a certain positive driving effect on the urban economy. The impact of airport aviation business development is not only the income and profits it brings to the airport itself, but also the economic benefits and driving effect it brings to other industries around the airport and even the entire city. The contribution of airport aviation business development to urban economy cannot be underestimated, and with the continuous development of airports and urban economy, the contribution of airports also increases, indicating that the position of airports in future urban development is becoming increasingly important. Therefore, the investment and construction of airports is of practical significance and is an important planning project in the long-term development planning of cities, and the government should pay attention to it.

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