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Analysis on the Influencing Factors of the Development of Air Transport Industry in China

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Abstract: A brief review of relevant research results on the factors affecting the development of air transport industry at home and abroad. The influencing factors and impacting mechanism of air transport development in China are discussed from three aspects: supply side and demand side and the fluctuation of international oil price, and establishes a multivariate regression model for empirical analysis. The research finds that the supply factors such as the number of airports, demand factors such as per capita GDP and imports and exports have positive impacts on passenger and freight turnover. Crude oil prices have a significant negative impact on the operating income of the air transport industry. The number of aircraft introduced by leasing is negatively correlated with the total profit of the air transport industry. It is recommended to increase investment in aviation industry infrastructure construction and improve relevant policies supporting for aviation leasing to better promote the development of air transport industry in China.

1. Introduction

The air transport industry is the main mode of modern international transport and an important embodiment of the economic development of a country.

The rapid development of economy and the continuous expansion of openness have led to steady growth of air passenger and freight turnover in China. The passenger turnover increased from 109.135 billion passenger-km in 2001 to 951.304 billion passenger-km in 2017. The freight turnover increased from 4.372 billion ton-km in 2001 to 24.355 billion ton-km in 2017. In addition, the increasing demand for air transport also has promoted the development of air transport, especially after 2007, the state has liberalized restrictions on financial leasing business for banks, and introduced a series of preferential policies, which has resulted in rapid growth in the number of aircraft introduced by leasing and rapid expansion of the fleet size, which from 566 in 2001 to 3,296 in 2017. At the same time, the air transport capacity and volume have been continuously improved, and the route network has been continuously perfected, which has promoted the further development of regional aviation. However, there are still problems, such as unbalanced development of small and medium-sized cities and remote areas and insufficient overall transport capacity.

Insufficient air transport capacity has inhibited the development of air transport to a certain extent, especially the lack of air freight supply. For example[1], in 2018, the annual throughput of passenger at Jiangsu is only 8th in China, 60% of outbound passengers and 95% of international freight must be imported and exported from airports such as Shanghai. The serious lack of international transport capacity has restricted the construction of an open and strong province. By the end of 2017, there were 219 national transport airports in China, while there were more than 500 transport airports in the United States, and the number of airports in China is still small. In addition, the development of air leasing in China is relatively lag, which is not enough to support the rapid development of air transport. In view of these problems, based on the qualitative analysis and taked the data of air transport development and influencing factors in China from 2001 to 2017 as a sample, this paper establishes a multivariate regression model for empirical analysis, identifies the key factors that

restrict the development of air transport industry in China, and then puts forward specific recommendations to promote the development of air transport.

2. Literature Review

The development of air transport in western developed countries is relatively mature, and relevant theoretical research results are also relatively early. Goetz (1992) conducted a study of US airline passenger volume, arguing that population and employment rate have a greater impact on air passenger tiansport[2]. Flening (1994) conducted a study of aviation demand in the southeastern United States, arguing that air transport was related to manufacturing, tourism, and domestic flights[3]. John Kasarda (2009) believes that the development of e-commerce has promoted the rapid development of air transport and has studied aviation infrastructure planning and government management[4]. Karp, Aaron (2014) argues that the aviation industry demonstrates the economic strength of a country and points out that aviation leasing, as the main introduction method of aircraft, not only expand the fleet size, but also enhance competitiveness and improve profitability[5].

Domestic research on the factors affecting air transport has produced some representative results in recent years. Miao Qingfen (2007) based on single regression analysis and multiple regression analysis, demonstrated the impact of aircraft number, fuel consumption, population and per capita GDP on air passenger transport. He believed that per capita GDP and population had a greater impact on air passenger demand, while fuel consumption represents supply capacity and has little impact on air passenger transport[6]. Guan Chiming (2008) believes that civil aviation routes, inbound tourism, per capita GDP, industrial added value, import and export have an impact on the development of air transport[7]. Dang Yaru, Peng Lina (2012) believe that the development of the economy, docmestic and external demand have a positive impact on air freight, while the lack of air freight capacity and smaller route networks coverge restrict the development of air freight[8]. Qi Yumeng (2015) based on the interpretative structural model, found that transport demand and air transport capacity are the main factors affecting air transport. Per capita GDP, tourism and foreign trade have significant impact on air transport[9]. Liu Guangcai (2016) believed that compared with developed countries, air transport market in China is sufficient supply, but airspace resources and airport resources are insufficient. It is recommended to speed up the construction of civil airports[10]. Wang Qinyun (2018) used multiple regression model to analyze the factors affecting of passenger volume of civil aviation in China. He believed that the total population at the end of the year, inbound tourists and railway passenger volume were closely related to air passenger volume[11].

3. Analysis of Influencing Factors of Air Transport

This paper mainly analyzes the factors affecting air transport from the supply side and the demand side. The factors such as the number of aircrafts and the number of airports at the supply side of air transport fundamentally reflect the development of air transport in China; passenger transport and freight transport are the basic services of air transport and reflect the demand of air transport to a certain extent.

3.1. The Impact of the Supply Side on Air Transport

Supply-side air transport capacity is one of the main factors affecting the development of air transport. The market demand of air transport in China is relatively large, and only when the airline capacity reaches a certain scale ,the demand of passenger transport and freight transport can be met. The number of transport aircraft in China has been rising rapidly since 2001. By the end of 2017, the number of aircraft has reached 3296. The increase of air transport capacity has led to the increase of air transport volume. However, due to the high cost of aircraft, it is difficult for airlines to purchase aircraft in full with their own funds. Faced with the rising aviation demand, the introduction of aircraft by leasing is the primary choice for airlines. Airlines can have the right to use aircraft only if they pay a certain rental fee every year. Aviation leasing plays an indispensable role in improving air transport capacity.

The number of airports and the route network are the most basic factors affecting air transport. The more airports there are and the more dense the route network, the more people can enjoy the convenience of air transport. Especially in recent years, domestic second and third-tier cities, remote areas such as Xinjiang and Inner Mongolia, which have unique advantages compare with ground traffic, the number of airports and the number of routes have increased significantly, which has injected new driving force into the development of air transport. On the international routes, the opening of the sky has been greatly improved in the award of shipping rights, and the liberalization of international air transport services will become inevitable. Airlines also seize the favorable opportunity of "The Belt and Road" to open up international routes to Southeast Asia and Africa. By the end of 2017, Chinese has opened 432 routes to the countries along "The Belt and Road", accounting for 54% of international routes, which has increased the share of international air transport and has promoted the development of air transport in China.

3.2. The Impact of Demand on Air Transport

3.2.1. Air Passenger Transport Demand

At present, the proportion of air passenger is relatively large, the income level of residents is constantly improving, resulting in the continuous increase in demand for air transport. The demand for air passenger transport mainly from tourism, international students, business travel and so on. Firstly, the development of tourism provides a stable source of passengers for air transport, especially cross-border tourism. Air travel saves a lot of travel time for tourists and is the primary choice for tourists. The number of cross-border tourists in China increased from 12 million in 2001 to 130 million in 2017, which has promoted the development of air transport. On the other hand, the competition of domestic educational resources is fierce, and the developed countries in the West have relaxed the conditions for international students, which makes the phenomenon of younger students studying abroad more obvious. By the end of 2017, the number of international students in China has reached 0.61 million, which has achieved historic growth and the round trip of international students will definitely lead to the increase of air transport.

Secondly, the degree of opening to the outside world is constantly increasing. From the background of WTO accession and “going global” to the “13th Five-Year” period, Chinese will build a new pattern of comprehensive opening up, and cooperation and exchanges between countries will be closer. Especially under the national “The Belt and Road” initiative, foreign business volume and the number of multinational corporations have been increasing continuously, the number of business trips has increased year by year. In addition, labor resources in China are abundant and the labor exports are large, and the main modes of transport for the people from countries are long-distance is aircraft, which will increase the demand for air transport.

3.2.2. Air Freight Demand

Air transport is favored by high-value, light-weight, short-lived goods with its advantages of fast speed and geographical limitations. Especially, the demand for air freight is growing rapidly due to the investment of aircraft with large capacity and low fuel consumption. Firstly, air transport is undoubtedly the best choice for fruits, seafood and other goods that cannot be preserved for a long time, and commodities with strong timeliness. Secondly, due to the extensive use of emerging technologies, managers pay more attention to the timeliness and security of transport, for high-tech products with high value and small volume, air transport is often used. In terms of global air freight, the transport of such high-tech products accounts for one-third of air freight. Experts predict that the scale of such products will continue to expand in the future.

In recent years, the rapid development of cross-border e-commerce has increased the demand for air freight. The volume of cross-border e-commerce transaction in China has increased from 1.3 trillion yuan in 2010 to 6.9 trillion yuan in 2017, which has more than five times. The traditional bulk trade in maritime transport has not been able to adapt to the current form of development. More and more small trade orders have begun to appear with the form of air parcels. With the rapid development of cross-border e-commerce, the entire international logistics approach is undergoing

tremendous changes. Aviation logistics has become a major development trend.

3.3. The Impact of Market Fluctuations on the Air Transport Industry

Market fluctuation affects air transport supply and demand by affecting costs. This paper mainly analyzes the impact of fluctuations in crude oil prices and exchange rates on air transport. Fuel costs account for a large proportion of the total cost of air transport. The fluctuation of oil prices will directly affect the cost of air transport. The increase in fuel prices will increase the cost of airlines. But due to the development of domestic low-cost airlines, competition in the industry has intensified. Airlines do not dare to easily raise fares or freight rates, and it is possible to reduce the supply of capacity by delaying the introduction of aircraft or reducing the utilization of aircraft to ensure their own interests.

The impact of exchange rate fluctuations on air transport is mainly reflected in the following two aspects: On the one hand, due to the aircraft and related large-scale machinery and equipment used in China are basically imported from abroad, most of them are denominated in US dollars or euros, and the airlines pay a certain amount of interest and principal every year, exchange rate fluctuations directly affect the cost of airlines; on the other hand, exchange rate changes affect the air transport by affecting the number of people going abroad and import and export.

4. Empirical Analysis

4.1. Air Transport Impact Mechanism and Research Hypothesis

This paper mainly analyzes the influencing factors of air transport from actual output and economic benefits. As far as the actual output is concerned, supply-side such as the number of civil transport aircraft and airports increase, which can better meet demand of the passenger, then driving the increase of passenger volume. Usually, transport of international goods uses aircraft as a means of transport. The rise consumption levels of residents and the development of cross-border e-commerce have led to an increase in imports and exports, which has a positive impact on air freeight volume.

As far as economic benefits is concerned, changes in the number of transport aircraft, airports, consumption levels of residents, crude oil prices and exchange rate market fluctuations affect air transport volume and cost, then affecting air transport operating income and profits.

The aviation leasing, which integrates “financing” and “melting”, effectively solves the financing problems faced by airlines, it apportions the purchase cost of airlines, relieves the pressure on funds, reduce the financial risks of the company and make the airlines have more funds to improve operations of company. At the same time, the company can enjoy the benefits of accelerated depreciation of fixed assets while using the aircraft, reduce airline operating costs and improve profitability, therefore the following assumptions are forward:

H1: The more the number of transport aircraft and airports, the greater the turnover of air passenger transport;

H2: Per capita GDP, imports and exports increase, the greater the turnover of air freight;

H3: The more the number of airports, the higher the operating income of the air transport industry;

H4: The greater the number of aircraft introduced by leasing, the higher the profit of the air transport industry;

4.2. Construction of Econometric Model and Data Sources

4.2.1. Econometric Model Construction

The above hypothesis is validated from the perspective of actual output and economic benefits of air transport. This paper analyses the influence of the supply factors such as the number of aircraft and airports, the demand factors such as passenger volume, import and export, market fluctuations such as crude oil prices and exchange rates on air transport. To eliminate the multicollinearity of sample data, differential variable multivariate regression model is established, The relationship between explaned variables and explanatory variables is analyzed, and the factors affecting the air transport industry are explored.

$$D(Y_i)=\beta_1 D(X_1)+\beta_2 D(X_2)+\ldots\ldots+\beta_k D(X_k)+\mu \qquad (i=1、2、3、4、5)$$

Among them: βi represents the regression coefficient, Y_1, Y_2, Y_3, Y_4, Y_5 are the explaned variables in the model, which represent the total turnover of air passenger transport (100 million passenger-km), the total freight volume (100 million ton-km), and the total turnover of passengers and freight (100 million ton-km), operating income (100 million yuan), total profit (100 million yuan); X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9 are explanatory variables, respectively indicating the number of leased aircraft, the number of civil transport aircraft, the number of airports, the number of routes, per capita GDP, import and export (tens of billions of US dollars), passenger volume (person), crude oil price (dollar/barrel), exchange rate; μ is a random disturbance.

4.2.2. Data Source

Since Chinese joined the WTO in 2001, the degree of openness has been increasing, and the rapid development of the economy has driven the development of air transport. Therefore, this paper selects the statistical data from 2001 to 2017, and explaned variable passenger turnover, freight turnover, the total turnover of freight and passengers reflect the actual output of air transport. Operating income and total profit reflect the economic benefits of air transport. The data comes from the statistical bulletin of civil aviation industry development, Explanatory variable the number of civil transport aircraft, the number of airports and routes reflects the air transport supply. Passenger traffic, total import and export volume, and per capita GDP reflect the amount of air transportation demand. The data comes from the website of the National Bureau of Statistics and the Ruisi database. The annual average crude oil price and exchange rate reflect the cost of fluctuation in the air transport market. The data comes from the US Energy Information Administration and the Ruisi database; the number of leased aircraft has expanded the fleet size and improved the asset structure of the air transport industry. The data comes from the Prospective Industry Research Institute and partly from the literature research report.

4.3. Model Estimation

4.3.1. Model Estimation Results

Because there are multiple collinearities in the model, the difference method is used to regression analysis, and Eviews9.0 software is used to estimate. The estimated results of the above model, as shown in Table 1.

Table 1 Model estimation results

variable	Model 1	Model 2	Model 3	Model 4	Model 5
C	122.34**				
D(X1)					-1.636***
D(X2)	1.8488***				
D(X3)	13.894***		1.9693***	25.1038**	10.963***
D(X4)	0.2871*				
D(X5)		0.0044***	0.0218***		0.0606**
D(X6)		0.1254*		17.206***	5.1814***
D(X7)					
D(X8)				-16.963**	-10.223***
D(X9)	470.72***	18.7785**	90.636***	1004.56**	800.923***
R^2	0.97093	0.3871	0.8522	0.6480	0.9274
AdjR^2	0.96031	0.2928	0.8295	0.5600	0.8912
D-W	2.62651	1.9552	2.5002	2.0891	2.2857

*10% level is significant; **5% level is significant, ***1% level is significant

4.3.2. Empirical Conclusion

Hypothesis H1 can be confirmed by the results of Model 1. The number of civil transport aircraft, the number of airports, and the number of routes have a positive impact on the turnover of air passengers, which indicates that the number of supply side has increased, the service of air transport has increased, thus increase the passenger turnover. Hypothesis H2 is confirmed by the results of Model 2, changes in the per capita GDP and import and export have a positive impact on freight turnover, indicating that the consumption level of residents has increased, imports and exports have increased,

which has a positive impact on freight turnover.

Model 3 further shows that the number of airports and per capita GDP have a significant impact on the total turnover of air passengers and freight. The number of airports increase, which can meet demand of passengers for air transport. On the other hand, the per capita GDP has risen, demand of residents for air transport has increased, it has a positive impact on air transport by increasing imports.

Hypothesis H3 can be confirmed by Model 4, the number of airports has a significant and positive impact on air transport revenue, and the increase in the number of airports makes the route network more perfect, which can effectively meet the air transport demand and have a positive impact on air transport revenue, but passenger volume and import and export on the efficiency of air transport operations is not significant. It may be due to the sufficient supply of passengers in China, and the most important factor is insufficient supply of air transport.

From the results of Model 5, it can be seen that the number of leased aircraft is negatively correlated with the total profit of air transport, which is contrary to the original hypothesis H4. The main reason is that the development of aviation leasing in China is relatively lagging, the financing channel is single, and in the price negotiation with manufacturers do not have advantage, so that the cost of aviation leasing is higher than those developed countries. At the same time, in terms of aviation leasing tax, the support of Chinese is still small, which leads to the introduction of aircraft by leasing may alleviate the pressure on airline to pay large amounts of cash at one time,but it does not play a positive role in profit of air transport.

From the above model, it can be seen that the exchange rate has a positive impact on air transport. The rise of exchange rate, that is the depreciation of the RMB, will increase the export and the fluctuations of exchange rate does not affect the rigid demand for air transport; On the other hand, the rise of exchange rate will increase the business cost of foreign currency settlement, but airlines have adopted relevant financial instruments and mode of foreign currency rents to effectively avoid exchange rate risks.

5. Conclusions and Related Recommendations

Air transport as an important strategic industry for economic development, It is a comprehensive method to analyzes the influencing factors from two aspects of actual output and economic benefits. Meanwhile, the above models are significant through the robustness test. It is found that the number of airports is the core factor affecting air transport, in terms of actual output, supply factors such as the number of airports and aircraft have a positive impact on the passenger turnover; the demand factors such as the import and export, per capita GDP have a positive impact on the air freight turnover.

In terms of economic benefits, the number of leased aircraft and crude oil prices have a negative impact on the total profit of the air transport industry. Import and export, the number of airports, per capita GDP and exchange rates have a positive impact on air transport operating income and total profit. On this basis, the following recommendations are put forward to promote the development of air transport:

(1) Increase investment in infrastructure construction of the air transport industry. It can be seen from the above conclusions that the airport is the core factor restricting the development of air transport. The layout of aviation network and the distribution of airports in China is dense in the east and sparports in the west. Therefore, investment in infrastructure construction of the air transport industry should be strengthened, increase the number of airports, improve the air route network, and improve the accessibility of small and medium-sized cities; secondly, in order to improve the convenience of exit, import and export,the province should be allowed to open international routes.

(2) Improve relevant policies to support the development of aviation leasing. For example, the government should increase its support for aviation leasing, such as low-interest loans, aviation leasing subsidies, financial subsidies and so on. Secondly, reducing the financing costs of aviation

leasing, expanding aviation leasing financing channels, and funds such as trust, insurance, asset securitization are added to achieve diversified financing; finally, the support of airline leasing for domestic aircraft should be strengthened. Aircraft of Chinese are mainly imported from abroad. Compared with domestic aircraft, the imported aircraft has higher purchase cost, and the production of domestic aircraft is accelerated, which can effectively reduce costs.

(3) Airlines should strengthen internal risk management. Most of the aviation company is a debt-driven enterprise with higher financial leverage. Airlines should take measures to reduce risks, increase revenue, and keep risks within a controllable range. Secondly, the loan plan should be prepared in advance to ensure the effective operation of funds, and taking an efficient management mode can effectively reduce costs; finally, most leasing and air transport involve international business, more effective measures should be taken to reduce the risk of exchange rate and crude oil price fluctuation.

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