

# Air deregulation in China and its impact on airline competition 1994–2012



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## ABSTRACT

China's air transportation has experienced rapid growth and major reforms in the past three decades, some of which have been partially successful and are still ongoing today. The paper aims to analyze China's air deregulation experience over the last two decades and its impact on airline competition from a geographical perspective. After the establishment of the "Big Three" in 2002, the paper reveals that there has been a trade-off between the extent of deregulation and airline competition in China because the central government has tended to strengthen the "Big Three" rather than totally open the market to private and locally owned airlines. The paper uses each airline group as the basic unit of analysis and reveals that (1) the air market has been more concentrated in the "Big Three" as a result of the process of air deregulation; (2) airline competition in over two thirds of the airports and one half of the routes has increased in the last 18 years, but the core airports and trunk routes are chiefly dominated by the "Big Three". The peripheral airports and thin routes have been operated by private and locally owned airlines; and (3) regionally, airline competition has occurred in most airports of the eastern region, and it is more intense than in the central and western regions. But even here, competition in the eastern region has however decreased in 1994–2012. The three main contributions of the paper are: (1) the use of two measures of competition in the airline market; (2) the analysis of the historical evolution of competition; and (3) an understanding the role of the geography of competition in the Chinese airline market.

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## 1. Introduction

Deregulation was first advocated in the U.S. in the 1970s (Kahn, 1971; Baumol, 1977) and then in other Anglo Saxon economies (Graham, 1993; Barrett, 1997). It was seen at that time as a means to achieve lower air fares, greater competition, improved reliability, and better quality airline services (Goetz and Graham, 2004). Since the 1980s, the airline industry of China has grown tremendously as its economy has expanded, and the air passenger volumes have increased from 11.7 billion person-km to 502.6 billion person-km, a 43-fold increase between 1985 and 2012 (National Bureau of Statistics of China, 2013). The rapid growth of air travel in China is a result of the increase in the numbers of flights, and the use of larger aircraft (Wang et al., 2014a). To understand this outcome we need institutional analysis and geographical analysis. At

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this stage China's airline deregulation is only partial because the Government wants to protect its growing domestic market. A key challenge for China is whether to first open up the airlines domestically and then to follow this with international agreements for further deregulation. China's airlines have little market power internationally, unlike the more mature airlines in the United States and the United Kingdom where liberalization started. The latter two have a much more extensive international network of routes, more market power, financial resources and the larger fleets (Fu et al., 2010). China has not yet followed this road because it wishes to create national champions before competing internationally. Hence the strategy of the Chinese central government priority has been airline consolidation and a further strengthening of the "Big Three" – Air China, China Southern, and China Eastern, which has involved mergers and acquisitions of many small airlines (Lei and O'Connell, 2011). This institutional dimension differs from the path taken to market led consolidation in the U.S. and Europe.

This paper attempts to answer three key questions about these circumstances. It will explore (a) what changes have taken place in

response to deregulation; (b) how the airline market has been re-organized; and (c) assessing airline competition from a geographical perspective over an 18 year period.

## 2. Literature review

The international literature on air deregulation and its impacts on airline competition can be divided into three main groups. The first group discusses the economic rationale for liberalisation (Kahn, 2004; Goetz and Vowles, 2009; Wang et al., 2014b); the second focuses on the spatial character of deregulation, especially on airlines' network characteristics (Shaw et al., 2009; Fu et al., 2010), and this work includes a minor group that focuses on the application of network theory to deregulation (Wang et al., 2011, 2014c; Lin, 2012). The third group refers to the decadal policy evolution of deregulation experience from an institutional viewpoint (Zhang et al., 1998; Zhang and Round, 2008; Lei and O'Connell, 2011; Eaton, 2013; Koo and Lohmann, 2013). This paper identifies the key studies, and it takes an explicit air transport geography bias.

Taaffe (1958) first analyzed the airline competition of the U.S. and its changes during 1940s and 1950s within a geographical perspective and using maps. Other studies have investigated the process of air deregulation and its impacts on airline competition, service and pricing (Hooper, 1998; Vowles, 2000; McHardy and Trotter, 2006), focusing on the U.S. context (Fleming, 1991; Goetz, 2002). The main argument for air transport deregulation has been that markets are contestable, meaning that entry and exit should be costless and easy, that sunk costs are not high, and that the threat of entry is sufficient to prevent anti-competitive strategies from the incumbents (Bailey and Panzar, 1981). Although the airline sector has many actors, it is a sector where multi firm production is more costly than production in a single firm (Baumol, 1977), but this claim has long been disputed by Caves et al. (1984). Brueckner and Spiller (1994) measure airline competition from the perspective of economies of traffic density versus economies of scale, and Dempsey and Goetz (1992) emphasize the role of competition, but with limited information on the role of geography. The literature reveals that deregulation has had both successes and failures. In addition to the economic studies on the subject, geographers have taken considerable interest in the airline industry under deregulation, focusing on the connectivity and accessibility benefits of air travel, network configuration (Chou, 1993; Ivy et al., 1995; Goetz and Sutton, 1997; Reynolds-Feighan, 1998; Bowen, 2002; Shaw and Ivy, 1994; Lei and O'Connell, 2011). These studies do not apply indicators (indices) measuring historical changes in levels of airline competition, but tend to concentrate on the situation at one point in time.

Brazil, India and China are all large developing countries, and each has seen rapid economic growth and so common lessons can be learned. Brazilian deregulation began in 1992 (Koo and Lohmann, 2013) and it did not produce an increased number of competitor airlines, since four airlines dominate the entire Brazilian market. Bettini and Oliveira (2008) provide empirical evidence that re-regulation periods further reduced competition as demonstrated by the supply of seats over time. This is in sharp contrast to China where deregulation is still ongoing. The Brazilian experience shows that policy uncertainty can inhibit competition in the airline market. Koo and Lohmann (2013) find that Brazilian domestic aviation is still undergoing major spatial restructuring in terms of its airport hierarchy, and this might also be occurring in China. In short, Brazil's deregulation was not sufficiently effective in increasing the number of private airlines, but it did widen airport capacity and it produced lower yields (per passenger km), by as much as 50% (BNDES, 2010). India's aviation

sector was state controlled until the 1980s and deregulation was introduced in the 1990s, but it has not delivered what was expected as many private airlines have exited the market (Nathan Associates, 2012). The experience of Brazil and India shows that policy uncertainty inhibits the entry of new competitors. The pace of these deregulation efforts will also be influenced by (1) the deregulation experience of these countries which is far from complete and (2) the pace of international deregulation. Although building new airports many not indicate successful deregulation, China is building new airports more rapidly than both Brazil and India (The Economist, 2011).

In the case of China, some existing literature has been used to illustrate how deregulation of the sector evolved before 2004. Zhang et al. (1998) first observed the air deregulation process in China, but this work is limited to the economic aspects, and in the update analysis Zhang et al. (2008) has included the driving forces of air deregulation of the early 2000s. Recently two key studies (Lei and O'Connell, 2011; Eaton, 2013) have focused on policy changes with respect to air deregulation. Furthermore, geographers (Jin et al., 2004; Wang and Jin, 2007) have examined the spatial patterns of air passenger transport in China after air deregulation. Chi-Lok and Zhang (2009) have investigated the effects of competition and policy changes on Chinese airport productivity and they have explored the efficiency of airports is positively correlated with the process of airport localization. Fan et al. (2014) find that international hub airports are operated at higher efficiency level than other smaller airports. In terms of airline competition, Zhang and Chen (2003) have examined the competition in China and find that up to 1979, the market and route entry, frequency and price were all controlled by a centralized authority. Zhang et al. (2013) find different strategies have been employed for competition by the "Big Three" in China's three busiest air routes (Beijing-Shanghai, Beijing-Guangzhou, and Shanghai-Guangzhou). That situation reflects the greater market power of Air China when compared to China Southern and China Eastern (Zhang et al., 2014). The Chinese approach to deregulation differs from that in western markets (U.S. and Europe) where airlines were allowed to serve any route. As a result, Chinese carriers have enjoyed high yields and low input prices in the domestic market, and this has led to high profitability in recent years (Wang et al., 2014b). These conditions mean that institutional analysis of air transport competition as carried out in the international literature is not of central relevance here. Substantial differences in the institutions, and other factors such as low per capita incomes, the distances flown and the airport capacity (including recent expansion) resemble an economy in the early stages of development. In essence China has an embryonic airline industry that has grown exponentially in the last few decades, and one that retains strong central control.

Existing studies (Zhang and Chen, 2003; Lei and O'Connell, 2011; Eaton, 2013) have tended to dissect the role of these regulatory strategies but they do not focus on the uneven geographical outcomes for certain Chinese regions. Moreover, many of these studies in the field are descriptive, and they do not take a long historical horizon nor examine the changes in airline competition at all airports and air routes. One exception is Shaw et al. (2009), who studied the deregulation experience of China and observed airline consolidation and the changes made by individual airlines in network structure and hub dynamics. These authors only examine two years' data for 2001 and 2004 (or before and after the establishment of the "Big Three") in China. The paper extends this work by considering the latest policies and changes in airline groups, evaluating the dynamics of airline competition in a geographical context.

Hence the contribution here is first to provide a more relevant institutional focus and link that to a geographical insight on

regulatory changes. The third section of the paper concentrates on the role of deregulation on airline competition over time and explains the deregulation and consolidation process with respect to airlines. The fourth section introduces the data and the methodology employed, and the fifth section examines the overall airline competition over time. The sixth section maps out the competitive positions between the airlines from a geographical perspective. Following the discussion, the conclusions of this research are summarized in the final section.

### 3. The deregulation process of airline industry in China

Zhang and Round (2008) and Shaw et al. (2009) analyze the deregulation process of the air industry in China in all its aspects over the early period (to 2004). This paper updates that analysis by covering the more recent developments that have given preference to the “Big Three”, and details of the recent reforms and in the further deregulation of the airline industry. The review is used to identify key stages in the de-regulation policy, which will be used in the subsequent analysis. As outlined below the air deregulation process is divided into four stages in the paper, which reflect key regulatory measures introduced by the Chinese State (Fig. 1).

#### 3.1. Pre-reform tight regulation (before 1978)

Before 1949, air transport in China was closely related to military needs, and civil airports were reconstructed from military airports by airlines and local government together or individually. Most airlines were controlled by the Government, except the Southwest Airlines which was run independently from the Government. Shortly after the founding of People's Republic of China (PRC) in 1949, the CAAC (Civil Aviation Administration of China) was established, and operated under the Central Military Commission until 1954. Before 1978, the air transport was fully controlled by the central government under the CAAC, which operated in a military or semi-military style, collaborating with the Air Force. Following the former Soviet aviation system, the CAAC was responsible for planning, building and operating airports and air routes. All the airlines and the flights were centrally controlled in a tightly regulated system.

#### 3.2. Transitional stage (1979–1987)

Since China's economic reform in 1978, the CAAC started to take cautious measures to change the way it regulates the airline industry. In 1980, the CAAC became independent from the military, and then implemented various reform measures (to 1987) including: separating the management of airlines, airports and the CAAC central office; transforming airlines into profit-driven business entities; and allowing local governments to operate their own airlines and encouraging competition (Jin et al., 2004). In 1987, six state-owned airlines (Air China, China Eastern Airlines, China Southern Airlines, China Southwest Airlines, China Northwest Airlines, and China Northern Airlines) were set up. The CAAC, however, remained as both the regulator of the air transport industry and the manager of airports, airlines, and other air transport services.

#### 3.3. State-led consolidation and privatization (1988–2004)

Deregulation on entry, exit, private/foreign investment, airfares and consolidation are the main features in this stage. From the middle 1980s to early 1990s, airlines funded by local governments and the private sector (e.g., Xiamen Airlines, Shanghai Airlines, and Xinjiang Airlines) were permitted to enter into the commercial air transport market. In addition, foreign capital was allowed for investment in airlines and airports (1994). In 1997, the CAAC started airfare deregulation by encouraging airlines to adopt price discrimination to improve efficiency. During 1997–1999, the Asian Financial Crisis and China's domestic economic restructuring led to a downturn for China's air transport, with many airlines suffering from declining demand, intensive competition and high debt-to-asset ratios. The CAAC advocated airline consolidation to create more cost-efficient airlines that could achieve economies of scale, and all state-owned airlines were regrouped into the “Big Three” airlines by 2002 (Fig. 2). Most of the merged airlines in this stage ceased their original IATA code and brand, and their identity was correspondingly replaced by the code of CA (Air China), CZ (China Southern), and MU (China Eastern). Furthermore, the CAAC completed the transfer of ownership and management of all airports (except for Beijing and Tibet airports) to local governments by

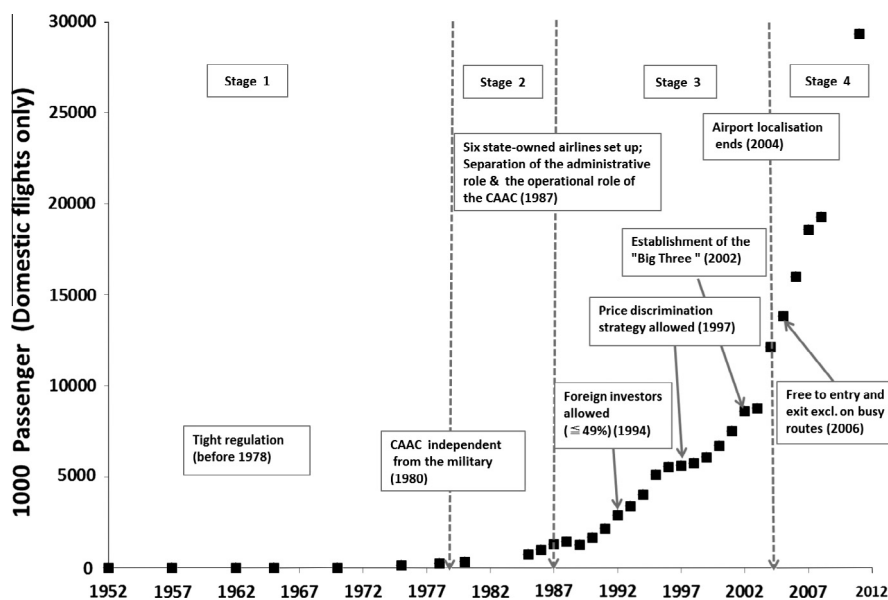
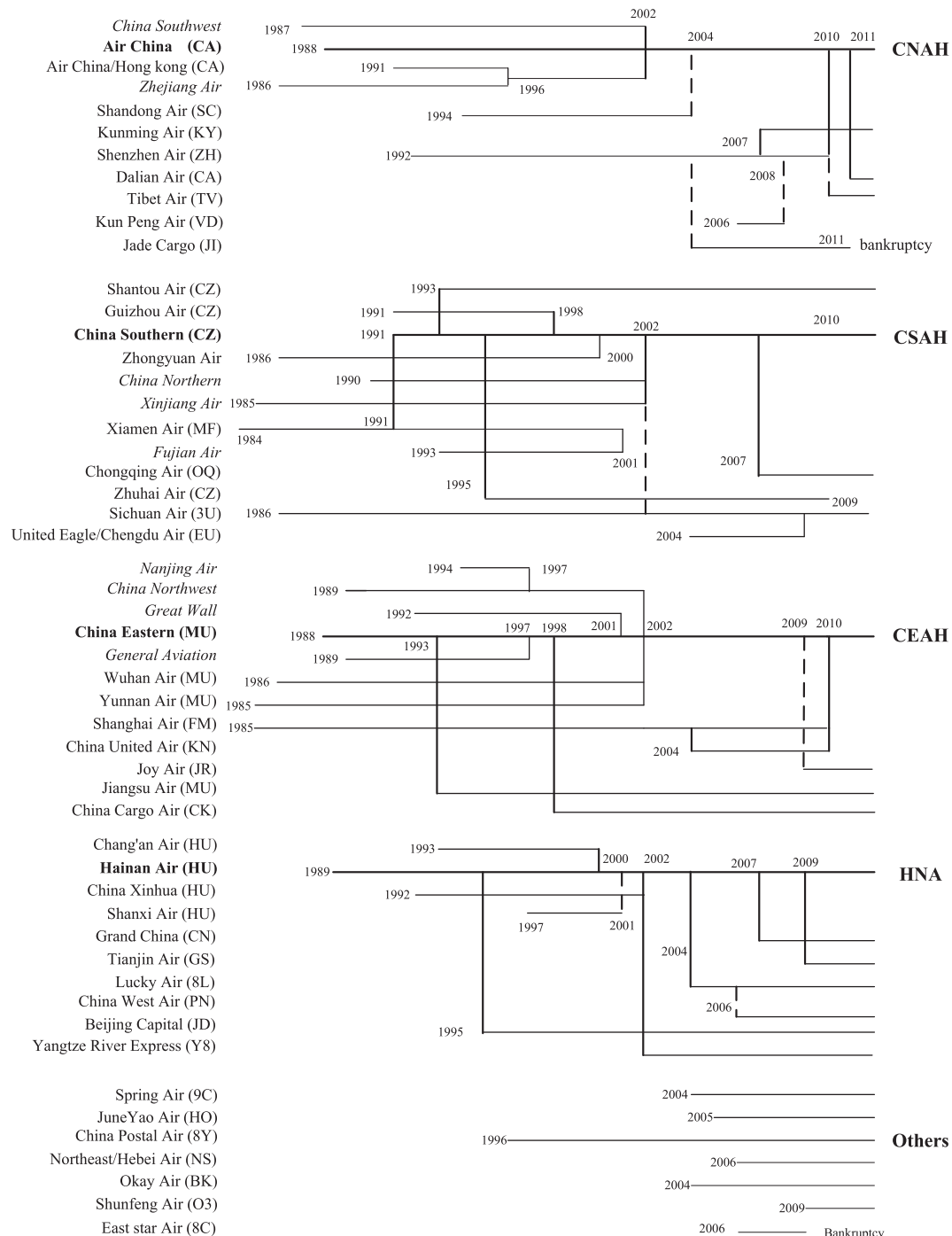


Fig. 1. Chronology of key regulatory measures by the Chinese state during 1952–2012.



**Fig. 2.** Chronology of entry, merger and reorganization of China's airlines, 1984–2012. Note: The brackets contain the IATA code of each individual airline, and the IATA code of airlines with *Italic characters* is ceased after the merger. The dot line represents the associated companies. The number represents the approved year of each airline officially and the merger year.

2004, in a process called “airport localization”. The program provided more incentives for local governments and private investment for constructing and improving airports, and it made the airports more financially accountable and efficient (Chi-Lok and Zhang, 2009). In this stage, the state-led consolidation was driven under the guidelines of the CAAC, and it was very different from the free-market deregulation implemented in the United States (Shaw et al., 2009), and it was completed much faster than that in the U.S.

### 3.4. New entrants, market-driven consolidation and deregulated competition (2005–2012)

In 2005, the CAAC opened its civil aviation sector to private investors, and the number of private airlines has grown rapidly, with new airlines being established for the expanding local markets. The very broad perspective on “opening up” allowed local authorities to establish their own airlines for attracting investment. Therefore, new startups have been founded jointly owned

by local government-owned enterprises and the “Big Three”. For example, *Chongqing Airlines* was established in 2007 and jointly owned by *China Southern* and Chongqing Municipal Development and Investment Company. *Dalian Air* and *Tianjin Air* are also jointly owned by the local government and one airline from the “Big Three”. Most new entrants are connected to existing airlines (Fig. 2). Since 2007, the CAAC have slowed down its rate of approval for accepting applications for new airlines, and this is a response to the rapid growth of airlines and a particular concern over aviation safety. China launched safety checks after the jet crash in Yichun (in Heilongjiang Province) in 2010, which was operated by *Henan Airlines*. Market-driven consolidation has continued for two reasons. Some private airlines were facing bankruptcy because of the effects of the financial crisis (2007–2008), and secondly, the “Big Three” have expanded their markets by acquiring local/private airlines (Fig. 2). For example, *Air China* acquired a majority stake in *Shenzhen Airlines* in 2010 and *China Eastern* acquired *Shanghai Airlines* in 2011. The first acquisition was intended to expand market coverage into different regions, and the second was directed toward reducing competition since these two airlines are both Shanghai-based carriers. In contrast to the state-led mergers, most airlines have retained their original logo, IATA code and uniforms.

In summary, China’s air transportation has passed through many changes since the foundation of new China: from a semi-military era of strict regulation in the pre-reform People’s Republic of China to a transitional stage, then an era of state-led consolidation and privatization, and it is now entering an era of market-driven consolidation, new entrants, and deregulated competition with the full impacts yet to be realized and assessed. This process is foremost highlighted by the transforming role of the CAAC from being a “two-headed” regulator and operator to a lesser role of supervision. The air deregulation since 1980s has been partially successful, and this success has been associated with the rapid increase of air travel demand. The curve of air passenger traffic in Fig. 1 was very flat in the first stage, and it then showed an upward trend in the second stage, followed by a linear function with a steep upward slope in the third stage and an exponential growth function in the fourth stage. Today, there is a mixture of airlines in China operated by the State, local government and private business.

## 4. Data processing and methodology

### 4.1. Data processing

The study area is limited to the mainland of China excluding Hong Kong, Macao, and Taiwan. As shown in Fig. 2, three years are chosen for analysis, and these represent the status before and after the state-led consolidation events of the airline industry in China (1994 and 2004), and the latest data with new entrants and market-driven consolidation (2012). The data are sourced from the scheduled domestic timetable databases of all Chinese airlines with unique IATA codes during 25th March to 27th October in each of the three years (1994, 2004, and 2012). The timetable data (CAAC, 1994, 2004, 2012) provides a detailed and disaggregate description of the scheduled air supply (origins, destinations, stops, frequencies) performed by all Chinese airlines. All the analysis in Sections 4–6 is based on this source. Cargo carriers such as *Air China Cargo*, *China Cargo Air*, *Yangtze River Express*, *Jade Cargo International*, and *SF Airlines* are excluded from the research. Cities are chosen for analysis as most of them have a single airport. For those with multiple airports, the data are combined with one entry for each city. All the stopover air routes are divided into two air routes: from the departure city to the stopover city, and

then from the stopover city to the destination city. Each air segment is assigned with the same flight frequency. Since the air passenger volume of each airport (CAAC, 2013) was highly related to the frequency of flights (correlation coefficient of 0.978 in 2012), the research below uses the number of air routes and the frequency of flights per week to analyze the network coverage and market structure of airlines (Table 1).

The airline group shown in Table 2 includes the core airline and its subsidiaries and affiliates, where the core airline have stake share over 50%. For example, the Air China Group included *Air China*, *Shenzhen Air*, and *Kunming Air* in 2012 but only *Air China* in 1994 and 2004. Similarly, the China Southern Group included *China Southern (CZ)*, *Xiamen Air (MF)*, and *Chongqing Air (OQ)*, the China Eastern Group included *China Eastern (MU)*, *Shanghai Air (FM)*, and *China United Air (KN)*, and the Hainan Airline Group (HNA) included *Hainan Airlines (HU)*, *Lucky Air (8L)*, *Grand China (CN)*, *Beijing Capital Air (JD)*, and *Tianjin Air (GS)* in 2012. The market share of air routes and flights of the “Big Three” Airline Groups is greater than that for the three individual airlines. For example, the “Big Three” accounted for 73.5% of air routes and 70.9% of flights in 2012, while the three individual airlines alone accounted for 61.6% of air routes and a much smaller 53.2% of flights respectively. The following analysis uses the larger airline groups as the basic unit, instead of the individual airlines. In addition, all the other airlines are called “private and locally owned” airlines in the paper.

### 4.2. Competition measures

Taneja (1968) concluded that the flight frequency share and the number of competitors were the most effective explanatory variables for airline market share, which was confirmed by results of the research of Zhang et al. (2014) on competition in the airline market. Following those leads, the research developed a market competition index and the market concentration index to evaluate the airline competition.

#### 4.2.1. Market competition index

The market competition index in each airport (or air route) is defined as the number of airlines operating there, written as,

$$C_i = \sum_{j=1}^N a_{ij}$$

where  $a_{ij} = 1$  when the airline  $j$  operates any flight departing or arriving at airport  $i$  (or on air route  $i$ ) and  $a_{ij} = 0$  otherwise.  $N$  is the total number of airlines in the market. The market competition index  $C_i$  is the sum of  $a_{ij}$  for airport  $i$  (or air route  $i$ ) and reflects how many airlines operate there. This means that the higher the index, the more competitive the market. The market competition of the whole aviation industry  $C$  is defined as the average value of  $C_i$  in all airports (or air routes), written as,

$$C = \frac{1}{M} \sum_{i=1}^M C_i$$

where  $M$  is the total number of airports or air routes in the market.

**Table 1**  
Statistics of the analysis data in the three years.

Year	No. Airlines	No. Airline groups	No. Airport cities	No. Routes	No. Flights
1994	21	20	100	634	7901
2004	10	9	122	843	29,359
2012	27	17	171	1146	84,982

Data source: Own calculation based on the timetable of all Chinese carriers.



**Table 2**

A comparison of market share: individual airline vs. airline group.

Carrier	% Airport cities			% Air routes			% Flights		
	1994	2004	2012	1994	2004	2012	1994	2004	2012
Air China (CA)	44.0	50.0	52.6	12.1	21.5	16.1	10.3	13.6	13.0
Air China Group	44.0	50.0	57.3	12.1	21.5	28.9	10.3	13.6	19.4
China Southern (CZ)	53.0	65.6	65.5	27.3	47	35.2	17.1	28	23.8
China Southern Group	53.0	67.2	67.3	34.2	56.5	41.8	21.3	35.1	30.4
China Eastern (MU)	29.0	56.6	61.4	13.1	31.2	29.1	10.9	20.3	16.4
China Eastern Group	29.0	56.6	69.6	13.1	31.2	31.5	10.9	20.3	21.0
Big three airlines	63.0	82.8	85.4	45.0	73.1	61.6	38.3	61.9	53.2
Big three groups	63.0	82.8	87.1	49.5	78.5	73.5	42.4	67.1	70.9
Other airlines	90.0	80.3	83.0	79.3	53.3	62.6	57.6	21.8	29.1

Data source: Own calculation based on the timetable of all Chinese carriers.

Note: Since two or more airlines are allowed to operate in the same airports and air routes, so the sum of their percentages are more than 100 percent.

#### 4.2.2. Market concentration index

Herfindahl–Hirschman Index (HHI) (Miller, 1982) is used to measure the market concentration of any industry, written as,

$$HHI^* = \sum_{j=1}^N S_j^2 = \sum_{j=1}^N (X_j/X)^2$$

For the airline industry  $S_j$  is the market share of airline  $j$ , and equals to its market volume (evaluated by flights)  $X_j$  divided by the overall market  $X$ . The paper normalizes to the HHI index in order to compare it in all three years with unequal number of airlines, and the formular is written as:

$$HHI = \frac{HHI - 1/N}{1 - 1/N}$$

where the HHI index ranges from zero to 1, with the market structure varying from one extreme where perfect competition exists to a monopoly with effective barriers to entry. This means that the lower the index, the more competitive the market.

It is very easy to calculate the market competition index but it does not reflect each airlines market share. On the contrary, the market concentration index gives greater weight to the competitors with large market share; it however fails to consider the number of competitors, the distribution of market share of each competitor, the impacts of a few large airlines on the market. Hence the paper employs the two indices for evaluation of concentration. The larger the number of airlines operating on the air route (or at an airport), the higher the market competition index is and the lower the concentration index, and so more competitive the market.

### 5. Overall airline competition

#### 5.1. Airline competition and market concentration

The number of airlines decreased from 20 to 9 during 1994–2004 with the consolidation of regional airlines into the merger of the “Big Three”, and then the number rebounded back to 17 with the entries of new airlines during 2004–2012. In terms of the market competition index, the average airline competition at airports first decreased from 5.0 in 1994 to 3.73 in 2004 and then increased back to 4.7 in 2012 (Table 3), which is still a little lower than of the level in 1994. With regard to air routes, the market competition index shows a similar trend, although in 2012 it is higher than it was in 1994. On average, the number of airlines operating in airports and air routes reached 4.70 and 1.86 in 2012 respectively, which does not differ greatly from that in 1994. In other words, airports and air routes based on the market competition index have become more competitive after 2004. In all the three years, the market concentration index is relatively low for flights, which

**Table 3**

The overall competition of Chinese air industry by airline group.

Year	Market competition index (average)		Market concentration index
	Airport city	Air route	Flight
1994	5.0	1.72	0.067
2004	3.73	1.70	0.099
2012	4.70	1.86	0.144

Data source: Own calculation based on the timetable of all Chinese carriers.

means the aviation market of China is not highly concentrated and seems competitive. Specifically, the flight-based HHI index showed a growth trend and reached 0.144 in 2012, more than twice the level for 1994 showing the aviation market has become more concentrated. As the market competition index shows the air market has been slightly more competitive since 2004, while the market concentration on flights has increased two times, the results show more airlines have entered the market, but the market has become more concentrated due to the increased dominance of the large operators. Such growth in both competition and concentration has taken place in China, where the market is growing exponentially and this can be partially attributed to the air deregulation (Fig. 1).

#### 5.2. Monopoly vs. competition by airlines

During 1994–2012, most air routes and airports have become less monopolistic or duopolistic as shown in Table 4. The percentage of monopoly routes and airports decreased in the 1994–2012 period. Meanwhile, the proportion of air routes and airports served by three or more airlines has increased substantially over the same period. The private and locally owned airlines operated most monopoly routes in 1994, but this monopoly operation was replaced as the “Big Three” moved into these markets between

**Table 4**

The market structure of airline industry in China.

Type	% Route			% Airport city		
	1994	2004	2012	1994	2004	2012
Monopoly	58.7	55.8	55.9	39	24.6	21.1
Big Three	18.3	35.6	31.9	9.0	10.7	10.5
CA	4.1	4.0	7.1	5	0.8	0.0
CZ	10.4	23.1	12.2	4	4.9	4.7
MU	3.8	8.4	12.7	0	4.9	5.8
Other airlines	40.4	7.7	13.6	30.0	13.9	10.5
Duopoly	23.8	24.6	19.5	13	27.9	16.3
Three or more carriers	17.5	19.7	24.6	48	47.5	62.2

Data source: Own calculation based on the timetable of all Chinese carriers.

**Table 5**

Differentiated marketing tactics: “Big Three” vs. private and locally owned airlines.

Airlines	Flights/routes			Flights/cities			Market strategy	
	1994	2004	2012	1994	2004	2012	Network type	Market
CA	11	22	50	18	65	169	Higher freq.	Core airports & trunk routes <sup>b</sup>
CZ	8	22	54	32	126	225	Higher freq.	
MU	10	23	50	30	86	150	Higher freq.	
Others <sup>a</sup>	6	19	23	10	34	35	Lower freq.	Peripheral airports & thin routes

Data source: Own calculation based on the timetable of all Chinese carriers.

<sup>a</sup> Using the average value of all the other airlines.<sup>b</sup> The evidence is shown in Table 7.

2004 and 2012. Their influence in the market can be seen in an analysis of routes where one airline had a monopoly. There were 641 monopoly routes in 2012, with 17.8% of them departing from or arriving at Guangzhou (50), Beijing (47), and Shanghai (17). Of the monopoly routes from/to Beijing, 40.4% are operated by Air China, from/to Guangzhou 68% by China Southern, and from/to Shanghai 100% by China Eastern. This represents the oligopolistic power of the “Big Three” in their own base airports. Most of the other monopoly routes reflect low levels of demand market in small and remote airports and are operated by private and locally owned airlines. That is well illustrated by the fact that in 2012, all the 19 monopoly airports operated by the private and locally owned airlines are small and mainly located in the western region (Table 4).

There has also been a shift in the geography of competition. The airports and air routes with the highest level of competition in 1994 were the first-tier cities such as Beijing, Guangzhou, and Shenzhen while the most competitive air routes were Beijing-Harbin, Beijing-Guangzhou, and Shanghai-Guangzhou. By 2012 the top three in terms of competition were Chongqing, Hangzhou, and Chengdu and Beijing-Shanghai, Chengdu-Hangzhou, and Chengdu-Xi'an were the most competitive routes. This illustrates the shift in the market to include some of the fast growth second ranked western cities. That is confirmed by the fact that 2012 the highest values on the market concentration index were recorded at the airports of Wenzhou, Chongqing, and Yinchuan, and on the air routes of Chongqing-Nanjing, Chengdu-Hangzhou, and Kunming-Xiamen.

### 5.3. “Big Three” vs. private and locally owned airlines

Although the entry of private airlines into the aviation market has increased competition, as noted earlier some of them have been acquired by the “Big Three” or have been declared bankrupt (e.g., East Star in 2009). Private and locally owned airlines only accounted for 29.1% flights in 2012 so haven't resulted in real competition. As shown in Table 2, the “Big Three” accounted for less than half the air routes in 1994, but this percentage grew to 78.5% in 2004, and then dropped back to 73.4% in 2012. Conversely, the percentage of air routes operated by private and locally owned airlines has decreased from 79.3% (1994) to 53.3% (2004) and then back to 62.6% (2012).

If competition is evaluated by flights per week, it shows a different picture as the share of the “Big Three” in the market has increased steadily from 1994 and 2004 to 2012. The “Big Three” operated a much higher number of flights and carried a much greater passenger share as they concentrate flights in air routes and airports with high levels of demand and hence higher frequency of services (Table 5). Between 1994 and 2012, the “Big Three” have greatly intensified their flight frequency on those air routes in response to the dramatic growth of air travel demand. For example, China Southern increased its flight frequency on air routes by 5.75 times (1994–2012), and this growth is replicated

by China Eastern (4 times), Air China (3.54 times). In contrast among other airlines the increase was just 2.83 times. The private and local airlines (mostly new entrants) explore new markets and multiple the routes where high service frequencies are not required.

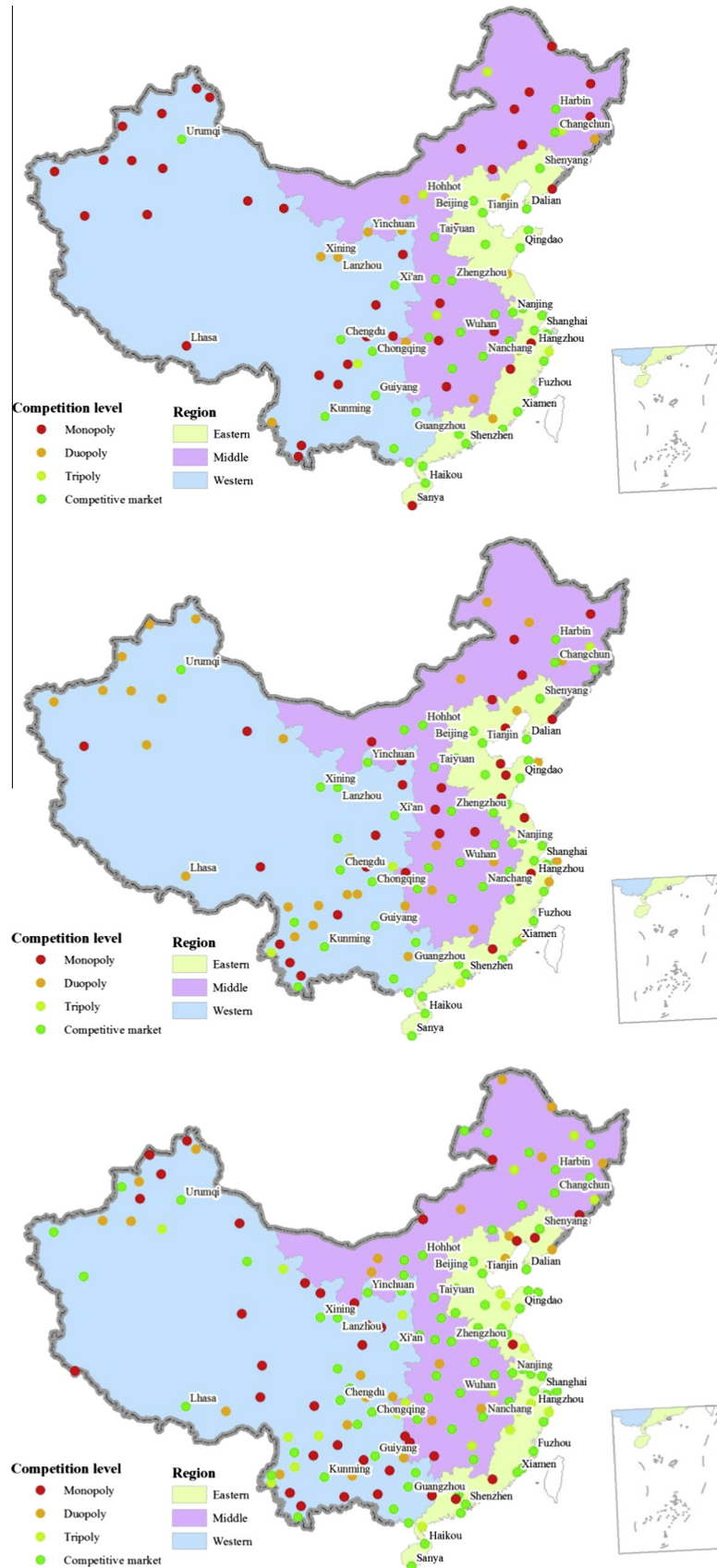
Hence the air deregulation policy has certainly had the effect of increasing the number of private and locally owned airlines but overall, the main thrust of the policy, to foster the development of the national champions, has been effective as the overall aviation market is still dominated by the “Big Three” because of their incumbent advantages, especially at busy airports and on the high demand air routes.

## 6. Changes in the geography of competition in routes and airports

### 6.1. Spatial competition

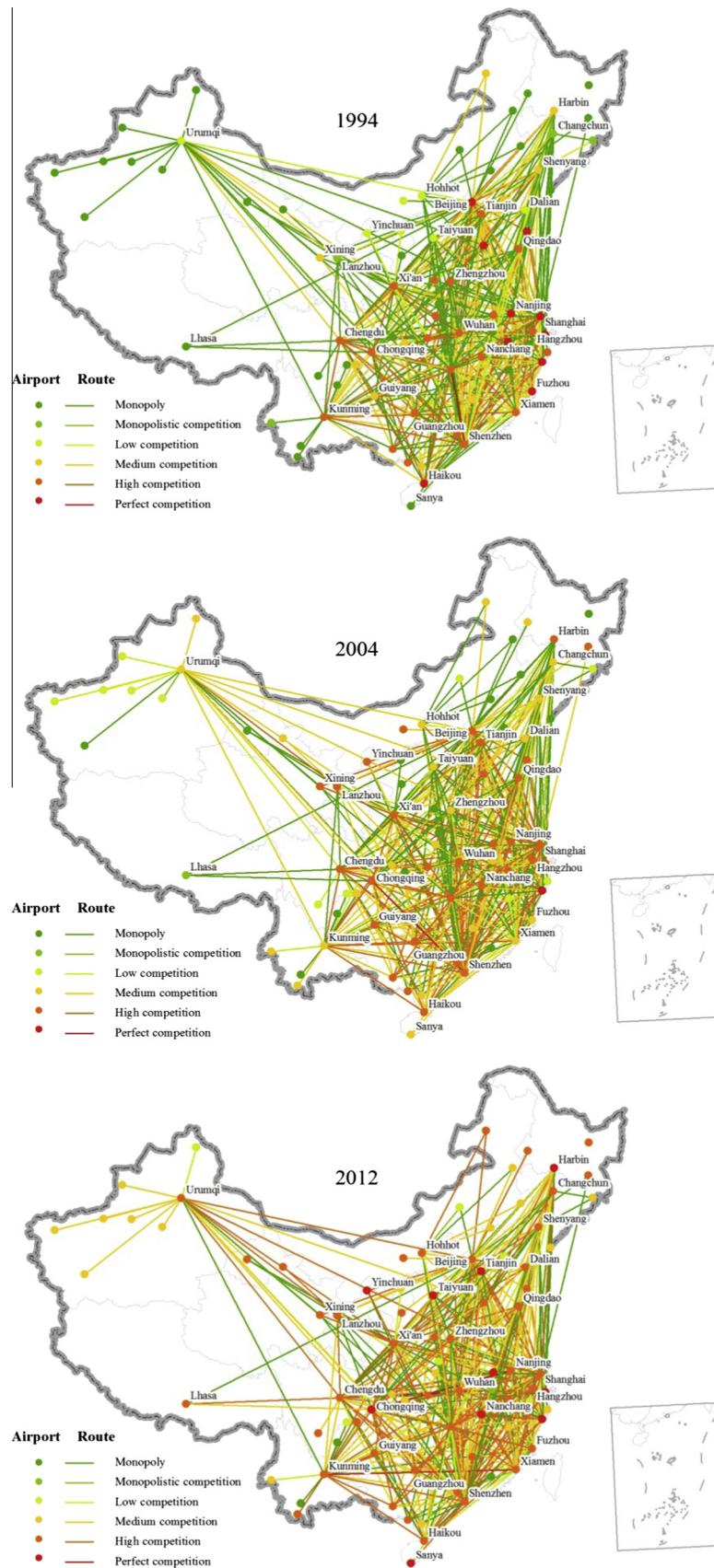
In the state-led consolidation before 2002 some monopoly airports (identified on scores on the market competition index, were located in the eastern region. Recently however most monopoly airports are located in central and western China because of the low demand levels for air travel in those regions (Fig. 3). In contrast, airports in the eastern region are usually operated by three or more airlines. The market concentration index shows airports and air routes in the eastern region are more competitive than those in the central and western regions even though more and more airports and air routes have become more competitive over time (Fig. 4).

In order to compare the changes of airline competition in each airport and air route over time, the 90 airports and the 418 air routes that were operated in all the three years (1994, 2004 and 2012) were chosen for further analysis. During 1994–2012, airline competition has increased in over two thirds of airports and one half of the routes, as measured by both indices (Table 6). Furthermore, the airline competition has decreased from 1994 to 2004 due to the state-led consolidation, but it has increased between 2004 and 2012 in the less regulated air market. Spatially, airports with decreasing airline competition are mainly concentrated in the eastern region, while those with increasing airline competition in central and western regions (Fig. 5). Looking at 29 airports in the eastern region in 2012, 15 (measured on market competition) and 14 (measured on market concentration) have become less competitive compared to their position in 1994. Specifically, all the headquarters of the “Big Three” (Beijing, Shanghai, Guangzhou), and Hainan Airlines (Haikou) have become more dominated by their own home-base carriers. In the western region, looking at 33 airports, 26 (on the market competition index) and 29 (on the market concentration index) have become more competitive over the period 1994–2012. In the 27 airports in the central region, 23 (on the market competition index) and 21 airports (by the market concentration index) have become more



**Fig. 3.** Airline competition in each city by the market competition index 1994 (top), 2004 (center), and 2012 (bottom). Note: In the legend, when  $C_i = 1$ , the market is named monopoly, when  $C_i = 2$ , namely duopoly, when  $C_i = 3$  or over, namely Tripoly, when  $C_i = 4$  or over, namely competitive market. Data source: Own calculation based on the timetable of all Chinese carriers.





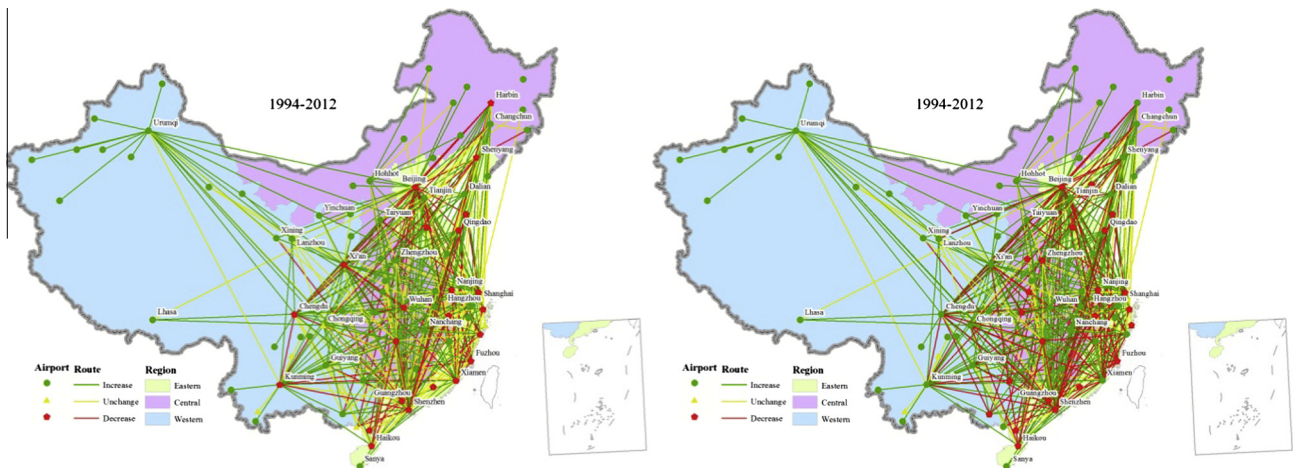
**Fig. 4.** Spatial distribution of airline competition by the market concentration index. Note: In the legend, monopoly represents  $HHI = 1$ , when  $0.8 \leq HHI < 1$ , namely monopolistic competition; when  $0.6 \leq HHI < 0.8$ , namely low competition; when  $0.4 \leq HHI < 0.6$ , namely medium competition; when  $0.2 \leq HHI < 0.4$ , high competition; when  $HHI < 0.2$ , perfect competition. Airport in the legend represents airport city.

**Table 6**

Changes of airline competition in airport cities and air routes.

Competition change	Market competition index						Market concentration index					
	Airport cities			Air route			Airport cities			Air route		
	2004/1994	2012/2004	2012/1994	2004/1994	2012/2004	2012/1994	2004/1994	2012/2004	2012/1994	2004/1994	2012/2004	2012/1994
Increased	35.6	81.1	67.8	36.4	48.6	53.1	48.9	86.7	72.2	47.4	52.4	58.6
Unchanged	21.1	13.3	6.7	40.4	37.5	30.6	14.4	3.3	2.2	24.6	17.0	17.7
Decreased	43.3	5.6	25.6	23.2	13.9	16.3	36.7	10.0	25.6	28.0	30.6	23.7

Data source: Own calculation based on the timetable of all Chinese carriers.

**Fig. 5.** Spatial distribution of competition changes by the market competition index (left) and the market concentration index (right). Data source: Own calculation based on the timetable of all Chinese carriers. Note: Airport in the legend represents airport city.

competitive. Overall, airline competition has increased in the central and western regions but decreased in the eastern region.

### 6.2. Trunk routes vs. thin routes

The top 100 routes and bottom 100 routes by frequency of flights per week can be defined as trunk routes and thin routes. In 1994, the 100 trunk routes accounted for 53.9% flights and this proportion decreased to 46.6% in 2004 and 39.1% in 2012. Conversely, the 100 thin routes just accounted for quite a small percentage of the total flights (2.7% in 1994, 1.5% in 2004, and 0.78% in 2012). Overall, all trunk routes were operated by two or more carriers, whereas all thin routes were operated by a single carrier in 2012. Among the 100 thin routes, 6 routes were operated by Air China, 12 by China Southern, 12 by China Eastern, and the remaining 70 by private and locally owned airlines. In 1994, the “Big Three” shared less than a half of the number of flights (48.4%) in trunk routes and the ratio increased to 78.7% in 2012. None of the private and locally owned airlines operated more than 50% flights on any trunk routes. Consistent with results shown above over the last 18 years, the “Big Three” (with the exception of China Eastern) have increased their market share in trunk routes and decreased their share in thin routes (Table 7), and this is the exact reverse for private and locally owned airlines.

### 6.3. Core airports vs. peripheral airports

Core airports and peripheral airports are defined as the top and bottom 20 airports by flight frequency per week, and these accounted for 66.6% and 0.3% flights in 2012 respectively. All the core airports were operated by more than one carrier, while 18 out of 20 peripheral airports in 2012 were operated by only a single

**Table 7**

Market shares of airlines by flights in the top and bottom 100 routes. Unit: percent.

Airline	Top 100 routes			Bottom 100 routes		
	1994	2004	2012	1994	2004	2012
CA	13.9	19.3	26.4	8.4	12.1	6.3
CZ	21.5	30.0	28.2	15.9	43.3	13.7
MU	13.0	22.8	24.1	1.9	10.7	12.0
Others	51.6	27.9	21.3	73.8	33.9	68.0

Data source: Own calculation based on the timetable of all Chinese carriers.

carrier. The “Big Three” have the largest market share in the core airports but the smaller airports are mainly operated by private and locally owned airlines (Fig. 6). Over the last 18 years, the “Big Three” have increased their number of flights at the 20 core airports, up from 43.3% (1994) to 74.4% (2012). Conversely, the percentage of flights operated by private and locally owned airlines in the peripheral airports grew from 33.9% (2004) to 68.0% (2012). Specifically, the “Big Three” increased their market share in all 18 core airports, except Qingdao (slight decrease of 0.9%) and Sanya (decrease of 50.4%). Sanya is the home-base airport of Hainan Airlines, and this company dominates there. Among the core airports, the “Big Three” have adopted different strategies but all find a way to dominate the market in their base airports. Specifically, Air China has increased its flight share in 13 core airports, China Southern in 3 airports, and China Eastern in 9 airports.

## 7. Conclusions and discussion

This paper has assessed the evolution of air deregulation in China and how that has been reflected in airline competition. This has been accomplished by evaluating empirical data of flight frequency per week the market share of airports and air routes

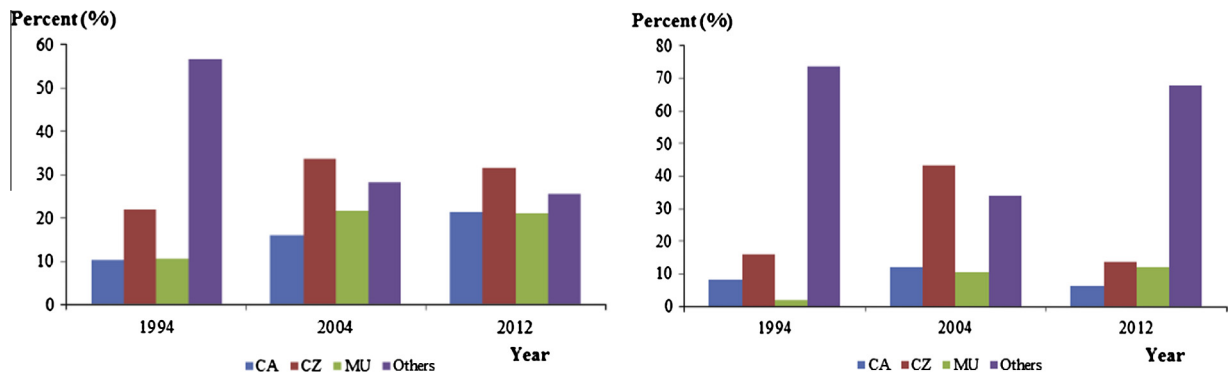


Fig. 6. Market shares of airlines in the top (left) and bottom (right) 20 cities by flight frequency. Data source: Own calculation based on the timetable of all Chinese carriers.

over an 18 years period. Following the empirical work of Shaw et al. (2009), this paper has considered competition in a spatial setting in greater depth at three points in time, and it has examined historically the effects of airline competition on market structure for each airport and air route in the domestic air market. The market competition index and the market concentration index have been used to understand the geography of change.

There are three main conclusions: First, before 2002, China had taken a state-led approach to air deregulation which differs to that followed in the EU and U.S. After 2002, a state managed free market approach has played an increasing role in the aviation industry with the objective of strengthening the “Big Three” rather than open the whole market to private and locally owned competitors. Second, the analysis of market competition index shows that airline competition has decreased during 1994–2004 and increased again between 2004 and 2012; this index reflects the number of competitors. In contrast, the market concentration index reflects market shares and it confirmed airline competition decreased between 1994 and 2012. The percentage of monopoly and duopoly airports and air routes has also decreased. In the geographic context, over two thirds of the airports, and one half of the air routes have become more competitive (1994–2012) predominantly in the airports of the eastern region (with the most prosperous air market), and less intense in the central and western regions, where competition has declined over time. Third, the “Big Three” are the most competitive airlines and they dominate the aviation market on trunk air routes and at core airports, even where many of the routes were previously operated by the private and locally owned airlines in 1994. By 2012 the thin air routes and peripheral airports are now the exclusive domain of the private and locally owned airlines. Overall, the CAAC’s role in the deregulation process has been transformed from being a “two-headed” regulator and operator to a lesser role of supervision. The deregulation process has increased the competition level among airlines. However, CAAC still controls the entry of airlines into major airports and trunk air routes, and it aims to maintain the strength of the “Big Three” to provide capacity for international competition, while encouraging smaller airlines to operate on the more peripheral routes, where levels of demand are likely to take much longer to be established. The picture of growth and spatial change given in this paper on the domestic airline industry in China is only part of the story, as there is also the international aviation industry that has developed in parallel, and the two are integrally connected. In addition the paper did not discuss the competition of airlines in the same airline group, which may compete with each other aggressively in the Chinese aviation market.

The air deregulation process is still under development, and the next set of decisions may involve policy attitudes to low cost carriers. This issue will involve fundamental questions about the future, whether a much more liberal approach to the market and

competition should be adopted, or whether the more centralized state capitalist approach currently used in China can be seen as a permanent and stable structure within which to organize such a dynamic sector of transport.

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