

# **The Effects of China's Airline Mergers on Prices**

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Abstract:

After the 2002 airline mergers in China, no significant airfare increases were found to have occurred in a sample of markets served by China Eastern and China Southern. In most of the markets that were directly affected by the mergers, airfares in fact declined. This is somewhat surprising, especially given the absence of antitrust laws and enforcement over the period subsequent to the mergers. Our results, however, do show that market power was possibly exercised after the mergers in China Eastern's hub-to-hub markets.

Keywords: Airline mergers, market power, China

## 1. Introduction

On 11 October 2002 China's nine airlines merged into three airline groups: the Air China Group, the China Eastern Group and the China Southern Group. The Air China Group was a consolidation of Air China (based in Beijing), China Southwest Airlines (Chengdu) and CNAC.<sup>1</sup> The China Southern Group was formed from China Southern Airlines (Guangzhou), China Northern Airlines (Shenyang) and China Xinjiang Airlines (Urumqi). The China Eastern Group included China Eastern Airlines (Shanghai), China Yunnan Airlines (Kunming) and China Northwest Airlines (Xi'an).

These airline mergers have resulted in a reduction in the number of competitors, changed concentration on routes or at airports, increased multimarket contact, enhanced networks and possibly improved service quality, and induced new competitive strategies. Potential market power and potential efficiency gains have been associated with these changes. Airfare variations reflect one or more of these changes, but it is not easy to identify to what extent each of these changes has contributed to airfare changes because of the difficulty in measuring these changes and quantifying their effects. In the absence of other significant events that could have affected the airlines' pricing, we can assume with some confidence that airfare changes observed after the end of 2002 were most likely due to changes arising from the 2002 mergers.

Market power has been a prime concern of consumers and antitrust authorities. Several case studies have focused on mergers in the US airline industry following the merger waves of the 1980s, including GAO (1988), Borenstein (1990), Werden et al. (1991), and Kim and

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<sup>1</sup> CNAC: China National Aviation Corporation, owned by CAAC and based in Hong Kong (but not directly providing air services to and from Hong Kong), was a major shareholder of Dragon Air and Air Macau, and through a small subsidiary, Zhejiang Airlines, provided services to and from Zhejiang province.

Singal (1993). The absence of airline mergers during the 1990s has resulted in few new empirical studies, even after the wave of airline mergers in the late part of the decade.

Many articles concerning China's airline mergers have appeared in newspaper and airline industry magazines. No published study has as yet systematically investigated the effects and policy implications of these mergers. These mergers have conferred on China's big three airlines a joint dominant status in domestic Chinese markets. There was no clear-cut antitrust law and no effective antitrust authority during the period of the mergers. Given that China's airline industry has a long tradition of engaging in price fixing, and the difficulty of achieving efficiencies in the short run, it could have been predicted that the airlines would likely continue this practice after the mergers. A study of these issues should inform the development of an effective competition policy in China with respect to airline markets.

This paper will examine changes in the airfares charged by China Eastern and China Southern after 2002 in a sample of their markets. Whenever possible we will seek to infer whether market power has been exercised and/or whether efficiency gains were realised in these markets. Market power may exist not only in the markets that are directly affected by the mergers, but also in markets that do not experience any obvious effects from the mergers. For example, the enhanced dominant status of a carrier at an airport resulting from a merger may influence airfares in all of the markets out of this airport, including any "unaffected" routes. It is therefore suggested that merger effects studies should look at both the "affected" markets and the "unaffected" markets.

In this paper, the effects of the Chinese airline mergers on airfares will be examined by considering the following questions:<sup>2</sup>

*1. How have fares changed on average in the sample markets following the mergers?*

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<sup>2</sup> As will be discussed later, only China Eastern's and China Southern's airfare data were available for this study.

2. *How have fares changed on hub-to-hub markets within an airline group?*
3. *How have fares changed out of the airline groups' major hubs ( Shanghai and Guangzhou)?*
4. *How have fares changed in market groups with different market structures?*

Section Two will briefly describe the history of China Eastern and China Southern. Section Three will present the data and some key variables associated with the mergers. Section Four will discuss the methodology used to answer our questions of interest, and Section Five will answer these questions. Section Six will conclude.

## **2. Profiles of China Eastern Airlines and China Southern Airlines**

### **2.1. China Eastern Airlines**

China Eastern Airlines was one of the six trunk airlines that separated from the former CAAC Shanghai Bureau in June 1988. Shanghai International Airport Company was established at the same time by hiving off the airport management function from CAAC's Shanghai Bureau. China Eastern Airlines headquarters are at Shanghai Hongqiao International Airport. It was publicly listed in Hong Kong, New York and Shanghai in 1997.

After the acquisition of China General Aviation Corporation, China Great Wall Airlines and Wuhan Airlines in the late 1990s and early 2000s, China Eastern's base areas covered the East China provinces, including Shandong, Jiangxi, Anhui, Zhejiang, Jiangsu, and Shanghai Municipality, the two northern provinces of Shanxi and Hebei, and the central province of Hubei. China Eastern Air Holding Company (hereafter, CEA Holdings or the China Eastern Group) was founded on 11 October 2002 after the acquisition of China Northwest Airlines and China Yunnan Airlines. As a result of the consolidation, in October 2002 CEA Holdings

had total assets of 47.3 billion Chinese yuan (US\$5.9 billion) with a fleet of 142 aircraft providing services on 386 routes.

CEA Holdings paid nothing for the acquisition of China Northwest and China Yunnan as they were both 100 per cent state owned. CEA Holdings represented the state in managing these state-owned assets. However, the ultimate goal of the consolidation was to incorporate the two acquired airlines into China Eastern, the publicly listed company. As China Eastern had been partly privatised, it needed to pay its parent company, CEA Holdings, for the acquisition of China Northwest's and China Yunnan's assets. This was not accomplished until mid-2005. Therefore, within CEA Holdings, the two new members remained financially independent from CEA until 30 June 2005, when China Eastern absorbed their assets and liabilities after paying 986 million Chinese yuan (US\$123.3 million) to CEA Holdings.

From March 2003, all flights of the new members within CEA Holdings adopted CEA's carrier code "MU". From the beginning of 2003 individual logos on planes were gradually phased out and replaced by CEA's logo. From 8 August 2003, all three airlines jointly adopted a new frequent flyer program called "Eastern Miles".

## **2.2. China Southern Airlines**

Similar to the birth of China Eastern Airlines, China Southern Airlines was separated from CAAC Guangzhou Bureau and declared independent on 26 January 1991. Also in 1997, only several months after the public listing of China Eastern, China Southern Airlines Co. Ltd succeeded in listing its shares on both the New York and Hong Kong stock exchanges. Its shares have also traded on the Shanghai Stock Exchange since 2003. Before the consolidation with China Xinjiang and China North, China Southern operated from 11 base cities in south and central China, namely, Guangzhou, Wuhan, Zhengzhou, Changsha, Shenzhen, Zhuhai,

Xiamen, Guiyang, Guilin, Haikou and Shantou. Most are provincial capitals or business centres in their provinces.

China Southern Air Holding Company (hereafter CSA Holdings or China Southern Group) was founded on the same day as CEA Holdings when it announced the acquisition of China North and China Xinjiang Airlines. As a result of the consolidation, in October 2002 China Southern Group had total assets of 50.1 billion Chinese yuan (US\$6.3 billion) with a fleet of 186 aircraft providing services on 666 routes.

Members of CSA Holdings unified their carrier code on 1 January 2003 on all their domestic flights, two months after the consolidation. China Southern's code "CZ" also applied on all the members' international flights from 30 March 2003. The new members' logos were removed and replaced by China Southern's logo since early 2003. Their ticketing offices and airport staff across the country gradually merged from the second half of 2003.

At a meeting on 12 December 2004 the shareholders decided that publicly-listed China Southern should purchase the aviation-related assets and liabilities of China Southern North Company and China Southern Xinjiang Company. This was completed in 2005, which marked the full integration of the airlines.

### **3. Data**

#### **3.1. Airfare data**

The airfare data sets for this study come from China Southern and China Eastern. The raw data include the number of passengers carried by each of the two airlines, and the average airfares (monthly revenue divided by the number of passengers carried) charged by each carrier on a given route for a given month from January 2002 to December 2004. The monthly average airfare does not include airport taxes as this amount does not constitute any

part of the revenue of the airline, nor any other types of taxes. Note that the average revenue is calculated as the monthly average on a given route of a single carrier, and hence is not the average revenue for an individual flight. Many of the markets covered by the two data sets are associated with the two airlines' primary hubs—Shanghai<sup>3</sup> for China Eastern and Guangzhou for China Southern. The route-level airfares for the two airlines cover the 36-month period from January 2002 to December 2004. As China's airline mergers occurred in October 2002, the data set contains a 10-month period before the mergers and a 26-month period after the mergers, enabling us to study any anticompetitive issues that might be associated with them.

It should be noted that there are missing data for some months, either because the airlines suspended their services on some routes from time to time, or because of incomplete data collection by the airlines themselves (for example, no price information for August 2002 was available for China Eastern). If the total service interruption time length of a route, or the number of periods with missing data for the route, was more than 12 of the 36 periods that being studied, the route was dropped from our analysis.<sup>4</sup>

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<sup>3</sup> Shanghai is the only city in China with two airports: Hongqiao and Pudong. Hongqiao has been a domestic-only airport since 2000, while Pudong has accommodated both domestic and international flights since then. Passengers generally prefer to depart and arrive at Hongqiao airport, which is close to the city. In the past few years, flights to another domestic city have not consistently departed from one airport because it is largely the government's choice to decide which flights should use which airport, and this decision has changed from season to season. For convenience, we treat the two airports equally and assume that they have no influence on pricing and customers' choice. Therefore, if an airline has flights departing from both airports to the same destination, or from one city to both airports, the average fares will be computed across both airports to replace the raw information for these city-pair markets.

<sup>4</sup> It should be noted that the analysis in this study is restricted to non-stop routes. This has no serious drawbacks as, during 2002–2004, the vast majority of the passengers carried on a flight were origin and destination (O&D) passengers. Only a small number of passengers took trips with more than one stop, in part because many airports did not provide convenient transfer facilities, and in part because airlines did not have a well-designed hub-and-spoke system to increase the number of connecting passengers.

The airfare for each route is calculated as a one-way, directional airfare. After screening, we have 113 markets for China Eastern, accounting for 29 per cent of the total number of markets in which China Eastern Group members operated (computed by the authors based on the 2002 information in China Eastern's financial report). The data from China Southern consists of 76 markets, accounting for 24 per cent of China Southern Group's total markets (computed by the authors based on the 2002 information in China Southern's financial report). There are 21 identical markets in these two samples where China Eastern and China Southern were simultaneously present.

In this study the average revenue yield, or the price per kilometre, is used to examine pricing trends. The revenue yield is obtained by dividing the average airfare charged by a carrier on a given route by the route distance.

### **3.2. An overview of China Eastern (MU) and China Southern (CZ) in 2002–2004**

It would be expected that the merger activities would change the structure of the airline industry. A simple count of the average number of airlines operating on China Eastern's and China Southern's sample routes is reported in Figure 1. The average number of airlines present on each route for both airlines has fallen since the mergers. Generally, China Eastern's sample routes had more competitors than China Southern's routes, which is not surprising given that Shanghai is the biggest commercial city in China, and routes to and from Shanghai should have attracted more carriers.

The market shares of China Eastern and China Southern, as well as the Herfindahl–Hirschman Index (HHI) at the 20 busiest airports in China from 2002 to 2004, are reported in Table 1. It shows that each airline's market share at their acquired carriers' base airports and the airport HHI have increased greatly since 2003, especially at Kunming for China Eastern and at Shenyang and Urumqi for China Southern, because these airports were previously

significantly dominated by the acquired carriers. China Eastern commanded a market share of less than 40 per cent at Shanghai Airport in 2004, while China Southern accounted for about 50 per cent at Guangzhou Airport. Other airlines clearly had a relatively significant presence at both airports, and especially at Shanghai. This is consistent with the picture in Figure 1, which shows that on average more competitors are present in China Eastern's sample markets.

Figure 2 shows that the yield (revenue per kilometre) adjusted for inflation for China Eastern had been falling before the mergers.<sup>5</sup> This might have been because of the collapse of the "revenue pooling" scheme in early 2002, an overt price collusion required by CAAC mainly in 2000 and 2001, but not very strictly observed by all airlines on all routes.<sup>6</sup> Further declines for both airlines appear to have occurred subsequent to the mergers, except during the SARS period from May to July 2003. Before October 2002, when the mergers occurred, there was a large difference in their yield means, and they seemed to price independently. Average yields from the two airlines show that their pricing patterns have become similar for most of the periods since the mergers (although China Eastern enjoyed higher yields again after April 2004), even though the routes in the two samples are not identical.

As mentioned previously, there are 21 identical markets in the two airlines' samples, that is, both airlines were present in them. Figure 3 shows the average number of passengers carried by China Eastern and China Southern in these markets. On average, China Eastern had a much lower share in terms of the passengers carried per city-pair market before the mergers, and the takeover of China Yunnan and China Northwest appears to have given it the opportunity to catch up. One reason might be that China Eastern's competitiveness has been

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<sup>5</sup> The break in the line for China Eastern is because of missing data for all of its sample routes in August 2002

<sup>6</sup> Under this scheme, airlines operating on a route were required to put their sales revenue into a pool for reallocation, taking into account the seats actually offered, and passengers carried, by each airline.

strengthened through acquiring these two airlines, at least in these 21 markets. As a result, Figure 4 shows that the average load factors of the two airlines in 2003 and 2004 were almost identical. Airline sales managers have done everything possible to achieve a load level not less than a rival's, as this is a key criterion in assessing the performance of a marketing team in China's airline industry. It is our understanding that any difference of more than 10 per cent in load factors on the same route operated by any two airlines would cause an unavoidable price war to break out, because price competition is the only effective means that airlines with lower load factors can use to achieve a similar load factor to that of rival airlines.

#### **4. Airfare comparison methodology**

To attribute observed airfare changes to mergers, a relative fare is usually employed to compare the treatment group (the sample routes) with the control group (routes with similar distances that are not affected by the mergers) (see Kim and Singal 1993 and Singal 1996).<sup>7</sup> However, in China's 2002 airline consolidations, a comparable group or control group is not easy to establish because of the small number of unaffected routes. Given the sweeping consolidations involving all the major airlines that have extensive networks across China, most of the routes in our sample have seen changes in the airlines flying these routes. This has left very few comparable markets from which to construct an effective control group. Even though there are some markets where the number of competitors and the carrier presence have been the same in both the pre- and post-merger periods, it is believed that the new airline groups would be likely to follow a different pricing strategy in these markets after the mergers. Notably, according to the mutual forbearance hypothesis (Edwards 1955), the

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<sup>7</sup> Some literature uses the industry average price as a benchmark to compare the individual airline's prices (see Borenstein 1990 and Borenstein and Rose 1995). Given the important dominant status of China Eastern and China Southern, the industry average prices would be very close to their prices. Therefore, it is not appropriate to use this method in this study.

effect of the changed multimarket contacts resulting from the airline mergers could change the pricing patterns in the markets where the mergers did not occur. Therefore, it is difficult to find a group of markets to serve as a meaningful control group.

However, the use of the same subjects (here, the airline markets) without a control group to compare airfares during the periods before and after the merger is appropriate if this can be justified by strong evidence that the two-period data sets are comparable, and if we believe that fare changes in the same markets were mainly caused by merger activities (Meyer 1995).

The preliminary discussion period for China's airline mergers commenced in 2001 and ended on 11 October 2002, when the new conglomerates were formed. During this period, the would-be merging parties were still competing. Because the impact of a policy change is almost never instantaneous but requires time to be implemented, and also for reason of convenience, we will take 1 January 2003 as the date from which the actual mergers commenced and a certain degree of coordination was initiated. Before then, the merging parties are assumed to be competing with each other.<sup>8</sup>

As mentioned earlier, full integration of the assets of the merging parties into the publicly listed China Eastern and China Southern was not finalised until mid-2005. In the initial period the component airlines operated much like an airline alliance. Members in the same group may have engaged in some competition against each other after their consolidations, especially during the SARS period, as they were still financially independent and had to generate cash flow to survive. Therefore, it is appropriate to say that 2003 was a transition period in which the joint deployment of the resources began, but it was unlikely that any significant efficiency gains could have been achieved at this stage. However, with the onset

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<sup>8</sup> Although there is a time difference (two months) between the actual merging date and the assumed merger data, it is appropriate to assume that the integration process actually started from 1 January 2003, as it was on this date that the merged airlines began to use the major merging partner's carrier code.

of deeper integration, internal competition should have been eliminated in 2004 with full schedule integration. Possible economies of scale, scope and density should have begun to emerge. A three-stage comparison of the average yields can be made to find out how prices differed between the pre-merger period (2002), the mid-merger period (2003) and the close-to-full merger period (2004).

This study is a short-run analysis over three years. It is believed that most costs were kept stable, given that the fleets had been upgraded by the end of the 1990s by switching from Russian-made aircraft to Boeing and Airbus models. The only possibly significant shock to this industry might have been the rise in fuel prices from the second half of 2004, but most airlines would have suffered only from early 2005, and so this rise in oil prices should not pose a serious problem for this study. Clearly, it should be acknowledged that we cannot attribute all the fare changes observed during this period to the mergers. However, once inflation has been controlled for, it seems that the average yields in the three periods should still be comparable even without a control group.<sup>9</sup> It is most likely that a great part of the variation in fares from one period to another can be associated with the merger activities.<sup>10</sup>

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<sup>9</sup> Inflation is adjusted for by using the national monthly Consumer Price Index (CPI) that can be found at the official website of National Bureau of Statistics of China, <http://www.stats.gov.cn/tjsj/>. January 2002 is taken as the base period.

<sup>10</sup> “The Scheme of Domestic Air Fare Reform” (Scheme) promulgated in 2004 was an official move to deregulate airfares. For the first time airlines were given the right to decide the price with a range 25 per cent higher and 45 per cent lower than the benchmark price. Some people may argue that this policy change could cause a problem in assessing the effects of the mergers. However, in fact the real purpose of this Reform Scheme was to set a price floor to prohibit destructive competition, as in many markets airlines had already discounted coach fares up to 70 per cent before the Scheme was announced. After the promulgation of the Scheme, airlines still priced with little reference to the lower limit. Therefore, the announcement of this Reform Scheme had virtually no significant effects on the airlines’ pricing (see Zhang and Round 2008). When studying the merger or the market concentration effects, this policy change will not be taken into account.

Having justified the appropriate comparison method, the ANOVA technique, extending the paired t-test to more than two points in time, will be used to compare the means of the yields of the same group of markets in each of the three years. In the absence of any impact from other major events following the mergers, a significant price rise thus is likely to indicate increased market power and a significant decrease in price is likely to provide the evidence that efficiencies emerged from the mergers. However, it should be noted that efficiency would have been hard to achieve immediately after the mergers, especially in the semi-integration stage of 2003. If we see a significant fall in prices in 2003, it would not be sensible to interpret it as the result of efficiency gains. Rather, it could be possible that competition was stronger than before even with a reduction in the number of competitors, which means that the airlines could have competed with no reference to their cost, bearing the loss in some markets in the short run, especially when the newly merged firms sought to grow their market shares and establish a market presence. This is not uncommon, even in a concentrated airline market where competition is still strong. This might be particularly the case for state-owned firms that may have multiple objectives apart from the goal of profit maximization. As most major Chinese airlines were only partly privatised at the end of the last century and the beginning of this century, some of the ideologies and goals of a state-owned firm still probably existed in them to some extent. At times, the airlines' behaviour has not conformed to that of a goal of profit-maximisation.

However, after privatisation, there has likely been a shift towards the goal of pursuing maximum profits, given the pressure coming from shareholders. Therefore, we believe that the profit-maximisation assumption still holds in the long run. As a result, if we see a decrease in airfares in 2004, the close-to-full integration stage, the most likely explanation would be that the efficiency effect dominated the market power effect, and we could

conclude that the market power effect outweighed the efficiency effect if we observe a significant increase in prices in 2004.

## **5. Results and analysis**

### **5.1. How have fares changed on average in China Eastern's and China Southern's sample markets?**

The yield means adjusted for inflation for China Eastern's and China Southern's sample markets for each year are presented in Table 2. For China Eastern, the results show a drop of some 4 per cent from 2002 to 2003, and a further slight decline in 2004. The means of China Southern show a slight increase in 2003, and then a drop of a little over 3 per cent in 2004.

A one-way repeated-measures ANOVA test was conducted with the dependent variable being the yields in China Eastern's sample markets, and the factor (otherwise called the independent variable) being the time period. The result for the within-subject effects test displays a significant time effect, indicating that yields were significantly affected by the independent variable (year periods), proxies for the influences of the pre-merger period (2002), the merger-in-progress period (2003), and the close-to-full merger period (2004).<sup>11</sup>

Results of pairwise comparisons (not reported here) suggest that for China Eastern, the mean yield for 2002 was significantly different from those for 2003 and 2004, while the difference between 2003 and 2004 was not significant. Although we do not know what the competitive price is, it seems that China Eastern earned a relatively high return in its markets

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<sup>11</sup> When repeated ANOVA measures are used, the assumption that observations are independent is frequently violated. For example, airfares in a given airline market in different time periods are likely to be correlated. Therefore, an additional assumption called sphericity is introduced. SPSS will automatically conduct the test for this assumption—Mauchly's test. SPSS can generate corrections such as Huynh–Feldt (1976) correction for the violation of sphericity (see Field 2005).

in 2002, and that competitive pressure from Air China and China Southern pulled down its average airfare in 2003 and 2004.

For China Southern, the test of within-subject effects implies a significant variation of yields during the three years. The pairwise comparisons indicate that the yield means in 2002 and 2003 were not significantly different, while the decrease from 2003 to 2004 was statistically significant at the 1 per cent level.

It is evident from these comparisons that neither airline seriously abused any market power they might have developed following the mergers. Although we do not have any evidence to claim that efficiency gains were achieved across the board following the mergers, and that these led to the decrease in prices, these results clearly show that the outcomes from the mergers (which occurred without any antitrust monitoring) have not been realised at the expense of reducing consumer welfare in general, at least over this period, in terms of the airfares charged. However, this is an observation that applies only across the whole sample of markets. It is possible that market power could have been exerted in individual markets. We turn now to examine some of them.

## **5.2. How have fares changed on hub-to-hub markets within an airline group?**

We define a hub airport of an airline group as an airport where this group has set up a branch or a subsidiary company, deployed planes and occupied airport facilities. We refer to the airport where an airline is headquartered as its primary hub, and the rest as secondary hubs. A market linking an airline's hubs (including primary hub or secondary hub) is thus defined as a hub-to-hub market. The two airlines' hub-to-hub markets are listed in Table 3, together with their average market share each year in these markets. Markets on the same

route but in opposite direction (for example, Shanghai–Nanchang and Nanchang–Shanghai) are treated as separate markets because air pricing is directional.<sup>12</sup>

Table 4 suggests that the yield mean of China’s Eastern’s hub-to-hub markets decreased in 2003 and then rose again in 2004 to a level higher than in 2002. The one-way repeated-measures ANOVA with Huynh–Feldt correction suggests a significant time effect on the means. As merger activities and internal integration were the main factors that would have influenced airfares, the significant increase in 2004 indicates the possibility that market power was exercised by China Eastern in its hub-to-hub markets after the merger.

Table 4 shows that in China Eastern’s non-hub-to-hub markets, yield means kept falling over the period and the falls were statistically significant, in contrast to the results from the hub-to-hub markets. China Eastern presumably charged lower prices in these markets either because of efficiency gains, or because of stronger competition.

Table 4 also shows that hub-to-hub markets exhibited much higher yield means than non-hub-to-hub markets in every time period. However, in this paper, we have sought to evaluate the effects of the airline mergers based on the reasonable assumption that the mergers and the subsequent integration were the only cause that led to the changes in airfares over time, with no specific intention of considering whether the hub-to-hub markets might exhibit higher prices than non-hub-to-hub markets. The higher yields could be because of market power being exercised in the hub-to-hub markets, or may simply reflect higher demand or higher costs in these markets. It is not wise to rely on such a simple comparison between hub-to-hub

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<sup>12</sup> It should be noted that the airlines acquired by China Eastern (China Yunnan and China Northwest) were based in Kunming and Xi’an, respectively. Owing to the unavailability of data to and from these two hubs, Table 3 therefore mainly comprises the markets that had been China Eastern’s hub-to-hub markets before the mergers, and contains no hub-to-hub markets resulting from the mergers except for the Taiyuan–Kunming market. This is a shortcoming in the data.

markets and non-hub-to-hub markets without controlling for other factors that clearly made a contribution to the determination of airfare levels.

We now focus on the hub-to-hub markets of China Southern. These include markets to and from Shenyang and Urumqi, where the acquired airlines, China Northern and China Xinjiang, were based. China Southern dominated most of these markets, especially after the merger (see Table 3). Interestingly, the yield means in China Southern's hub-to-hub markets (see Table 4) continuously declined from 2002 to 2004,<sup>13</sup> although the decrease from 2002 to 2003 was not statistically significant. It is most likely that efficiency gains occurred in these markets and China Southern was willing to pass them on to consumers. In contrast, the means in the non-hub-to-hub markets were not significantly different at the 5 per cent significance level, so it can be said that the means were roughly the same during the three years.<sup>14</sup> This is in contrast to China Eastern's pricing behaviour.

### **5.3. How have fares changed in the markets departing from the airline's primary hubs?**

There is no doubt that China Eastern had substantial influence in determining the airfares before and after the mergers at its primary hub, Shanghai, through its extensive sales channels, advertisements, and the resultant local reputation that it had established in the two decades prior to the mergers. This was also true for China Southern at its primary hub, Guangzhou. Mergers may have enforced the dominant status of the airlines in their primary airports, but at the same time, the simultaneous mergers also increased the ability of the airlines to challenge each other's dominant status. So it is hard to predict the actual effects of the mergers on airfares out of these two cities. However, the ability to fix prices in these

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<sup>13</sup> As we only retain three decimal places, Table 4 does not show the slight change from 2002 to 2003 for China Southern. This is also the case for Table 6 for the markets not departing from Guangzhou from 2002 to 2003.

<sup>14</sup> When the within-subject effects are not significant at the 5 per cent level, it is not meaningful to do a pairwise comparison.

cities should have been enhanced after the mergers in these two cities due to the reduction in the number of parties with whom such agreements had to be negotiated. Although China Eastern and China Southern possessed the highest airport shares in Shanghai and Guangzhou respectively, Table 1 shows that their shares never exceeded 54 per cent. This indicates there has always been a strong presence of at least one other airline in these two airports. As a result, unilateral effects would seem to be less likely and coordinated effects seem to be more possible. In the absence of the ability to raise prices unilaterally, it could have been expected that it was in China Eastern's and China Southern's interests to keep fares as stable as possible through collusion in the markets out of Shanghai and Guangzhou respectively.

Table 5 reports China Eastern's yield means in its markets out of Shanghai. Although the mean yield fell from 2002 to 2003, it increased in 2004 to be roughly equal to that in 2002. These changes were statistically significant at the 1 per cent level. Interestingly, for its markets not flying out of Shanghai (including those flying to Shanghai), the yield means decreased steadily and significantly each year. China Eastern seems to have enjoyed the ability to keep airfares steady in markets from Shanghai, and at levels little lower than they were before the mergers occurred, but this ability appears not to have been present after the merger in its markets that did not involve departures from Shanghai. It is likely that it faced fewer constraints in pricing in its headquarters city. In fact, it was not an uncommon practice for the airlines to collude for the flights out of Shanghai in the years before and after the mergers. Our findings here reflect this fact.

For the markets for China Southern out of Guangzhou, although there was an increase in mean yields from 2002 to 2003, and a decrease from 2003 to 2004, the ANOVA test results in Table 6 indicate that these changes were not statistically significant at the 5 per cent level. This suggests that mergers and the subsequent integrations did not have an obvious impact on China Southern's fares. Its ability to charge higher prices appeared to be neither enhanced nor

weakened at Guangzhou. However, it still exercised a certain degree of influence on prices in the markets from Guangzhou by keeping prices relatively stable, as was the case in Shanghai for China Eastern. In contrast, Table 6 shows that the yield means from the markets that did not depart from Guangzhou decreased each year, the decrease from 2003 to 2004 being statistically significant, indicating that efficiency gains dominated in the close-to-full integration period. Similar to China Eastern, it shows a weaker ability for China Southern to charge higher prices after the mergers in the markets that did not depart from its primary hubbing airport.

#### **5.4. How have fares changed in markets with different market structures?**

We partitioned the sample markets of each airline into six market groups according to various structural characteristics of the markets before and after the mergers, and considered how fares changed in each group. The definition of each group and the number of markets for each category is reported in Table 7. We plot the yield means of the different market structures in all three years in Figure 5 for China Eastern and in Figure 6 for China Southern.

In Figure 5, the six lines are not parallel, indicating different trends following the merger in the different market categories. Yields in the monopoly markets (category 1) are higher than those of most other categories, except in 2004 when monopoly route yields fell substantially, one possible reason being that the threat of potential entry by other airlines had increased. As there is only one market where the merger led to monopoly, shown by the line plot as category 2, the result might not be representative and we will not discuss it further. In the markets where the China Eastern mergers occurred, but at least one other rival remained (category 3), airfares were lower in 2003 and lower again in 2004. However, the fare changes from one year to the next were not statistically significant at the 5 per cent level. China Eastern's airfare in the markets where the number of carriers remained constant (category 4)

exhibits a relatively steady pattern (the changes were not significant). This could be due to the fact that neither substantial market power nor significant efficiency gains might have been present in these circumstances, or that the two effects cancelled each other out.

For category 5, where the number of carriers was reduced from takeovers not involving China Eastern, airfares fell significantly in 2003 and then remained relatively steady in 2004. If we believe that efficiency was hard to achieve in 2003 immediately after the merger, this can only be explained by the fact that there existed market power before the merger, and stronger competition after the mergers pushed fares down. In fact, most of the major rivals in this type of market were ones that were later acquired by China Southern and Air China. China Southern or Air China were also present in their own right but on relatively small scales. After the takeovers, China Eastern faced a stronger China Southern or Air China, leading to lower fares immediately after the mergers. It is surprising that category 6 with its relatively low fares could still attract new entrants after the mergers, but this entry led to a further lowering of fares by China Eastern in 2003 (statistically significant) and again in 2004 (not significant). Possibly these markets were routes thought to be potentially profitable in the future, which the airlines sought to cultivate. In these markets, China Eastern's airfares might have been more influenced by the new entry than by the merger activities, making it difficult to assess efficiency effects, but clearly market power has been restrained in these markets.

For China Southern, Figure 6 shows that markets in category 1 were associated with slight yield rises in 2003 and 2004. Even though the change in each year was not statistically significant, this suggests that China Southern did not face any threat from potential entrants in these monopoly markets. Category 2, in which routes that were a duopoly became a monopoly, exhibited lower yields each year. Unlike the case of China Eastern, yields did not always decrease immediately after the mergers. Rather, in categories 3, 4 and 5 they rose slightly in the second year but not significantly, except for category 3, and decreased

significantly in the third year. This is consistent with our expectations that efficiencies would not be achieved until some time after the mergers. No obvious market power could be perceived in each market group over the whole period. Category 6 exhibits a pattern that is quite similar to that for China Eastern, suggesting a declining trend due to new entry.

It is worth pointing out that there were no significant fare rises in 2004 by China Eastern or China Southern compared with 2002 in market categories 2, 3 and 5, where there was a reduction in the number of competitors, and which presumably were most likely to be affected by the mergers. It should also be noticed that no significant rise in prices was observed in each period in almost all the category groups from China Eastern's sample markets. It seems that neither market power effects nor efficiency gains systematically impacted on each type of market. However, owing to the lack of a control group, we should bear in mind that we cannot rule out the possibility that other factors beyond takeover activities might have caused the fluctuations in airfares, for example, the increasing travel demand from year to year,<sup>15</sup> and the SARS epidemic in 2003.<sup>16</sup>

## **6. Conclusions**

We need to emphasise that our attention has been restricted to assessing fare changes resulting from the mergers within the same groups (types) of markets, without comparing

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<sup>15</sup> Our results for the different market groups might have been different if we had controlled for the effect of tourist routes. Prices on these routes should be looked at separately in future studies in order to make more precise inferences about the effects of market power. However, given the small number of tourist routes in our sample markets, it is unlikely that considering their effect would have changed our conclusion.

<sup>16</sup> The SARS shock in 2003 had a negative impact on demand, but it was obvious that during this period airfares were much higher than in any other periods. Almost all airlines charged full normal fares because of the low and inelastic demand resulting from the fact that all individuals and businesses cancelled their unnecessary travel, and there was no hope of increasing demand with lower prices. That is to say, without SARS, the average airfares in 2003 could have been even lower. Therefore, controlling for this variable is unlikely to change the declining tendency in prices from 2002 to 2003.

fares between different types of markets. We also acknowledge the limitation of the methodology used to compare airfares before and after the mergers without being able to control for all the other possible influential factors. However, some useful conclusions on the effects of the mergers can still be drawn using this simple methodology. Overall, it appears that the Chinese airline consolidations did not result in any apparent harm to consumers, at least for the first two years after the event. This is somewhat surprising, especially given the lack of antitrust laws and oversight at this time. We suspect that what happened was the emergence for the first time in China of three strong airline groups who each were desperate to gain market share to create strong market positions, and who needed strong loads and good cash flows to help provide a firm financial foundation for further expansion, both in China and into overseas markets.

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Table 1 Market share of China Eastern (MU) and China Southern (CZ), and HHI at China's 20 busiest airports

	Airport	MU Share (%)			CZ Share (%)			HHI		
		2002	2003	2004	2002	2003	2004	2002	2003	2004
1	Shanghai	27	36	38	12	19	16	1533	2209	2362
2	Beijing	13	17	16	13	25	20	1401	2169	2233
3	Guangzhou	11	15	13	48	54	51	2701	3351	3086
4	Shenzhen	8	12	11	30	38	33	1823	2316	2070
5	Chengdu	8	15	13	7	11	11	2302	2478	2343
6	Kunming	13	64	66	10	14	14	3623	4467	4656
7	Haikou	4	9	10	21	27	23	4093	3768	3883
8	Xi'an	10	34	33	7	11	10	2002	2690	2695
9	Hangzhou	17	19	17	12	22	22	1742	2201	1940
10	Xiamen	10	13	11	12	22	18	2913	3111	3058
11	Chongqing	6	20	21	11	16	13	1672	2020	1966
12	Qingdao	20	25	17	11	22	21	1627	2212	2454
13	Dalian	4	8	7	17	56	55	3733	3718	3801
14	Nanjing	49	54	49	7	16	19	2788	3384	3011
15	Wuhan	8	27	24	24	31	29	2431	3364	3193
16	Shenyang	3	8	9	16	62	60	3924	4134	3917
17	Urumqi	1	8	5	17	82	78	7834	6909	6269
18	Changsha	8	22	21	30	40	39	1617	2524	2429
19	Fuzhou	12	16	14	5	10	6	2930	3199	3741
20	Guilin	8	27	24	24	30	27	1510	2057	1823

Notes: 1. Calculated by the authors based on *Timetable for Chinese Air Carriers* (2002–2004),

published by CAAC Chinese Air Carrier Timetable Press every March and October. Flight frequencies of all airlines out of an airport were used to calculate airport market share and airport HHI.

2. These airports were in the top 20 list in terms of passenger traffic in 2004 (see China Civil Aviation Statistics 2005)

Table 2 Means of yields (in US\$) in 2002, 2003 and 2004 for China Eastern and China Southern

	China Eastern (MU)			China Southern (CZ)		
	Mean	Std. Deviation	N	Mean	Std. Deviation	N
Yield mean in 2002	.102	.036	916	.091	.022	769
Yield mean in 2003	.098	.037	916	.092	.026	769
Yield mean in 2004	.097	.041	916	.089	.230	769
Mauchly's test of sphericity	$\chi^2(2) = 59.56^{***}$			$\chi^2(2) = 34.04^{***}$		
Test of within-subjects effects	F(1.89, 1724.83) = 41.21***			F(1.92, 1475.70) = 6.6***		

\*\*Significant at the 5% level. \*\*\*Significant at the 1% level.

Table 3 Hub-to-hub markets for China Eastern and China Southern

Market		Market share (%)		
		2002	2003	2004
China Eastern	Shanghai–Nanchang/Nanchang–Shanghai	57	44	54
	Shanghai–Taiyuan/Taiyuan–Shanghai	67	49	50
	Shanghai–Wuhan/Wuhan–Shanghai	18	39	47
	Taiyuan–Kunming	67	66	93
	Shanghai–Hefei/Hefei–Shanghai	71	71	79
	Shanghai–Ningbo/Ningbo–Shanghai	48	64	89
	Shanghai–Jinan/Jinan–Shanghai	53	42	40
	Qingdao–Ningbo	28	27	18
China Southern	Guangzhou–Changsha/Guangzhou– Changsha	100	100	100
	Guangzhou–Guiyang/Guiyang–Guangzhou	63	56	55
	Guangzhou–Haikou/Haikou–Guangzhou	48	53	56
	Guangzhou–Nanning/Nanning–Guangzhou	100	100	87
	Guangzhou–Shenyang/Shenyang– Guangzhou	63	100	100
	Guangzhou–Urumqi/Urumqi–Guangzhou	31	100	100
	Guangzhou–Wuhan/Wuhan–Guangzhou	70	59	54
	Guangzhou–Xiamen/Xiamen–Guangzhou	38	38	44

Source: Market shares were calculated by the authors based on *Timetable for Chinese Air Carriers* (2002–2004). The total seat numbers provided by each carrier in each period were used to construct route market shares.

Table 4 Mean yields (in US\$) in China Eastern and China Southern's hub-to-hub and non-hub-to-hub markets

		Hub-to-hub markets			Non-hub-to-hub markets		
		Mean	Std. Deviation	N	Mean	Std. Deviation	N
China Eastern	Yield mean in 2002	0.136	0.062	119	0.097	0.027	797
	Yield mean in 2003	0.132	0.066	119	0.093	0.027	797
	Yield mean in 2004	0.139	0.077	119	0.091	0.027	797
	Mauchly's test of sphericity	$\chi^2(2) = 19.51^{***}$			$\chi^2(2) = 41.47^{***}$		
	Test of within-subjects effects	F(1.76, 207.4) = 7.67 <sup>***</sup>			F(1.91, 1518.53) = 60.98 <sup>***</sup>		
China Southern	Yield mean in 2002	0.097	0.022	174	0.089	0.021	595
	Yield mean in 2003	0.097	0.026	174	0.090	0.026	595
	Yield mean in 2004	0.092	0.025	174	0.088	0.031	595
	Mauchly's test of sphericity	$\chi^2(2) = 10.77^{***}$			$\chi^2(2) = 29.66^{***}$		
	Test of within-subjects effects	F(1.91, 329.68) = 20.68 <sup>***</sup>			F(1.91, 1136.30) = 2.56		

\*\*Significant at the 5% level. \*\*\*Significant at the 1% level.

Table 5 Mean yields (in US\$) in MU's markets departing and not departing from Shanghai

	Markets departing from Shanghai			Markets not departing from Shanghai		
	Mean	Std. Deviation	N	Mean	Std. Deviation	N
Yield mean in 2002	0.107	0.042	299	0.100	0.033	606
Yield mean in 2003	0.101	0.043	299	0.096	0.034	606
Yield mean in 2004	0.105	0.048	299	0.093	0.036	606
Mauchly's test of sphericity	$\chi^2 (2) = 87.50^{***}$			$\chi^2 (2) = 16.19^{***}$		
Test of within-subjects effects	F (1.60, 476.97) = 11^{***}			F (1.96, 1182.57) = 58.58^{***}		

\*\*Significant at the 5% level. \*\*\*Significant at the 1% level.

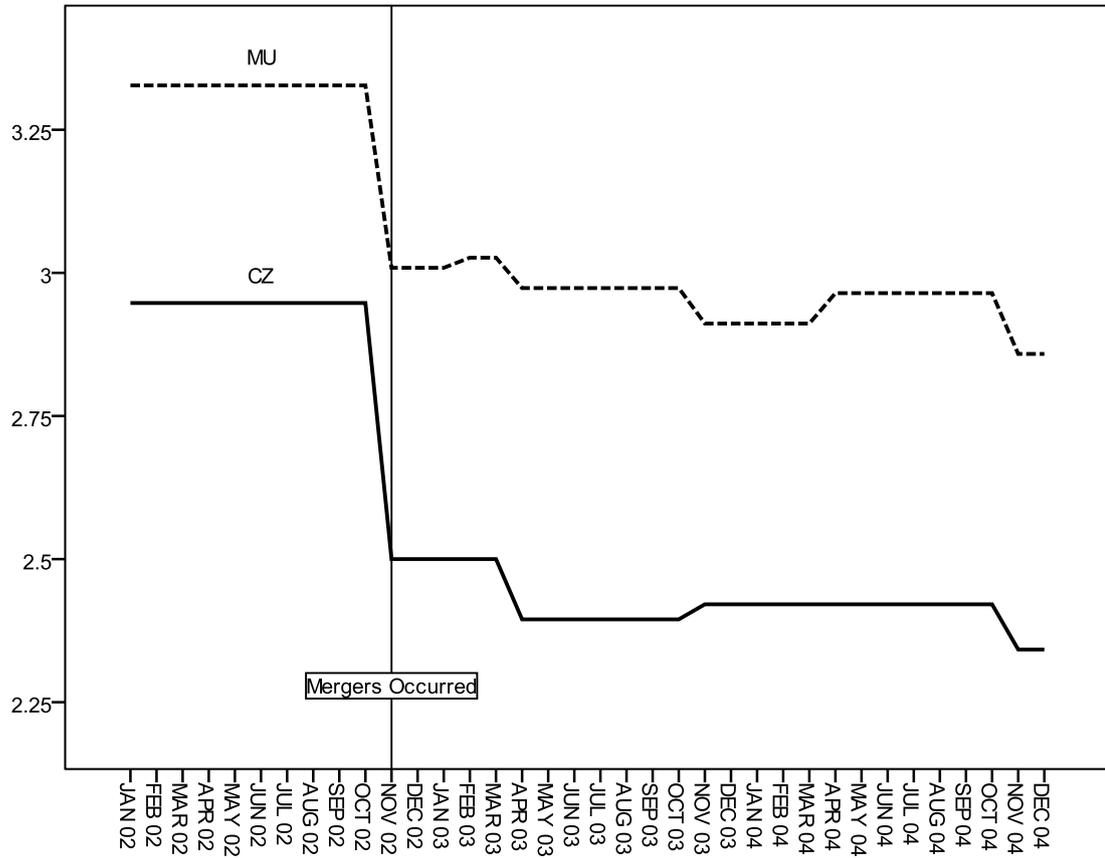
Table 6 Mean yields (in US\$) in CZ's markets departing and not departing from Guangzhou

	Markets departing from Guangzhou			Markets not departing from Guangzhou		
	Mean	Std. Deviation	N	Mean	Std. Deviation	N
Yield mean in 2002	.091	.019	318	0.090	0.023	451
Yield mean in 2003	.094	.028	318	0.090	0.024	451
Yield mean in 2004	.091	.037	318	0.088	0.024	451
Mauchly's test of sphericity	$\chi^2 (2) = 46.91^{***}$			$\chi^2 (2) = 16.19^{***}$		
Test of within-subjects effects	F (1.76, 560.00) = 3.09			F (1.96, 1182.57) = 58.58^{***}		

\*\*Significant at the 5% level. \*\*\*Significant at the 1% level.

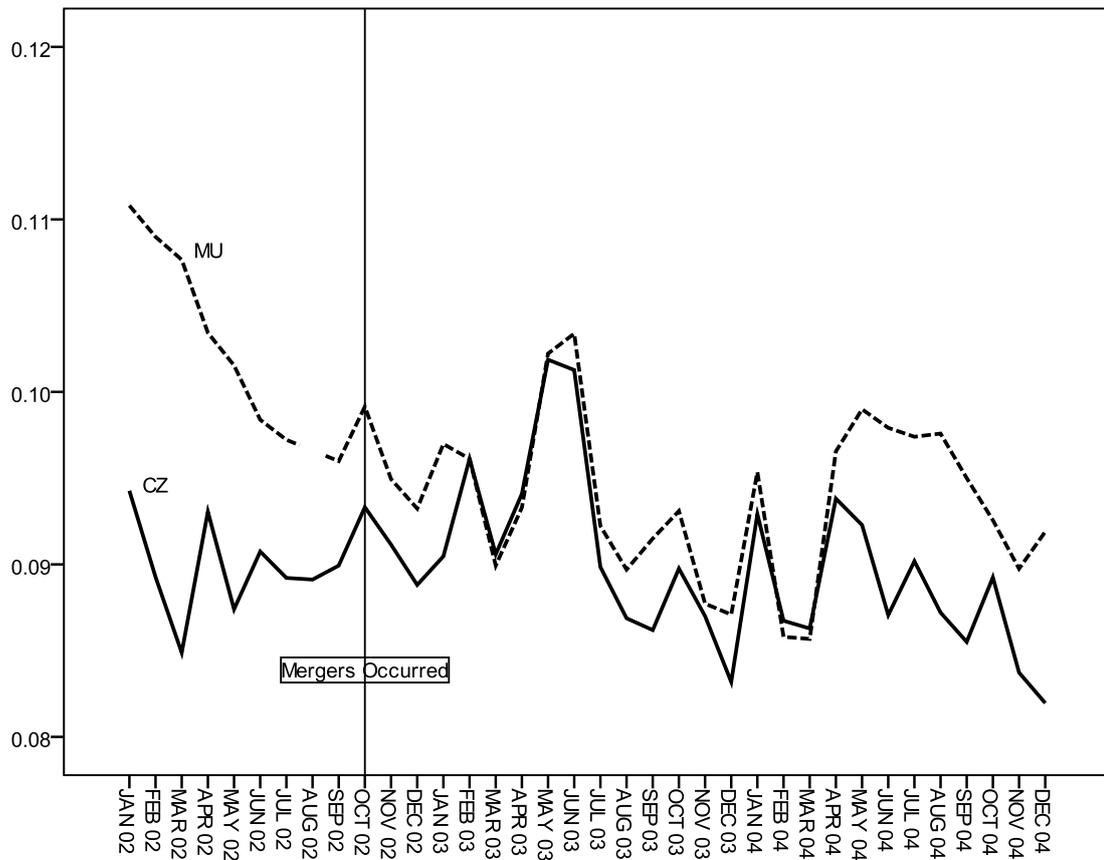
Table 7 Number of markets in each market category

Category	Definition	China Eastern	China Southern
1	Monopoly market throughout the pre- and post-merger period	7	16
2	Airline mergers resulted in monopoly	1	4
3	The elimination of the acquired airline(s) resulted in fewer airlines, but still at least two competitors remained in the market	5	16
4	There was no reduction in the number of airlines in the market after the mergers	38	18
5	The number of competitors was reduced after the mergers because one or more competitors of MU/CZ was taken over by other airlines	42	10
6	The number of airlines increased after the mergers as a result of new entry	20	12

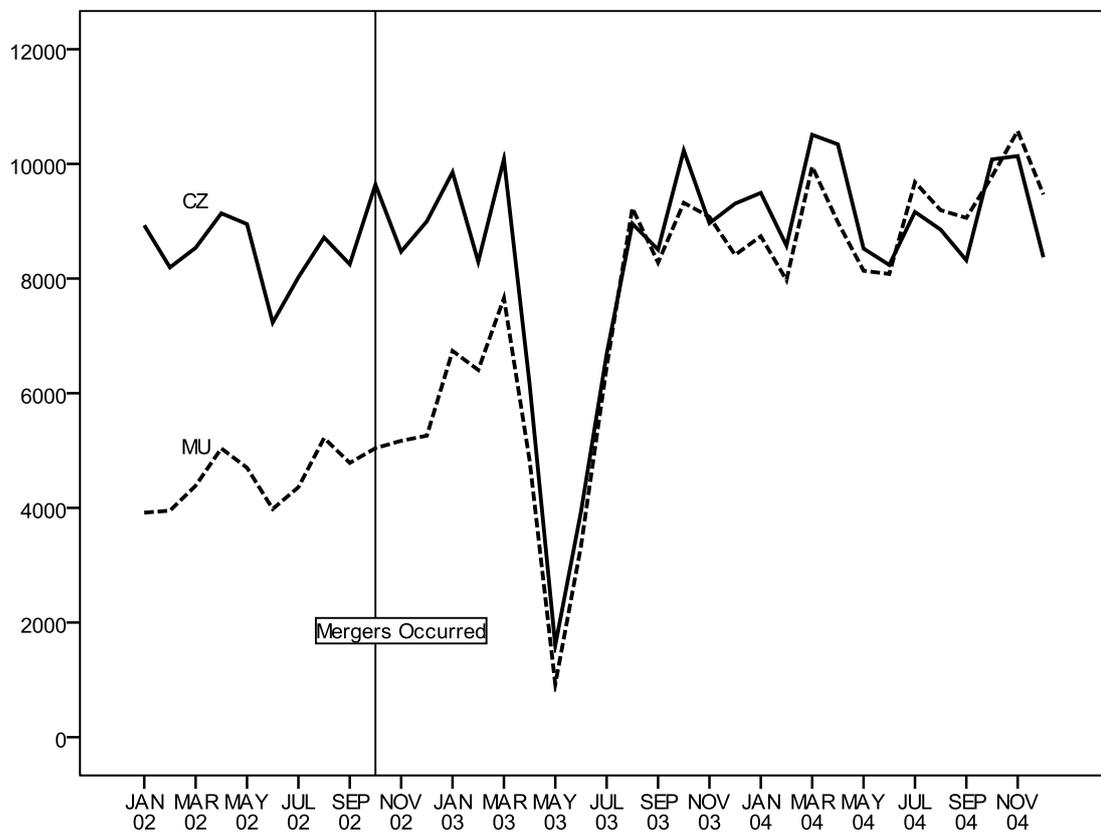


Source: *Timetable for Chinese Air Carriers (2002–2004)*.

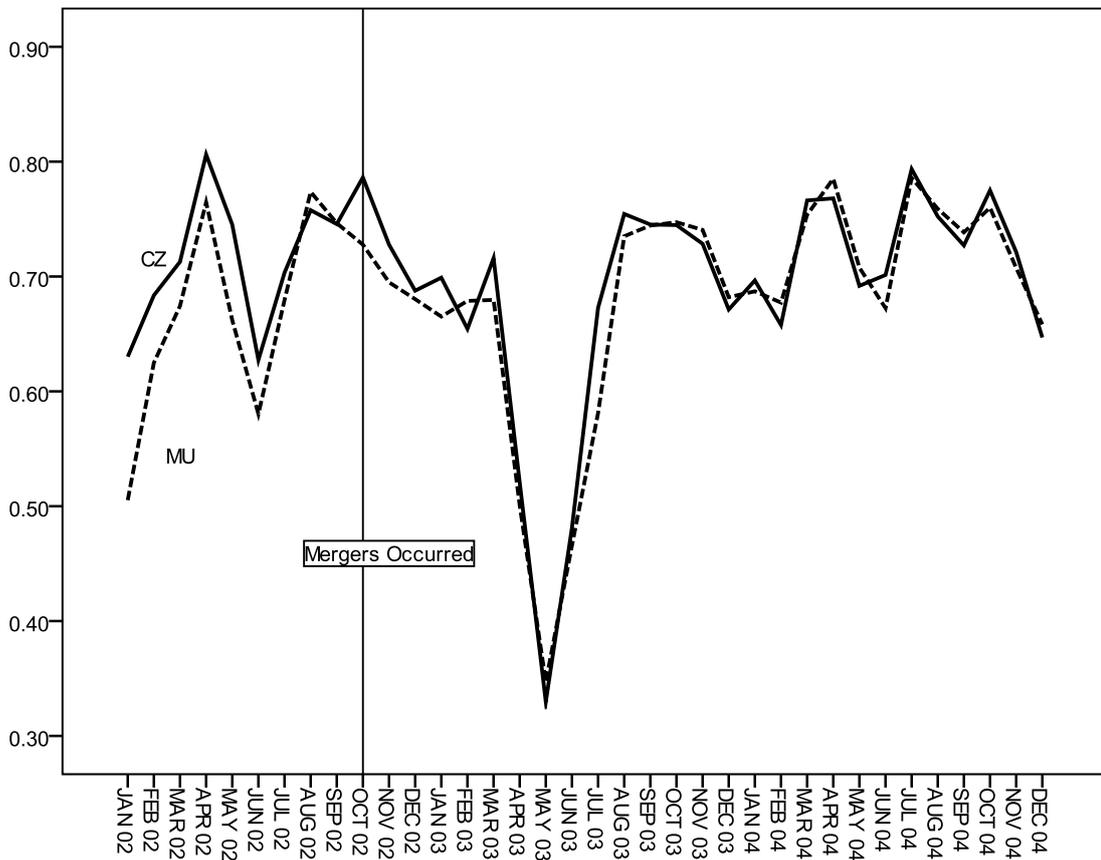
Figure 1 Average number of carriers in the sample markets



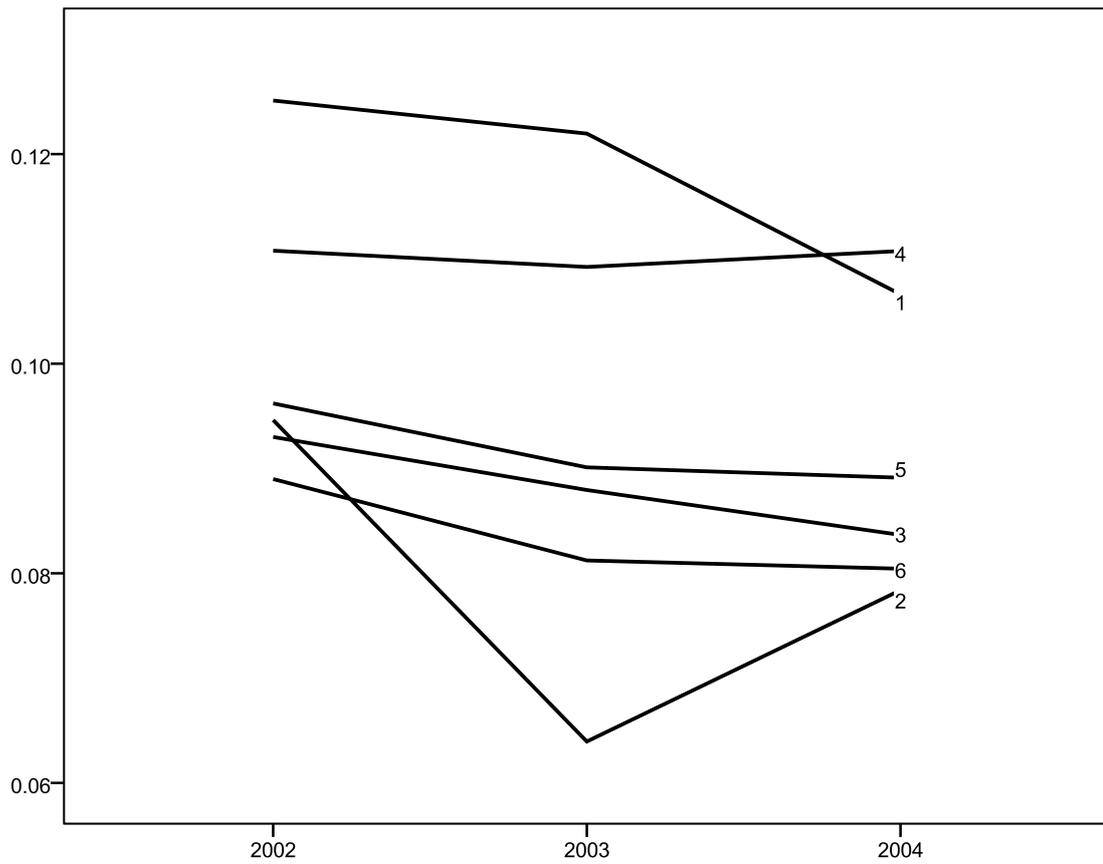
Source: China Eastern and China Southern  
 Figure 2 Yield means (CPI adjusted) in sample markets (in US\$)



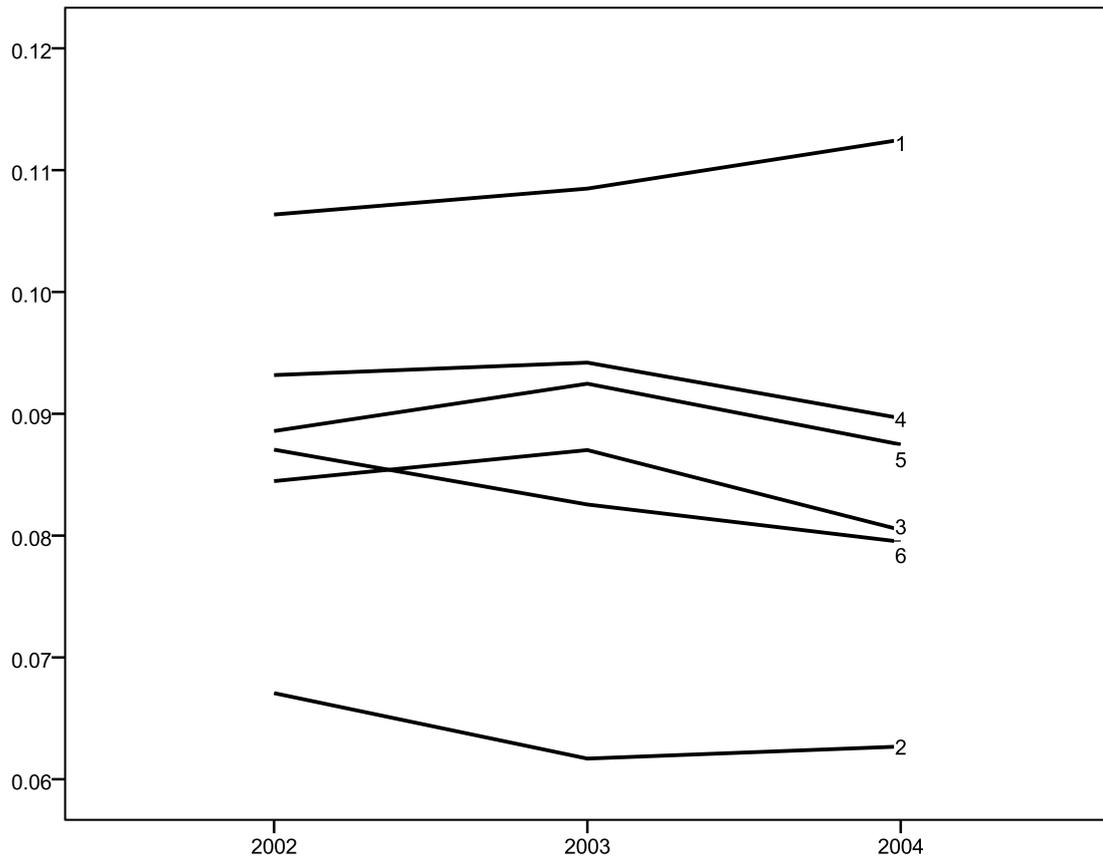
Source: China Eastern and China Southern  
 Figure 3 Average number of passengers carried per market in the 21 identical markets



Source: China Eastern and China Southern  
 Figure 4 Average load factors in the 21 identical markets



Source: China Eastern and China Southern  
 Figure 5 Yield means (in US\$) in different market categories (MU)



Source: China Eastern and China Southern  
 Figure 6 Yield means (in US\$) in different market categories (CZ)