A Longitudinal Analysis of Deconcentration Process for the Top 20 Airlines in China

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Abstract With the rapid development of China’s economy, the aviation industry, as an important part of transportation services, has undoubtedly achieved rapid development. However, there is hardly any academic work that was based on the development of the top airlines in the Chinese airline industry. Hence, this study provides empirical research that takes into account the longitudinal development of the top 20 airlines in China from 2009 to 2018. The throughput values (cargo and passenger) of the airlines were analyzed by concentration indicators, namely the concentration ratio (CR), the Herfindahl-Hirschman index (HHI), the Gini coefficient, and the shift-share analysis (SSA). In this paper, the top 20 airlines have been analyzed in terms of the passenger and cargo throughput from 2009 to 2018. The calculation results of CR6, HHI and the Gini coefficient show that the airlines were extremely deconcentrated. In addition, by comparing the ABSGR of passenger and cargo throughput, it is shown that China’s aviation industry is dominated by four airlines—Air China, China Eastern Airlines, China Southern Airlines and Hainan Airlines. In the future study, it is necessary to explore growth strategies to find niche markets for passenger and cargo transportation.

Key Words: Longitudinal Analysis, Deconcentration, Airlines, China, HHI, CR, SSA

요약 중국 경제의 빠른 발전과 더불어 운송 서비스의 가장 중요한 역할을 하는 항공산업은 상당한 발전을 이루고 있다. 이러한 성장에도 불구하고 중국 항공산업에서 상위 항공사만을 대상으로 발전과정을 연구한 논문은 제한적이다. 이러한 측면에서 본 연구에서는 2009년에서 2018년 기간 동안 중국 상위 20위 항공사의 중단적 발전상황에 대한 실증적 연구를 수행하는 것을 연구의 목적으로 하였다. 연구의 방법은 집중도 분석, 허핀달-허쉬만 분석, 지나께수 분석, 전이합당 분석을 활용하였으며, 분석 자료는 물동량 및 여객수를 활용하였다. 집중도 분석, 허핀달-허쉬만 분석 및 지나께수 분석결과, 중국항공사는 탈 집중화 현상을 보이는 것으로 나타났다. 절대성장률 분석결과 중국 항공산업은 여객측면에서는 상위 4개의 항공사가 선점하고 있는 것을 확인할 수 있다. 향후연구에서는 여객 및 화물운송의 동체시장을 찾는 성장전략 모색이 필요하다.

주제어: 중단적 분석, 탈 집중화, 항공사, 중국, 집중도 분석, CR 분석, 전이합당 분석

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1. Introduction

With the implementation of the “reform and opening up” policy, China has witnessed rapid development in recent years[1-3]. In turn, the aviation industry has gained favorable conditions for development. According to the International Air Transport Association[4], China is predicted to surpass the United States in the number of international flights and passenger flow, and become the world’s largest aviation market by 2020. With an increase of passenger flow, airlines compete with each other fiercely[5]. There are numerous factors that influence a person’s choice of airlines, such as the security of the planes, the reputation of the airlines, the service on the flights, and so on[6]. In addition, airlines have received considerable attention, and this has caused cost competitiveness, price reductions, and sustained market expansion[7-9]. Thus, it is important to evaluate these airlines through their cargo and passenger volumes to understand how they are performing[10,11]. Through the results, we can more clearly see the competition and cooperation between these airlines as well as the market construction and then take appropriate measures to improve the efficiency of the airlines[12-14].

With the development of China’s aviation industry, there are more and more airlines that have emerged[15,16]. The Civil Aviation Administration has announced that in 2018 there was a total of 64 transport airlines in China. However, due to the varied start-up construction of these airlines and associated airports, their development has also been different[7,13]. In the past, the aviation industry in China was far behind other developed countries. However, with the rapid development of China’s economy, the aviation industry, as an important part of transportation services, has undoubtedly achieved rapid development[17-19]. This is evidenced by the average growth rate of passenger throughput that in China in the past 10 years has reached 12% which is far higher than the economic growth rate[18,20,21].

In China, the competition among the airlines has resulted in deconcentration tendencies and shift-share situations. Related research on China’s airlines had been conducted in highly researched areas, such as convergence in the Chinese airline industry[22], a comparative study of airline efficiency in China and India[23], and so on. Similar to the current study, some other scholars have also applied a longitudinal analysis of deconcentration process to the airline market. Burton & Hanlon(1994) and Brueckner & Spiller(1991) first investigated both the consequences and the causes of market concentration[24,25]. After that, several scholars began to focus on this topic. Lee(2003) analyzed concentration in the U.S. domestic airline industry for the period 1990-2000[26]. Pitfield(2007) shed light on the impact of alliances on market concentration by U.S. routes[27]. Oliveira et al. (2017) developed an empirical model to examine the evolution of concentration in the airline markets[28].

However, there is hardly any academic work that was based on the development of the top airlines in the Chinese airline industry. Hence, this study provides empirical research that takes into account the longitudinal development of the top 20 airlines in China from 2009 to 2018. The throughput volumes (cargo and passenger) of the airlines were analyzed by concentration indicators, namely the concentration ratio (CR), the Herfindahl-Hirschman index (HHI), the Gini coefficient, and the shift-share analysis (SSA).

The remainder of this paper is organized as follows: Section 2 introduces the research background of the paper; Section 3 reviews the relevant literature about the development of the airlines, as well as the research method; Section 4 discusses the applied methodologies; Section 5 presents and analyzes the results in terms of the
concentration ratio of the top 20 airlines in China; lastly, Section 6 provides the discussion and the conclusion, respectively.

2. An overview of China’s civil aviation industry

Since the start of the twenty-first century, China’s civil aviation industry has developed rapidly. With the development of China, passenger capacity, transport turnover, the number of flight routes and so on within the aviation industry are at the forefront of the world. Compared with other developed countries, China’s aviation industry started much later and thus, could still be considered in the early stages of economic globalization. In addition, because the proportion of civil aviation airspace is relatively low and China has more strict airspace control, the aviation market of China seems apparently divided from other markets. But since the founding of the People’s Republic of China, the civil aviation industry has made great progress. In particular, since the reform and opening up of China, accompanying reforms in the aviation market have enabled the civil aviation industry to develop rapidly. In 2015, China was ranked second in the world in air transport turnover and maintained this position for three consecutive years, becoming one of the leading air transport forces in the world.

Due to different economic developments and geographical locations, the regional market development of China’s aviation industry is unbalanced. The Eastern region and the first-tier market share is too large, while the investment intensity and degree of development in the Central and Western regions and the third-tier market lag behind; the market differentiation is obvious. According to the statistics of the Civil Aviation Administration of China[29], there are 64 Chinese domestic airlines and 95 foreign airlines active in the Chinese civil aviation market in 2019. As we can see from Fig. 1, East China, North China, and South China account for 65% of the total market. It is obvious that the development of civil aviation in China is irregular.

![Fig. 1. Nationwide distribution of takeoff and landing sorties](Image)

Source: Civil Aviation Administration of China (CAAC)

In the past seven years, the number of airlines operating international routes has grown from 18 to 27. As the opening of international routes requires not only the approval of the airport but also an application for permission to fly through China’s civil aviation administration, the barriers are relatively high. Consequently, the market of main routes is still dominated by the three major airlines (Air China, China Eastern Airlines, and China Southern Airlines). According to the statistics of the CAAC, for example, the market share of the three major airlines was 83% in 2018[29].

In addition, as shown in Table 1, China’s aviation industry is still in a growth stage with large airlines monopolizing and maintaining a high market access threshold. From the perspective of income composition, it can be divided into passenger and freight revenue, in which the higher proportion of passenger revenue is the main factor affecting the performance of the airlines. Compared with the
United States, China’s civil aviation industry has a higher concentration and a stronger monopoly. When the industry booms, airlines can obtain stable and sustainable profits. With the continuous improvement of China’s per capita consumption, the existing airlines in the market will mainly benefit from the growth of the aviation industry. From the perspective of changes in passenger structure, the proportion of private passengers in China is increasing year by year, and the industry is moving from a high-end market to more mass consumption. China’s per capita GDP has exceeded 5,000 dollars, the consumption structure has begun to change, and the growth of business passengers is obviously affected by the macro-economy. When the rate of economic growth slows down, the demand for public aviation fluctuates accordingly. At present, due to the increase of consumption and the proportion of private demand, the demand for aviation has maintained a high-growth rate when the economic growth rate declines, and the industry is in a high-speed growth stage.

In general, China’s civil aviation industry has been in a growth stage for a long time, and the overall market demand has kept on an upward trend, which has been called the “fastest growing and most dynamic market”. But at the same time, there are still many weak links in the economic aspects of the air transport sector, which has not fully adapted in terms of quantity and quality to the reform and opening-up policy and the accompanying rapid economic development.

3. Literature Review

With the development of the economy, the people’s living standards have greatly improved, and they are more and more willing to use air travel as a means of transportation[6,30–32]. Compared with other modes of transportation, air transportation is faster, safer, and more convenient[33–36]. In order to maintain and expand their customer bases, airlines compete by introducing various preferential policies[37–40]. Many experts and scholars have written a number of research papers on airlines for the sake of improving performance and the development of the aviation industry[41,42].

The civil aviation transportation industry is an important part of the national economy, an
important basic and leading industry of the country, and also a strategic and innovative industry to promote economic and social development[11]. Since the reform and opening up policy change in 1978, the civil aviation transportation industry has achieved rapid development[14]. After decades of development, China has become the second largest civil aviation country of the world in 2019 (IATA). According to the statistics of the CAAC, there are 64 Chinese domestic airlines and 95 foreign airlines active in the Chinese civil aviation market in 2019. However, China’s civil aviation is mainly serviced by three national airlines (Air China, China Eastern Airlines, and China Southern Airlines) that account for more than 75% of the market share and have monopoly positions[21].

Among prior research on the development of the aviation industry, the HHI and CR are the most widely used methods to evaluate concentration and deconcentration issues from different points of view[43]. Rose(1991) used data from 35 large U.S. air carriers for the period 1957–1986 and deduced that lower profitability was correlated with higher accident and incident rates, especially for smaller carriers. After that, Richards(1996) evaluated Southwest airlines in the U.S. using CR and HHI, her results indicated that pricing strategies differed depending on Southwest’s presence or potential presence on a route[44, 45]. As one might infer, the performance of airlines can be influenced by many indicators, such as the satisfaction of passengers, the input of capital, the support of the local government, and so on (Ha et al., 2013). Zhang et al. (2015) conducted a comprehensive performance of 15 U.S. airlines using data collected over 10 years[46]. Their results revealed that some extent market concentration and base interest rate pressures could explain variations in facets of the operational quality across the aviation industry.

In the literature, there are also several studies using other methods to evaluate the performance of airlines. Tsaur et al. (2002) applied fuzzy set theory to evaluate the service quality of airlines[47]. They proposed a five-dimensional measurement by applying the AHP (analytic hierarchy process) method and TOPSIS (the technique for order preference by similarity to ideal solution) in ranking. Suzuki et al. (2001) used a reference-dependent model to represent the relationship between service quality and market share[48]. Chang et al. (2002) used fuzzy multicriteria analysis modeling to formulate the service quality of airlines[47]. Stamolampros and Korfiatis (2019) used an autoregressive distributed lag bound approach to evaluate fuel prices, interest rates, and market concentration in U.S. airline service performance[49].

In general, some studies have analyzed the concentration and deconcentration process of airlines in different countries using HHI and CR methods. However, in the literature on the deconcentration process of Chinese airlines, there has not been research that utilized the concentration ratio (CR), the Herfindahl–Hirschman index (HHI), the Gini coefficient, the ABSGR, and the shift–share analysis (SSA) approaches to weigh the passenger volume together with the cargo volume of the top 20 Chinese airlines for the period 2009–2018. Hence, this study fills a research gap by proposing an integration of these methods to examine the deconcentration process of the top 20 airlines in China. Furthermore, this paper presents some related suggestions regarding the results of the analysis with a view to provide more reliable data and as a reference for continuing research.

4. Methodology

This section describes the methods used to
achieve the stated goals. For the decentralization and competition analysis of airlines, the HHI, CR, Gini coefficient, and SSA index were selected. A description of each selected model, and the reasons for the selection are discussed in the following sections.

4.1 CR

A concentration ratio, CR(k), is usually used to show the extent of market control of the largest firms in an industry and to illustrate the concentration level. It is most common to consider the 3-firm, 4-firm, or 5-firm concentration ratio (Sys, 2009). Concentration ratios are used to assess the extent to which a given market is oligopolistic. Concentration ratios vary from 0% to 100%. The larger the value of the CR(k), the higher the concentration of the industry, the more the market competition tends to be monopolized; on the contrary, the lower the concentration, the more the market tends to be in competition. Concentration is an important indicator for measuring the market structure of the industry. The formula for concentration ratio is as follows:

$$CR(k) = \sum_{i=1}^{k} S_i$$

(1)

In which :

$S_i$: is the percentage throughput market share of the $i$-th largest airline ($i = 1, 2, ..., k$).

4.2 The Herfindahl–Hirschman index (HHI)

The Herfindahl–Hirschman index, also called the Herfindahl index, measures the extent to which the market share is concentrated among a few or many companies. It shows the proportional market share of the entire industry. Unlike the concentration ratio, all the companies (in this case, airlines) in the system are taken into account. For the purposes of this paper, it is defined as the sum of the squared value of each airline’s market share obtained by comparing the passenger throughput (or cargo throughput) of each airline with the total passenger throughput (or total cargo throughput).

The indicator calculation formula is as follows:

$$HHI = \frac{\sum_{i=1}^{n} Throughput_i^2}{(\sum_{i=1}^{n} Throughput_i)^2}$$

and

$$\frac{1}{n} < H \leq 1$$

(2)

In which:

H : is the concentration index for the system.

n : is the number of airlines in the system.

The value of HHI ranges from 1/n to 1. The greater the value of HHI, the higher the concentration of the market. A value of HHI is equal to 1 when the market is completely monopolized by one specific airline. If there are many companies in the market with the same scale, the index will equal its minimum value of 1/n; this means as n approaches infinity, HHI will approach 0.

4.3 The Lorenz curve and the Gini coefficient

The Gini coefficient is one of the most important indicators used to measure the degree of inequality. The Gini coefficient is based on the Lorenz curve, where the y-axis represents total revenue (market share) and the x-axis represents participants in the market[50]. It does not take into account the size of the market or the number of participants, so it can be used in a variety of situations.

The calculation formula of the Gini coefficient is as follows:

$$G = \frac{n+1}{n} - \frac{2\sum_{i=1}^{n} (n+1-i)\xi}{n\sum_{i=1}^{n} \xi}$$

(3)

In which:

n : is the number of airlines.

xi : is the cumulative market share regarding the throughput of airlines from the lowest to the highest.

A Gini coefficient is always non-negative with a value between 0 and 1. In this coefficient, 1 indicates the complete concentration and dominance of a company (in this case, an
airline), and 0 indicates no concentration of the companies (airlines). It will provide even more of a basis to make or confirm the hypothesis about the deconcentration process of the top 20 airlines in China.

4.4 Shift-share analysis

Shift-share analysis was defined as a model to analyze the composition of regional industrial sectors, changes in industrial structure, and local advantages. It is a widely used method in political economics that can be applied to determine regional growth and to see if an industry has a competitive advantage.

In this paper, change in the throughput capacity of airlines is divided into the “share” and “shift” effects. The “share” indicates the throughput growth of an airline that would maintain its market share. The result of the shift shows the difference between the actual growth and its “share” effect, showing what the business actually wins or loses from competitors. The calculation, on the basis of Notteboom,[50], is presented in the following formula:

\[
\text{SHARE}_i = \frac{\sum_{i=1}^{n} \frac{\text{Throughput}_{i,t}}{\text{Throughput}_{0,t}} - 1}{\sum_{i=1}^{n} \frac{1}{\text{Throughput}_{0,t}}} \cdot \frac{\text{Throughput}_{0,t}}{\text{Throughput}_{0,t}}
\]

(4)

\[
\text{SHIFT}_i = \frac{\sum_{i=1}^{n} \frac{\text{Throughput}_{i,t}}{\text{Throughput}_{0,t}}}{\sum_{i=1}^{n} \frac{1}{\text{Throughput}_{0,t}}} \cdot \frac{\text{Throughput}_{0,t}}{\text{Throughput}_{0,t}}
\]

(5)

\[
\text{ABSGR}_i = \text{Throughput}_{i,t} - \text{Throughput}_{0,t} = \text{SHARE}_i + \text{SHIFT}_i
\]

(6)

In which:

\( \text{SHARE}_i \): is the share effect in the throughput of airline \( i \) for the period \( t1-t0 \)

\( \text{SHIFT}_i \): is the shift effect in the throughput of airline \( i \) for the period \( t1-t0 \)

\( \text{ABSGR}_i \): is the absolute growth in the throughput of airline \( i \) for the period \( t1-t0 \).

\( \text{Throughput}_i \): is the (passenger/cargo) throughput volume of airline \( i \).

\( n \): is the number of airlines.

As mentioned previously, there are 64 Chinese domestic airlines and 95 foreign airlines active in the Chinese civil aviation market. This paper mainly provides a longitudinal analysis of the deconcentration process of the top 20 airlines in China. This section introduces the current situation of China’s airlines in more detail, explains why the author selected the top 20 Chinese airlines for analysis, and introduces the methods used in detail (CR, HHI, Gini, and shift-share).

5.1 China and the current situation

As China has become more established, it has developed at a faster and faster pace. China is the fourth largest country in the world with a population of about 1.4 billion. Since the reform and opening up policy, China’s economy has made great achievements. According to the latest data, China’s gross domestic product (GDP) reached 90.03 trillion yuan in 2018. But compared with the vast majority of countries in the world, the per capita income of China is still at a low level. China’s per capita GDP ranks behind 100 other countries in the world; at this point, China is still in the development stage.

Nowadays, China’s civil aviation industry is in a state of steady growth. With a high demand for civil aviation passengers and rapid growth, it is expected to become a civil aviation power. According to the predictions of the IATA, China will be the fastest growing air passenger market in the world in the next 25 years. According to this international civil aviation organization, in the next few years, the global average annual air freight growth rate will reach 5.35%, and China will be the fastest growing country in the world in that area.

China’s air transport industry has jumped to third place in the world. By 2020, with the rapid development of China’s economy, the average annual growth rate of China’s air transport
industry will remain at about 10%, the number of airports per million square kilometers will increase substantially, and various indicators such as flight density and passenger traffic volume will grow rapidly. China will become an important aviation market in the Asia-Pacific region and even in the world. In the future, airline services will no longer consist of just simple activities such as selling air tickets and sending passengers to destinations but will involve extension and value-added services including tourism and catering in the operation link. According to the predictions of the Air Transport Association, China will become a country with rapid development and great potential in the civil aviation industry. It is predicted that in 2020, the total number of China’s civil aviation transport airports will reach 244, with the addition of 97 new airports, forming five regional airport groups in the North, East China, Central South, Southwest, and Northwest.

As shown in Fig. 2, in the past 10 years, the annual growth rate of civil aviation passenger demand has maintained rapid growth each year and reached 14% in 2018. In that year, the passenger volume of civil aviation reached 610 million people (including a year-by-year increase of 10.6%) with a passenger turnover of 1,077.16 billion person kilometers (with a year-by-year increase of 12.6%). The annual growth rate in the past 10 years has been 14%, and the growth rate of industrial demand has maintained rapid double-digit growth. According to the statistics of the CAAC, at present, there are 64 domestic airlines and 95 foreign airlines active in the civil aviation market of China, but most of them are the top 20 airlines in terms of transportation share data, while the selection share of the other airlines is relatively small. Among the leaders, Air China, China Eastern Airlines, and China Southern Airlines are the three giants, bearing a large part of the transportation volume.

In order to better analyze the current situation of the international aviation industry in China, the author selected the top 20 airlines to examine, and investigated the passenger and cargo traffic volume of each airline in the ten-year period from 2009 to 2018, using the CR, Gini, HHI, and shift-share methods.

5.2 CR ratio

As shown in Table 2, the author used CR6 to calculate the passenger traffic volume and cargo traffic volume of the 20 airlines for the ten-year period. The calculation results show that the airlines were extremely deconcentrated. Also, the performance of the cargo transportation was better than that of the passenger transportation. In recent years, China has been vigorously developing air logistics; in addition, the major airlines have been competing fiercely, and they are scrambling to introduce various policies to attract customers.

As shown in Table 2, we can see that the value of the CR6 for passenger traffic volume was getting lower, which means the competition between the airlines was getting more fierce. The concentration index ranges from 0% to 100%. The higher the index, the greater the level of
market concentration, and the market will be dominated very small number of companies. It means there will be lack of competitions on the market. On the contrary, the lower value of CR means that there will be competition among the players.

China’s real economy has been affected by the financial crisis. As a result, China’s major airlines have introduced various preferential policies to attempt to attract customers. In terms of cargo transportation, China’s logistics industry is developing rapidly, and people’s requirements for cargo transportation are increasingly high. Compared with other modes of transportation, air transportation is more convenient and efficient, which can not only effectively ensure the quality of transported goods, but also improve the speed of transportation. So, for cargo transportation, people are more willing to choose air transportation.

Table 2. The CR6 of the Passenger and Cargo Volumes of the Top 20 Airlines in 2009–2018

<table>
<thead>
<tr>
<th>YEAR</th>
<th>The CR6 of passenger</th>
<th>The CR6 of cargo</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>0.836032132</td>
<td>0.882569503</td>
</tr>
<tr>
<td>2010</td>
<td>0.816908348</td>
<td>0.871127632</td>
</tr>
<tr>
<td>2011</td>
<td>0.795417457</td>
<td>0.857805115</td>
</tr>
<tr>
<td>2012</td>
<td>0.776535617</td>
<td>0.826654105</td>
</tr>
<tr>
<td>2013</td>
<td>0.757012855</td>
<td>0.822563956</td>
</tr>
<tr>
<td>2014</td>
<td>0.735139172</td>
<td>0.843605129</td>
</tr>
<tr>
<td>2015</td>
<td>0.723631825</td>
<td>0.845367145</td>
</tr>
<tr>
<td>2016</td>
<td>0.714356998</td>
<td>0.849994485</td>
</tr>
<tr>
<td>2017</td>
<td>0.793682468</td>
<td>0.849994434</td>
</tr>
<tr>
<td>2018</td>
<td>0.775462097</td>
<td>0.844652221</td>
</tr>
</tbody>
</table>

5.3 HHI

As shown in Fig. 3, the HHI shows the same trend as the CR6, and the momentum of passenger transportation was in the trend of deconcentration and decline. Although the growth rate of freight transportation was not stable, it was generally in a state of rapid development. In 2018, the rapid increase of the HHI for cargo was mainly due to the increasing support of government policies for air logistics transportation; prior to this, the cargo transportation volume of major airlines was gradually increasing. Therefore, the cargo volume in 2018 was quite different from the previous years.

From the perspective of passenger volume, as people become more and more familiar with airlines, more and more people will choose to travel by air. In order to absorb passenger flow, major airlines are competing to introduce low-cost policies to attract more customers. Some of these policies are likely the cause of the change after 2016.

For cargo transportation, 2017 was the year of the rise of China’s logistics industry. Major airlines have signed agreements with other airlines to use them as an additional means of transportation: together with government support, this has resulting in some of changes seen in the cargo trend chart in 2017.
5.4 Gini index

Similarly, Gini is used to analyze the passenger volume and freight volume of China’s top 20 airlines and draw the Lorenz Curves. As shown in Fig. 4, it can be seen that both passenger transport and cargo transport showed a trend of extreme decentralization. From the beginning of China’s aviation industry, Air China, China Eastern Airlines, and China Southern Airlines have occupied the leading positions in China’s air transportation industry. However, due to the promotion and development of China’s air industry and the introduction of more and more policies that gave strong support to development opportunities, other airlines were also able to develop rapidly and catch up with them. When HHI analysis is used, this type of scenario will produce the patterns seen in the charts.

For passenger transport, in order to attract people, all major airlines adopt a low-price policy, so the level of the airlines becomes the same as the probability of the customers choosing the different airlines is equivalent.

As for the cargo transportation, the competition among the major airlines is fierce. They want to sign contracts with express companies for better economic profits, which leads to the trend of extreme decentralization.

5.5 Shift-share analysis

As shown in Table 3 and Table 4, by using the data calculated by the shift-share methods, the ABSGR value of passenger and freight volume of these airlines can be analyzed. It can be seen that both the passenger and freight transport are developing rapidly in 2018, which is consistent with the previous analysis. However, one can also see that the development speed of airlines in different regions is different, as they are mainly affected by geographical location, policies, and environmental factors. In China, the development of the Western region lags behind that of other regions. Although supported by policies, due to the terrain and people’s habits, the development of the Western region is often slower and deviates greatly from that of the other regions.

From the perspective of customers, they are often more willing to choose bigger airlines for travel, which leads to the development of these airlines, while small airlines do not have that advantage. In addition, people will sometimes focus on local airlines, which can also lead to changes in the passenger traffic volume of airlines. As far as cargo transportation is concerned, local express companies are often more willing to sign contracts with local airlines because it is more convenient. In addition, this can provide mutual benefits and a win-win situation. Therefore, the transportation of goods will be very different from that of customers.

Through Table 3 and Table 4, we can see the results of shift-share analysis for the top airlines in the Chinese airline industry between 2009 and
Table 3. The Shift–share in Passenger Volume of the Top 20 Airlines in China, 2009–2018

<table>
<thead>
<tr>
<th>Airlines</th>
<th>SHARE EFFECT</th>
<th>AERSGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air China Limited</td>
<td>-142701.95</td>
<td>-352990.04</td>
</tr>
<tr>
<td>China Eastern Airlines Ltd.</td>
<td>-549320.80</td>
<td>-536949.82</td>
</tr>
<tr>
<td>China Southern Airlines Co.</td>
<td>-364477.22</td>
<td>-416124.28</td>
</tr>
<tr>
<td>Hainan Airlines Co., Ltd.</td>
<td>-119546.01</td>
<td>-234584.54</td>
</tr>
<tr>
<td>Xiamen Airlines Co., Ltd.</td>
<td>-132407.52</td>
<td>-546122.34</td>
</tr>
<tr>
<td>Sichuan Airlines Co., Ltd.</td>
<td>-142350.88</td>
<td>-163772.19</td>
</tr>
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<td>1729039.45</td>
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Table 4. The Shift–share in Cargo Volume of the Top 20 Airlines in China, 2009–2018

<table>
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<th>Airlines</th>
<th>SHARE EFFECT</th>
<th>AERSGR</th>
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<tr>
<td>Air China Limited</td>
<td>-71543.76</td>
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<tr>
<td>China Eastern Airlines Co.</td>
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<td>China Southern Airlines Co.</td>
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<td>Sichuan Airlines Co., Ltd.</td>
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<td>Shandong Airlines Co., Ltd.</td>
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<tr>
<td>Lucky Air</td>
<td>37091.46</td>
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<td>16331.85</td>
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<tr>
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<td>West Air Co., Ltd.</td>
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<td>58.65</td>
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<tr>
<td>Colorful Guizhou Airlines Co.</td>
<td>904.28</td>
<td>-5990.77</td>
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2018. By comparing the ABSGR of passenger throughput, it is shown that four ABSGR values in the selected airlines experienced a more competitive position. Those airlines' ABSGRs in terms of passenger volume are Air China Limited(51,012,723), China Eastern Airlines Corporation Limited(59,089,821), China Southern Airlines Company Limited(65,443,845) and Hainan Airlines Company Limited(58,202,028). Obviously, their value was much higher than other airlines. Therefore, it might be concluded that the market of passenger transportation is basically occupied by these four airlines. In contrast, the development of other airlines was slightly inferior. The results of shift-share analysis in cargo volume is indicated in Table 4. Displayed by the numerical results of the shift part, China Eastern Airlines Corporation Limited, China Southern Airlines Company Limited and Hainan Airlines Company Limited still accounts for a large proportion. However, Shenzhen Airlines Co., Ltd. replaced Air China Co., Ltd. with a shift of 81,125 tons, becoming the third fastest-growing airline in cargo transportation. The possible reasons are as follows: Firstly, Shenzhen is the city with the most express delivery in China. Secondly, Air China Limited pays more attention to the passenger market than cargo market.

In general, the combination of the HHI, CR, Gini, and shift-share methods to examine the passenger and cargo transport trends in the past decade have all shown the deconcentration of China's airlines.

6. Conclusion

With the improvement of people's living standards, more and more people will choose air transport as a means of transportation. As a platform for providing passenger tickets, the competition among airlines is becoming more and more fierce. In order to develop the aviation market better, it is important to improve the management of airlines and clarify their current situation. Although there are about 64 airlines in China, the proportion of each airline in the aviation market is not the same. Between these airlines, the top 20 airlines account for almost 90% of the Chinese aviation market. This study takes into account the passenger transportation volume and the cargo transportation volume of these airlines for the period 2009-2018 using the CR6, HHI, Gini coefficient, and shift-share methods in order to determine whether the airlines were concentrated or deconcentrated.

As shown in the results, the airlines have shown a trend of decentralization. Due to the impact of the economic crisis and the fierce competition among airlines together with the different initial construction investments and geographical locations of each airline, the reputation of each airline is different, which will have a certain impact on people's travel choices. From the results of the study, the following implications can be drawn. First, due to the deconcentration trend among airlines, there is a big reason for the fierce competition and lack of cooperation between them. Although each airline company has its own unique interests, reasonable cooperation and competition can jointly promote economic development.

Second, the government needs to strengthen its support for the aviation industry. During the period of economic crisis, China's economy was also affected, leading to a downturn in the aviation industry. Through the support of government policies, the self-confidence of the aviation industry was strengthened, and the consumption of citizens was also promoted.

Third, China's aviation industry is dominated by four airlines - Air China Limited, China Eastern Airlines Corporation Limited, China Southern Airlines Company Limited and Han Airlines Company Limited – on the passenger
side. However, as a result of shift-share analysis, Shenzhen Airlines Co. won 81,125 tons between 2015 and 2018 in competition with airlines. This indicates that Shenzhen Airlines Co. is the most competitive on the cargo side except for the big 4. Therefore, airlines should seek growth strategies by finding niche markets for passenger and cargo transportation.

It should be noted that the analysis in this paper also has some shortcomings. Because there are so many airlines in China, the author could not calculate the throughput for all of them, which means the data in the analysis was not fully complete. Although only the top 20 airlines have been analyzed in terms of the passenger and cargo throughput from 2009 to 2018, because they account for a large proportion of the market in China, they can still provide theoretical and practical assistance. In the near future, as China’s efforts to build more new airports and the government’s support for the aviation industry have been greatly increased, the competition among airlines will continue to be fierce and will enter a new stage of development. Further research can be carried out to continuously update the findings of this analysis so as to better evaluate the development of airlines when new aviation strategies are fully put into operation.

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