Research of Competition between China and the US in the domestic air transport market based on Market Concentration Rate

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Abstract: Accurate understanding and judgment of the competition degree of air transport market not only plays a vital role in the development of air transport enterprises, but also is the basis for formulating policies to promote the development of the industry. In this paper, the macro-aggregate market and micro-aggregate market concentration rate of routes between China and the United States from 2008 to 2018 are calculated by using the industry concentration method and Herfindahl-Hirschman Index method, and the horizontal and vertical comparison is made to summarize the characteristics of China's air transport market competition, Combining the experience of the development of the US air transport industry, recommendations will be given for the future development of China's air transport industry.

1. Introduction

With the continuous development of the globalization of the world economy, the status of air transport has become increasingly prominent. In recent years, China's air transport market has developed rapidly. In 2017, China's civil aviation industry completed a total of 538 million passengers, second only to the United States, and is the second largest air transport market in the world. According to the International Air Transport Association (IATA), China's passenger traffic will increase to 927 million passengers by 2025, surpassing the United States (904 million passengers) to become the world's largest air passenger transport market. Air transport industry has gradually become an important basic industry in China, which occupies an increasingly obvious position in the economic and social development. However, the problems of air transport industry in China are becoming more and more obvious. As one of the important entities of air transport, airlines play a vital role in air transport, therefore, by comparing the degree of competition between China and the United States in the domestic aviation market, we can judge the stage and characteristics of China's air transport market, which can provide reference experience for the development of China's air transport.

2. Estimation of market concentration of domestic air transport market in China and the United States

2.1 Subject selection and Overview of research methods

2.1.1 Route market selection

In this paper, domestic air routes in China and the United States from 2008 to 2018 are selected as the analysis objects for research. The data source is the capacity data of each airline in the OAG database. It is mainly carried out from two dimensions: first, the degree of competition in each of the first 50 airline markets, namely: the degree of competition in the micro airline markets; Second, the overall level of competition of domestic airlines, namely: the macro total market competition.

2.1.2 Calculation method description

The market concentration index is often used as the division standard of the market structure, which reflects the degree of monopoly of the market and the unevenness of market share. Vendor concentration ratio (CR_n) and Herfindahl index (HHI) are the main indicators of market

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concentration.

(1) Herfindahl index (HHI)

The herfindahl index (HHI) is expressed by the sum of squares of the market shares of all enterprises in a specific market. The formula is as follows:

$$HHI = \sum_{i=1}^{n} (Xi/X)^2 = \sum_{i=1}^{n} Si^2$$

Among them: X is the total market size; Xi is the scale of the enterprise; Si=Xi/X is the market share of the ith enterprise; n is the number of enterprises in the industry.

A higher HHI value indicates a higher degree of market concentration and monopoly. The index can reflect not only the market share of large enterprises in the market, but also the market structure outside the large enterprises. It can more accurately reflect the degree of influence of large enterprises on the market.

Generally, HHI values should be bounded between 0 and 1, but usually they are amplified by multiplying the value by 10000, so HHI should be bounded between 0 and 10000. The US Department of Justice uses HHI as an indicator to assess the concentration of an industry and sets the following criteria:

Tab.1 HHI Index Market Competitive Standard

market structure	oligopoly				competition	
	High oligopoly I	High oligopoly II	Low oligopoly I	Low oligopoly II	monopolistic I	Monopolistic II
HHI	HHI≥3000	3000>HHI≥1800	1800>HHI≥1400	1400>HHI≥1000	1000>HHI≥500	500>HHI

(2) Manufacturer concentration rate

Manufacturer concentration ratio (CRn) refers to the cumulative share of the largest n enterprises in the industry. The calculation formula is:

$$CR_n = \sum_{i=1}^{n} Y_i / Y$$

In the formula, CRn is the concentration of the top n companies in the industry. Y_i is the scale of the ith enterprise, the company is the size of all enterprises in the industry, and the value of n is usually 4 or 8. The value range of manufacturer concentration rate is between 0 and 100%, which is almost 0 in fully competitive market and 100% in a fully monopolistic market. The division of oligopoly and monopolistic competition is often bounded by “40%“: when the concentration ratio of 4 manufacturers exceeds 40%, it is considered to be an oligopolistic market; when the concentration ratio of 4 manufacturers is less than 40%, it is considered to be monopolistic competition market.

2.2 Construction of market concentration calculation model

2.2.1 Route Herfindahl index calculation model

$$HHI = \sum_{i=1}^{n} (Xi/X)^2 = \sum_{i=1}^{n} Si^2 \quad (1)$$

Among them:X is the total investment of available seat kilometers for this route;Xi is the investment of an airline in the available seat; Si is the market share of the ith airline; N is the number of airlines operating on the route.

2.2.2 Route manufacturer concentration rate calculation model

$$CR_n = \sum_{i=1}^{n} Y_i / Y \quad (2)$$

Among them :Y is the total investment of available seat kilometers for domestic airline; Yi is the available seat kilometer input of a certain airline company on domestic routes; CRn is the market share of the top n airlines; N is the number of the top airlines to be studied. We select the top 4

airlines and n is 4.

2.3 Market concentration calculation result

2.3.1 Route Herfindahl Index (HHI) calculation results

Using the data of the top 50 domestic routes of China and the United States from 2008 to 2018 and through the calculation model of the Höfendal index (HHI) (Equation (1)), the Herpandel index of China and the US domestic routes from 2008 to 2018 is calculated. Part of the calculation results are as follows:

Tab.2 China and USA top 50 domestic routes'HHI calculation partial results from 2008 to 2017

Rank	2008		2010		2012		2014		2016		2018	
	USA	China	USA	China	USA	China	USA	China	USA	China	USA	China
1	7540	3141	4686	3226	2617	3699	2120	2645	2589	3562	2335	2484
2	4293	3858	2280	3418	2129	4162	2123	3827	7196	2585	6332	3459
3	4363	3096	3202	4340	2531	2863	2464	3818	3019	3190	2692	3260
4	4542	4323	3724	3775	3753	2452	2994	2748	3404	3310	2754	3507
5	2603	3640	3373	3368	7437	3937	3511	3684	3980	2569	4068	2594
6	3093	2544	10000	3793	9197	2927	5962	2614	5243	2413	3390	1992
7	4148	3997	10000	2693	3905	3162	5309	2359	2783	2705	2511	2559
8	5056	4065	10000	2779	3008	2409	9119	2521	5669	1921	6523	2637
9	2266	3267	5938	2753	8119	3756	3548	3378	7756	2411	4918	2491
10	8381	3678	9918	2630	5261	2638	6051	3779	4303	2396	3820	1914
11	5032	2794	3202	3508	4938	2635	3887	2284	6769	2433	2280	2278
12	4562	2431	10000	3006	5000	3019	5124	2652	3347	3596	5803	3088
13	5045	2812	10000	4165	2961	2927	9958	3053	8383	3183	7575	3518
14	3366	3498	6594	2760	5402	5113	5097	2242	4926	2960	6695	3245
15	5850	1998	3801	3211	7462	3479	4633	3043	5387	3241	3417	3119
16	3518	3005	8148	2858	5559	3259	2688	2146	3362	3193	2882	2460
17	4015	3692	5144	2070	5325	2106	6788	5030	3494	2164	2773	2706
18	7579	4419	3203	3604	3854	2218	5962	2188	5515	2778	4540	2192
19	3863	5132	4903	3605	3514	3666	3450	2970	3676	1817	2727	2973
20	3592	3982	7367	3416	6164	2221	8851	2120	3096	2694	5003	2187

Note: Due to the length of the article, only some of the calculation results are shown here. and each airline is arranged from large to small according to available seats (ASKs).

2.3.2 Route manufacturer concentration rate (CR4) calculation result

Using the data of domestic routes between China and the United States from 2008 to 2018, the manufacturer concentration rate calculation model (formula (2)) was used to calculate the manufacturer concentration rate (CR4) of domestic routes between China and the United States from 2008 to 2018. The calculation results are as follows:

Tab.3 China and USA top 50 domestic routes'CR4 calculation result from 2008 to 2018

Year	CR_4 in China's Domestic Market	CR_4 in American Domestic Market
2008	69.47%	55.64%
2009	68.37%	55.01%
2010	65.62%	62.79%
2011	61.73%	62.33%
2012	59.33%	68.23%
2013	57.94%	70.69%
2014	56.21%	70.68%
2015	54.92%	72.85%
2016	52.10%	79.29%
2017	49.43%	77.66%
2018	48.84%	77.53%

3. Analysis of the degree of competition in China's air transport market

3.1 From the perspective of micro-airline market, the competition degree of China's domestic main airline market is constantly increasing

The competition in airline market is the micro level of civil aviation transportation competition, and also the ultimate embodiment of the degree of competition between airlines. Firstly, by comparing the HHI index changes of the top 50 airlines in China in 2008 and 2018, it can be found that the HHI index of 39 airlines in the first 50 airlines in 2018 is lower than that in 2008. The lower the HHI index is, the higher the degree of market competition is. This proves that China's domestic air transport market has been developing continuously for 10 years, and the overall competition degree of its routes has been improved.

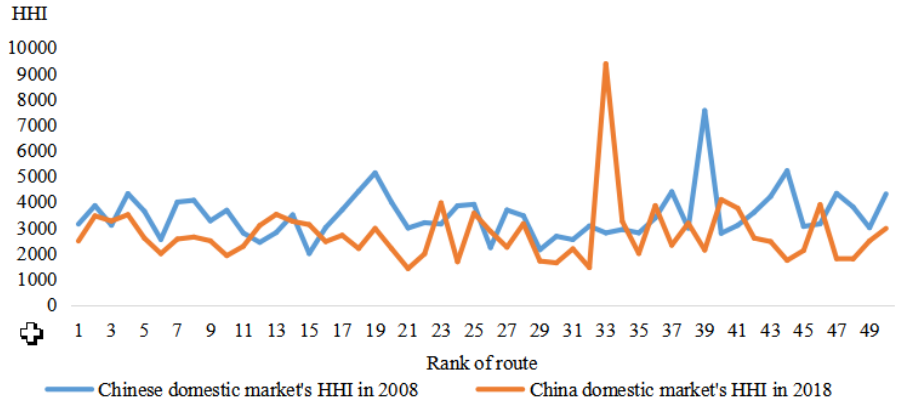

Fig.1 China top 50 domestic routes'micro-market HHI in 2008 and 2018

Then, from the type of competition of 50 specific routes in the past ten years ,2010 years ago, the TOP 50 routes are high oligopolyItype and high oligopolyIItype, and mainly high oligopolyItype; After 2012, there was a low oligopoly type I, and the number of high oligopoly type I routes decreased year by year. After 2016, the number of high oligopoly II exceeded the high oligopoly type I, and the number of high oligopoly type I continued to decrease; In 2018, low oligopoly II appeared, and the number of low oligopoly I continued to increase. It can be seen that the airline market in China has gradually changed from high oligopoly I type to high oligopoly II type in the past decade, and is now gradually transitioning to low oligopoly type, and the airline market competition is constantly increasing.

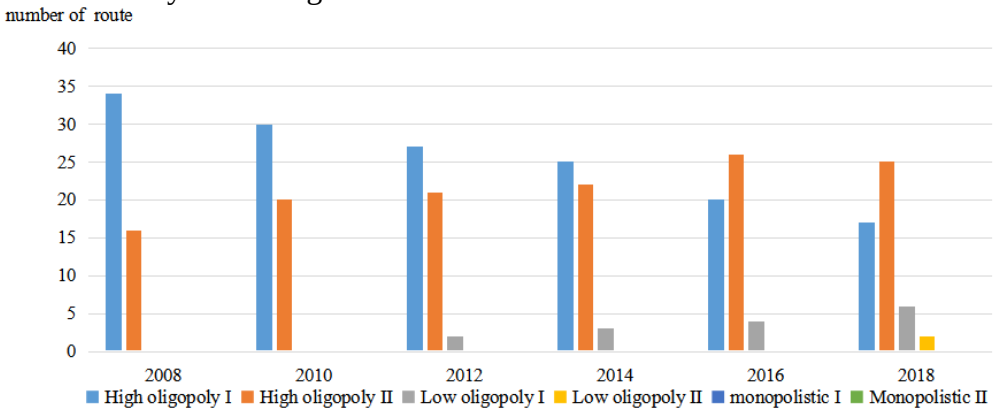

Fig.2 Classification of China top 50 domestic routes competitive Degree Types from 2008 to 2018

3.2 From the perspective of the macro total market of domestic airlines, the overall level of competition in the market has been continuously improved in the past decade. In 2018, the macro total market has initially emerged as a competitive market

First of all, from the perspective of the macro total market of China's domestic airlines, its HHI index has been on a continuous decline. In 2008, the macro market HHI index was 1505, which was of the low oligopoly type I. In 2018, the macro market HHI index drops to 785, reaching the

standard of competition type I , and the degree of competition is significantly improved.

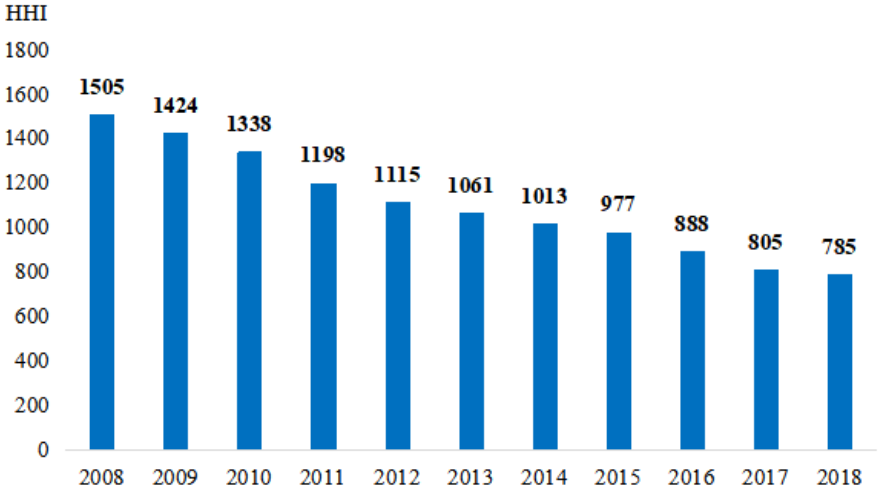

Fig.3 China and USA top 50 domestic routes'macro-market HHI from 2008 to 2018

Then, from the perspective of domestic airline manufacturer concentration rate (CR4), it has been on a downward trend, from 69.47% in 2008 to 48.84% in 2018, with a significant change. At the same time, the number of operating airlines in the domestic market has also increased from 39 in 2008 to 59 in 2018, and the degree of competition has changed significantly.

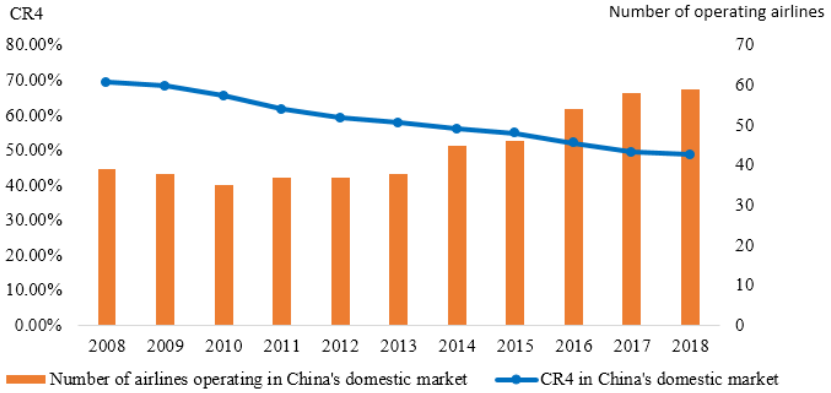

Fig.4 China domestic market CR4 and number of airlines from 2008 to 2018

4. Comparative analysis of air transport market competition between China and the United States

4.1 From the microscopic route market, the Chinese route market competition degree is higher than the United States

Firstly, from the comparison of HHI index between the top 50 airlines in the domestic market of China and the United States in 2008, 41 airlines in the top 50 airlines in the domestic market of the United States have a higher HHI index than China.By 2018, the number has increased to 45, and the gap with China is growing. The reason is that with the development of China's air transport market, the number of airlines in China's domestic market is increasing, leading to an increase in their market competitiveness. On the contrary, the us air transport market is already at a mature stage, with its capacity approaching saturation. Coupled with the serious mergers and acquisitions of its airlines in recent years, the number of its airlines has been significantly reduced, and its competition has slowed down.

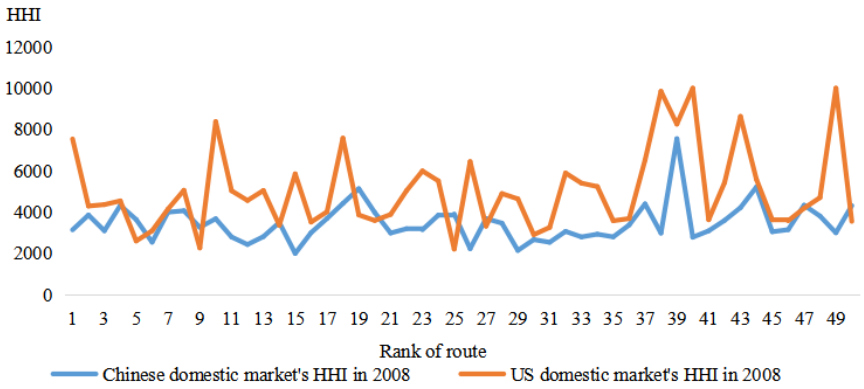

Fig.5 China and USA top 50 domestic routes'micro-market HHI in 2008

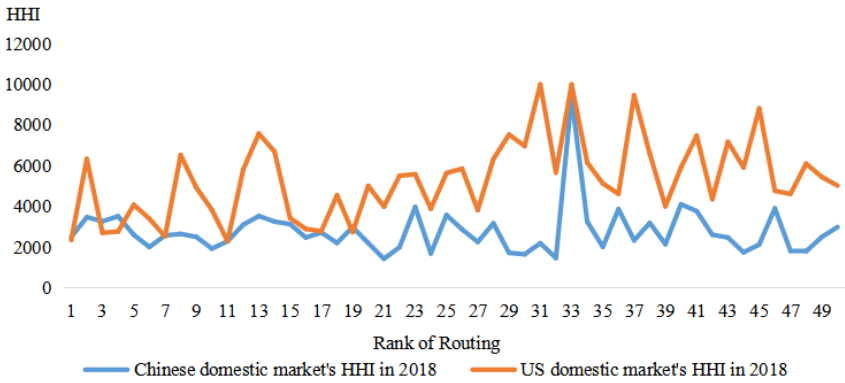

Fig.6 China and USA top 50 domestic routes'micro-market HHI in 2018

4.2 The degree of market competition in American micro-airline market has little change, and its development trend is opposite to that of China

Different from the characteristics shown by China's air transport market (the competition degree of micro route market and macro total market is increasing), the overall competition situation of micro route market in the us air transport market: there is basically no difference between 2008 and 2018. Judging from the index value, they all belong to the high oligopoly type. But in the macro aggregate market, the HHI index of the us domestic market has been on an upward trend from 2008 to 2018. Instead, China's domestic market has been on a downward trend. Since 2011, the overall domestic HHI index of China and the United States has been close, but the gap has been widening since then.

From the perspective of the number of operating airlines, it can be seen that the number of operating airlines in the US domestic market has been declining from 102 in 2008 to 64 in 2018; on the contrary, the domestic market in China increased from 39 in 2008 to 59 in 2018.

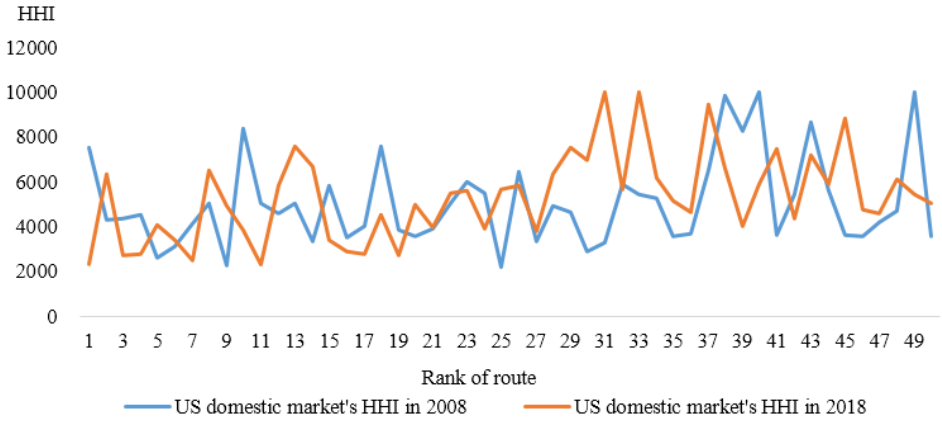

Fig.7 top 50 USA domestic routes'micro-market HHI from 2008 to 2018

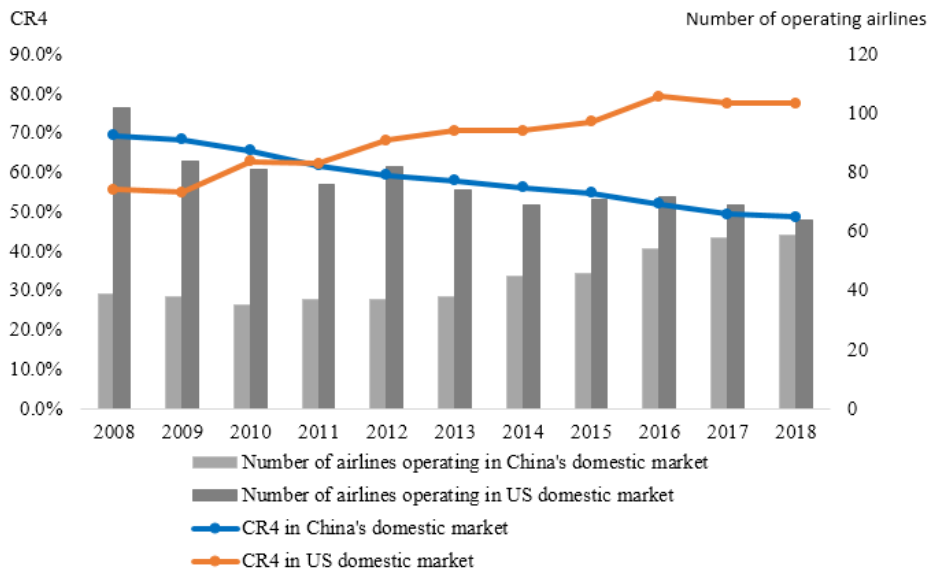

Fig.8 USA and China domestic routes'macro-market total HHI from 2008 to 2018

4.3 The different development mode leads to the different degree of competition in the round-trip capacity of American airlines

Through the analysis of route data, it can be found that the biggest difference between the domestic market routes of China and the United States is that the round-trip routes of the same route in the United States have obvious differences in the shipping capacity investment of the airlines. for example, in the US domestic market, the second-ranked "New York Kennedy-San Francisco" route, "New York's Kennedy-San Francisco" direction, there are five airlines operating, with a total capacity of 4.67 billion kilometers; and "San Francisco-New York Kennedy" direction The route is operated by only two airlines, and the capacity investment is less than 1/2 of the opposite route. And investment of capacity of round-trip of our country domestic course holds consistent basically. This is related to its route network structure and development strategy. The United States benefits from the hub-and-spoke route network structure, which connects a large number of airports in the United States. The airline company will release capacity according to the market demand of different airports, so as to ensure its revenue balance. Although China is developing towards the central hub and spoke route network structure, focusing on building international hubs and consolidating and cultivating regional hubs, due to the restrictions of civil aviation airspace, hub airports are always saturated with resources and lack of security capacity, which leads to the imbalance of air transport development to a certain extent. In order to promote the development of local airports, some provinces and cities have introduced various aviation subsidies to cultivate new routes and increase the investment in transportation capacity, so that the airline company can still make up for the revenue balance of route operation through subsidies in the case of insufficient passenger resources.

4.4 China and the US aviation industry are at different stages of development, and structural adjustments are not the same.

In the past ten years, China and the US civil aviation transportation industry structure have undergone tremendous changes and structural adjustments. However, the direction of industrial restructuring and development in the two countries is different.

The market of American civil aviation transportation industry has developed and matured, and its industry has completed a new round of merger and reorganization. The phenomenon of airline merger and acquisition is serious, and the concentration degree of total market has been improved; on the contrary, China's air transport market is in a stage of rapid development. The government is paying more and more attention to the development of the air transport industry. It has relaxed the entry barriers for the airlines and introduced a series of policies to support the development of the air transport industry. which has led to an increase in the competition level of China's aviation

market. No matter from the number of airlines entering the airline, the degree of competition between the airlines and the total market, etc., it has shown a more free and inclusive development.

5. Main research conclusions and development Suggestions

(1) China's domestic civil aviation transportation competition is gradually increasing, but it is still dominated by state-owned capital enterprises, and private capital enterprises have a lower market share.

Through the calculation of market concentration index of micro route market and macro total market, it can be seen that the degree of competition in China's civil aviation transportation market is continuously enhanced in both micro route market and macro total market. However, the three major airlines (groups) that are state-owned capital still dominate the market.

Although China began to relax the access policy of the civil aviation market in 2004, allowing private capital to enter the air passenger transport industry, the phenomenon of three major airlines (groups) holding shares in each other or taking shares in local airlines is endless, seemingly lively competition. China's air passenger transportation industry is truly a state-owned capital. Even so, private airlines are still striving for survival in this context. For example, the market share of spring airlines was only 0.81% in 2008, but it has reached 2.56% in 2018. The rapid growth of its market share is attributed to its low-cost airline operation mode.Therefore, encourage the development of Chinese private air transport enterprises implement differentiation strategy, increase the role of private capital in the air transport industry, and further promote the competition of China's civil aviation transportation industry, the domestic market competition, these can make air transport enterprise to improve its marketing, cost control, service and other aspects of product design ability, to participate in the international air transport market competition to lay the foundation.

(2) There are differences between China and the United States in the direction of industrial restructuring of civil aviation transportation in the past decade. It is suggested to focus on the driving force behind the industrial restructuring

By comparing the degree of domestic market competition between China and the United States, it can be seen that the degree of competition in China's civil aviation transportation industry is higher than that in the United States at both micro and macro levels. This has something to do with the different stages in the development of air transport markets in China and the us. At different stages of development, there are differences in the structural adjustment of civil aviation transportation industry between China and the United States.

The United States has a mature air transport industry. As of December 2018, it has 798 airports in total, which is the country with the most airports in the world. Meanwhile, its air transport volume ranks the first in the world. Conversely aviation transportation industry in China is in a stage of rapid development, in recent years, the Chinese government attaches great importance to the development of China's civil aviation, and introduced the corresponding policy support, which has further promoted the development of China's air transport industry. Its capacity market demand is strong. The entry barrier has been further relaxed, which has promoted the development of China's air transport enterprises. The number of airlines has increased dramatically. On the contrary, the adjustment of American transportation industry is mainly based on merger and reorganization, such as the merger of American airlines and US airways in 2013.

The degree of competition in the US aggregate market has been decreasing from 2008 to 2018. This result is more dependent on market means and adaptive performance of industrial development. During this decade, the American civil aviation transportation industry completed a new round of merger and reorganization, capacity reduction and other major industrial adjustments, and completed the transformation of industrial upgrading in the throes of industrial reform. Industrial policy has been playing a very important role in the development of civil aviation in China.

In the future industrial development, we can try to introduce more market-oriented means to let the market play a more critical and core role in the allocation of core resources for industrial development.

(3) The competition in China's air transport market is mainly dominated by homogeneous

competition, and the differentiation of products and services is not obvious. Therefore, it is suggested to implement differentiated development and innovate development mode

Although the degree of competition in China's air transport market is higher than that in the United States, it is manifested as the homogenization competition among the same type of airlines for hot routes. In 2018, a total of 59 airlines will operate flights in the domestic market, with 39 of them participating in the operation of the top 50 busy routes.The airline products and service products provided by airlines are highly homogenized. The main problem brought about by the homogenization of airline operations is that it cannot fully adapt to the characteristics of different types of passengers, which is reflected in both domestic and international routes. The development contradiction brought by the homogenization of airline operation mode in international market is more and more prominent. Especially in recent years, in the development of international air transport market in southeast Asia and northeast Asia, Chinese airlines operating in this direction are lack of competitive advantages in terms of seat capacity input, After several rounds of industrial restructuring, the American civil aviation industry has gradually stepped into a more mature and sTable market structure.capacity level or fare level. For different market segments of air transport, different types of airlines provide relatively rich and differentiated service products.

Therefore, in the future, on the basis of maintaining certain competitive vitality within the industry, China's civil aviation transport industry should also gradually enrich the business model of airlines, so as to achieve market positioning differentiation, product differentiation and brand marketing differentiation. In the context of the reform of the aviation market, various airlines go deep into market segments, implement differentiated development strategies and develop new aviation business models, which are not only conducive to the development of the airlines themselves, but also of practical significance to the healthy development of China's air passenger transport industry.

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