How to Improve the Competitiveness of Chinese Airlines in the World's Air Cargo Market?

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Abstract

Chinese airlines and logistics operators play relatively minor roles in the world's air cargo market.The study researches the air freight network within China using complex network analysis,and identifies the key drivers for the trade volumes which Chinese airline undertake with an augmented gravity model.As a result,GDP, free trade agreement and air network structure have positive effect on it,distance and border have negative effect on it.This should help Chinese airlines to achieve their cargo ambitions in the long time.

Key words: *air cargo*; *air transport network*; *complex network*; *gravity equation*

1 Introduction

With the rapid development of economic globalization,international trade plays an important role for China's economic growth.Transportation is essential in international trade,it can realize the spatial transfer of goods.

Since we followed the policy of reform and opening,the trade in goods is booming,the total volume of imports and exports was only 35.5 billion in 1978,but reached 26.4 trillion in 2014,we are the first in the world.In international sales of goods,the mode of transportation are shipping,rail,truck,pipeline and air.Airfreight only accounted for about 0.5% of trade in goods in 2014,but the value was 36%, Chinese airfreight annual growth rate as high as 8.91% in the past decade.Curiously, with the China's aviation trade in goods rapid growth,the proportion of the Chinese airlines is declining year by year.Why the proportion is declining?

In 1992,Kasarda put forward "the fifth wave theory",he thought that different mode of transportation would have led the development of economy one after another, after shipping,railway,highway and pipeline,air transport will lead to economy.The development of transportation can make international trade more convenient and efficient,and it can significantly promote the development of a country's international trade[4].The quality of the transport infrastructure,distribution and specialization play an important role for the country's share in the international trade market[5].The improvement of transport infrastructure would reduce transport costs and promote international trade[2].

Gong etc shows that China's air transport network is still a point-to-point network instead of a hub-and-spoke system[1].At present,the development of China's air transport network is

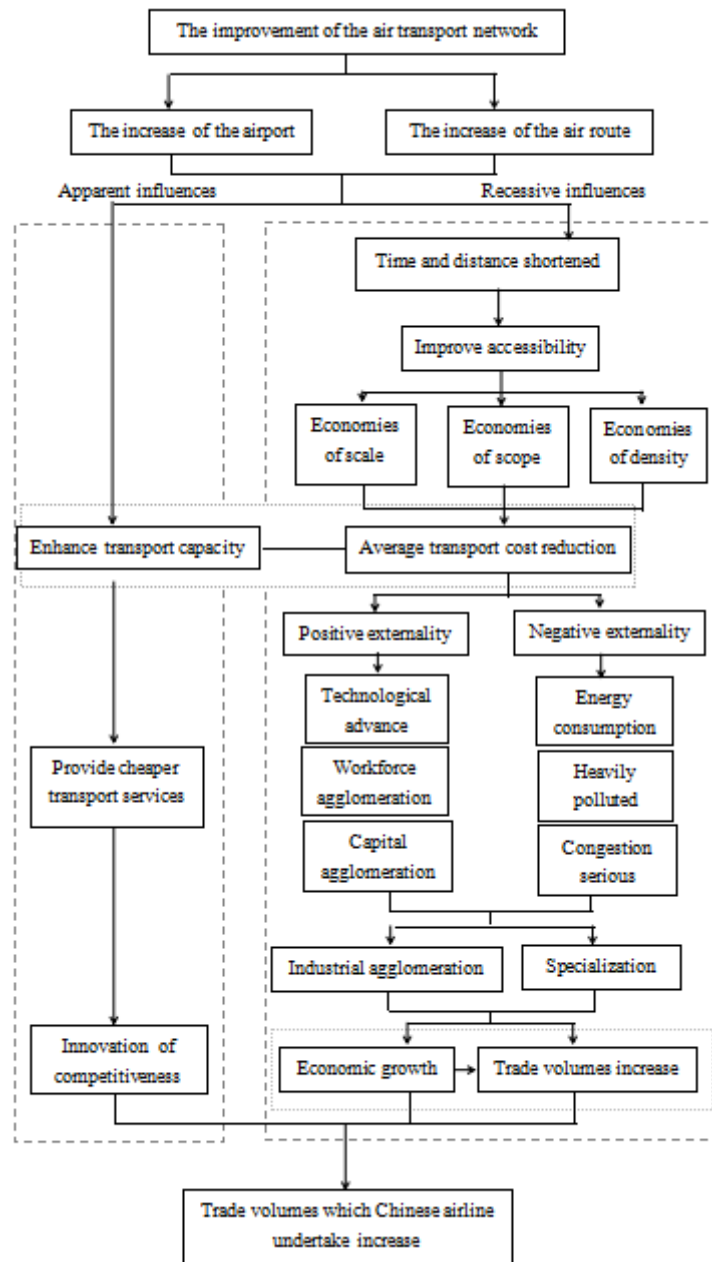unbalanced,Beijing,Shanghai and Guangzhou are the dominant airport forming a tripod in Chinese domestic air cargo traffic[3].

Fig. 1-mechanism diagram

2 Mechanism

The effect of the transport infrastructures on transport capacity is a worthy research.The increase of new airports and airlines will improve the air transport network.Then it will affect the proportion of Chinese airlines from two respect:apparent and recessive.As shown in Fig. 1,the apparent influence is relatively simple,the improvement of network will improve the capacity of Chinese airlines,then they will provide cheaper transport service and become more competitive.The recessive effect is more complex,the improvement of air network will shorten time and distance and improve accessibility,and then result in economies of

scale,economies of scope and economies of density.Then average transport cost will reduce.Then it will produce externality,the positive extenalities are technological advance,workforce and capital agglomeration,the negative extenalities are energy consumption,heavily polluted and serious congestion,it will cause the industry agglomeration and specialization,then promote economic growth and improve the proportion of Chinese airlines.

3 Experimental

In the 1960s,Tinbergen first used the trade gravity model,its basic form is[6]:

$$T_{ij} = kY_iY_j / D_{ij} \tag{1}$$

Where T_{ij} is bilateral trade flow between country i and country j,Y_i and Y_j are GDPs of the country i'and j,D_{ij} is the distance between country i and country j,k is the constant.Then more scholars extending the trade gravity model,they research of duties,infrastructure,exchange rate and free trade agreement on the influences of international trade flows.This paper has formulated a trade gravity model which is applied to the research on Chinese air cargo trade,the basic form is:

$$\begin{aligned}\ln y_{ij} = &\alpha_0 + \alpha_1 \ln GDP_{i_t} + \alpha_2 \ln GDP_{j_t} + \alpha_3 \ln Dis + \alpha_4 FTA_t + \alpha_5 BOR + \alpha_6 \ln \beta_{d_t} \\ &+ \alpha_7 \ln \beta_{f_t} + \alpha_8 \ln L_{d_t} + \alpha_9 \ln L_{f_t} + \alpha_{10} \ln C_{d_t} + \alpha_{11} \ln C_{f_t} + \eta_j\end{aligned} \tag{2}$$

Where

①y_{ij}：The trade volumes which Chinese airline undertake between China and country j;

②GDP_{it} and GDP_{jt}：GDPs of China and country j;

③Dis:The distance between China and country j,which reflect transport costs;

④FTA:Dummy variable,it is 1 when there is a FTA in force between the trading partners;

⑤BOR:Dummy variable,it is 1 when country j shares a border with China;

⑥ β_{dt} and β_{ft} : The connection rate of the domestic and international air transport network

of Chinese airline.It reflects the network complexity,the basic form is[7]:

$$\beta = \frac{m}{n} \tag{3}$$

Where β is zero,the network is complete non-communication network;when

β<1,the network is discrete sub-network;when β>1,the network is loop network. Generally

speaking,β is larger,the network is more complex.

⑦L_{dt} and L_{ft}：The average path length of the domestic and international air transport network of Chinese airline,it is defined as the average number of edges along the shortest paths for all

possible node-pairs in the network,the basic form is:

$$L = \frac{1}{\frac{1}{2}n(n-1)}\sum_{i>j} l_{ij}$$ （4）

Where l_{ij} is the number of edges of the shortest path from i to j,and the diameter of a network is defined as the maximum value of all l_{ij}.Generally speaking,L is smaller,the network is more effective.

⑦C_{dt} and C_{ft}：The clustering coefficient of the domestic and international air transport network of Chinese airline,it is the portion of actual edges between the nodes within its neighborhood divided by the maximal possible edges between them,the basic form is:

$$C_i = \frac{E_i}{k_i(k_i-1)/2}, k_i \geq 2$$ （5）

Table 1-Gravity model estimation results for different region

Variables	All	Asia	Oceania	Europe	North America
$LnGDP_{it}$	0.119（0.74）	0.103（0.66）	-5.929 （-1.99)*	0.756（2.21)**	2.416（2.21)**
$lnGDP_{jt}$	0.044 （4.24）***	0.256（9.41）***	3.579 （2.62）**	0.203（1.95）*	1.238（3.11)***
$lnDis$	-0.363 （-3.97）***	-1.715 （-15.69）***	10.199 （1.70）	-1.963（-1.94)*	-9.559（-2.34)**
FTA_t	-0.029(-0.30)	0.575(6.61) ***	0.252（0.51）	-0.661（-1.41）	
BOR	-1.140(-11.16)***	-0.489 （-5.12)***		-1.608（-5.04)***	
$Ln\beta_{dt}$	0.475(0.718)	-0.788（-1.25）	16.169 （3.47）***	1.652（1.94)*	-2.349（-0.84）
$Ln\beta_{ft}$	2.282 （20.28）***	1.665 （12.02）***	-0.862 （-1.10）	2.402（12.49)***	0.808（1.24）
LnL_{dt}	-0.427(-0.39)	1.404（1.97）*	-9.612 （-2.89)**	-2.498（-1.58）	0.854（0.36）
LnL_{ft}	0.995 （54.88）***	0.781 （32.01）***	0.658 （8.84）***	1.099（35.24）***	-0.661（-1.22）
LnC_{dt}	-0.129(-0.82)	0.087（0.59）	-0.073 （-0.23）	-0.171（-0.78）	0.149（0.89）
LnC_{ft}	-1.554 （-29.81）***	-1.341（-18.81） ***	0.345(0.89)	-1.036（-7.57)***	0.051（0.16）
R^2	0.932	0.949	0.998	0.953	0.995
Observations	5880	3700	240	1560	240

The clustering coefficient of the whole network C is the average of all individual C_i's,the

basic form is:

$$C = \frac{1}{n}\sum_{i=1}^{n} C_i, 0 \leq C \leq 1 \qquad (6)$$

C is more larger,the more likely nodes are to reach one another within a short topological distance.

4 Empirical analysis

The result of gravity equation is listed in Table 1. As I expected,GDP_{it} and GDP_{jt} have positive effect on the trade volumes which Chinese airline undertake,distance have negative effect on it but Oceania.Free trade agreement have positive effect on the trade volumes which Chinese airline undertake in Asia and Oceania,but have negative effect in Asia.Network structure have positive effect on the trade volumes which Chinese airline undertake.

On the whole,the air transport network in China is developing rapidly,but it's not enough,we should develop it as soon as possible.

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