Policy Implications of the Effect of Multimarket Contact on Airfares in China's Civil Aviation Market.

By Yidan Chai

(6769892)

Major paper presented to the Department of Economics of the University of Ottawa in partial fulfillment of the requirements of the M.A. Degree

Supervisor: Professor Yongjing Zhang

ECO6999

August 2014

Ottawa, Ontario

Abstract

China’s civil aviation has experienced tremendous growth since the deregulation in 1978. Especially after the merger in 2002 and 2004, the multimarket contact among airlines increased. The paper examines the effects of multimarket contact under the conditions of asymmetric territorial interests on airfares during the period 2nd June – 22nd June 2014 in China’s civil aviation. The results show that the multimarket contact has limited effect on airfare. However, the government regulatory polices have more significant effect on airfares. Although Chinese government has deregulated the civil aviation industry in the past three decades, it has been careful to limit the pace and scope of deregulation so that ultimate control of the industry remains firmly with the state. Under this condition, the pricing behavior of airlines has been partially weakened and thus the effect of multimarket contact is not significant enough in China’s civil aviation. The analysis results reveal that civil aviation market in China is still away from completely free market.

Keywords: Civil Aviation, Multimarket contact

Contents

1. Introduction

Civil aviation industry nowadays is in a totally different story compared to what it was a few decades ago. In 1978, the U.S. Congress issued the Airline Deregulation Act (ADA), which signified the start of the transformation of civil aviation. It started transforming the U.S. civil aviation into a freely competitive environment driven by market forces. Soon after, many other counties followed and started their own deregulations (e.g., Button, 1991; Kasper, 1988; Williams, 1994).

In 1978, China started the deregulation in the civil aviation. Since then, many important changes have been experienced by the civil aviation in China due to economic reforms, which include the number of competitors, market concentration, networks, services quality and market strategies. In October 2002, nine airlines were consolidated into three state-owned airlines groups, and in 2004 four regional airlines merged into the fourth dominant airline group. One obvious characteristic of China’s civil aviation after the mergers is the largely increased degree of multimarket contact among the four airlines groups. With the impact of enhanced multimarket contact, airfares went up. A similar merger occurred in the U.S. civil aviation in 1985, which increased the multimarket contact among firms and further significantly affected airfares (Signal, 1996). However, not similar to other developed countries, such as US, Japan which have antitrust authorities to examine the impacts of merger, the consolidation in China in 2002 happened without antitrust supervision. Therefore, the resultant impact of increased multimarket contact on airfares cannot be assessed. The paper will investigate the outcomes of multimarket contact among China’s airlines.

There are two objectives of this paper. First, the development of the civil aviation in China since the country was founded in 1949 will be reviewed. Then the effect of multimarket contact and deregulatory policy on airfares in China’s civil aviation will be analyzed through the regression model with controlled related variables.

This paper consists of 6 sections. Section 2 outlines the development of China's civil aviation. Section 3 shows the definition and effect of multimarket contact and a related literature review. Section 4 is a core discussion of the data and models, of variables to be constructed and of the descriptive statistics. Section 5 presents the analysis on results of each model respectively. The last section is a conclusion that summarizes the findings of this study.

2. Development of China's Civil Aviation

China's civil aviation has experienced four development stages since 1949. The first stage is from 1949 to 1978, when China's civil aviation was under full regulations in all aspects like entry and exit barriers, airfares, routes and schedules. At this stage, the Civil Aviation Administration of China (CAAC) was strictly managed by the People's Liberation Army (PLA) Air Force. The CAAC not only administered and regulated the civil aviation, but also served as the direct operator of airports and airlines. Managed by the CAAC, six regional civil aviation bureaus were located in six main cities[1]. Moreover, "23 provincial bureaus and 78 local civil aviation stations" (Shih-Lung Shaw, 2009 p 294) were established. It can be seen that there exist no competition in aviation market so that the market was a monopoly market whose efficiency was quite low. During this stage, the customers were mainly working for government or government facilities (Zhang, 1998). Consequently, the civil aviation industry suffered continuous financial losses in this stage. For example, only from 1968 to 1974, the total loss was 360 million yuan (Shen, 1992).

The second stage started from 1978, when the economic reforms was launched and ended in 1987. During this period, the civil aviation of China had been transformed from a state-run sector to a profit-seeking industry. First, in 1980 the CAAC was removed from the Air Force and one year after that an incentive policy was introduced by the government. As a result, the CAAC was accountable for any losses suffered itself and was able to keep a portion of the incomes (Shih-Lung Shaw, 2009). However, the CAAC

[1] The six cities are Beijing, Shanghai, Guangzhou, Chengdu, Lanzhou (moved to Xi'an later on), and Shenyang.

still served as an authority that both managed the civil aviation and operated the airports, airlines, and other air transport services.

From 1984, the government began to relax the regulations on civil aviation. The next year, airlines financed by local governments and citizen sectors began to enter civil aviation market (Shih-Lung Shaw, 2009). This stage is featured as the initial deregulation of China's civil aviation, though far from reaching a totally liberalized environment.

The third stage started in 1987 with a policy launched by the State Council which removed the operational role of the CAAC. After the separation, the CAAC is only an administrative agency. The operation of airports was transferred from the CAAC to local authorities so that they were responsible for their own operational losses or profits. In addition, six state-owned airlines[2] were established from 1987 to 1991 (Shih-Lung Shaw, 2009), who can make decisions on operating problems such as flight schedule and staff employment (Zhang, 1998). From mid-1980, the CAAC deregulated the entry barriers on market and route, which was another vital change in China's civil aviation (Zhang and Round, 2008). Many new airlines supported by local governments or government facilities stepped into the market during the period of 1980s–1990s. For instance, Shanghai Airlines, which is owned by the local government, started operations in 1985; Hainan Airlines was originally founded as Hainan Province Airlines and began their service in 1989. By the end of 1993, there were 24 airlines in China serving in 476 domestic routes (Chinese Airline Industry Developed Statistical Bulletin, 1994). However, the new entrants were not large enough to obtain the economies of scale, so they could only make limited profit and some even ended with bankruptcies (Shih-Lung Shaw, 2009). This situation is similar to that in the US after the Airline Deregulation Act (ADA) was passed in 1978. From 1983 to 1988, quantities of U.S. airlines were stuck in fiscal difficulties and many cases like consolidations, acquisitions and even bankruptcies happened in the U.S. civil aviation market (Goetz and Sutton, 1998). Then the Chinese government launched a policy to exam the qualification of the new entrants and stopped the approval

[2] Six state- owned airlines: Air China, China Southern Airlines, China Eastern Airlines, China Northwest Airlines, China Northern Airlines and China Southwest Airlines,

of new carrier applications to avoid the financial crisis caused by competition among the airlines (Zhang and Chen, 2003). However, the new policy may lead to the airline consolidation.

In 1997, the "one airfare with a variety of discounts" policy was launched by the CAAC, symbolizing the beginning of multistage airfare system. However, this gave rise to severe price wars among the airlines. As a result, a total loss of 2.1billion yuan was suffered in 1998. In 1999, the CAAC announced that airlines could not set up airfares on their own discount. Nevertheless, the new pricing policy was still unsuccessful to produce a fair, competitive environment driven by market power (Wang, 2005). In conclusion, the third stage carried out lots of important policies to civil aviation that made it step forward to a competitive market.

The fourth stage began in 2002 with the airlines mergers announced by the CAAC. After the mergers, China's nine airlines were consolidated into three airline groups: the China Southern Group, the China Eastern Group and the Air China Group. Among the three groups, the China Southern Group included China Southern Airlines, China Xinjiang Airlines and China Northern Airlines. The China Eastern Group was a consolidation of China Airlines, Northwest Airlines, Air Great Wall and China Yunnan Airlines. The Air China Group was formed from China National Aviation Corporation, Air China, and China Southwest Airlines (Yahua Zhang & David, 2009). In 2004, Hainan Airlines, the leading airline of regional airlines, merged with some other small regional airlines, such as Xinhua Airlines, Shanxi Airlines and Chang'an Airlines, and became the fourth airline group (Anming Zhang, 1998). From then on, the "Big Four"– Air China, Hainan Airlines, China Eastern, and China Southern– have clearly dominated the civil aviation in China. After the consolidation, market concentration and multimarket contact were increased and the number of competitors was decreased, which is easy to result in price collusion. "The Civil Aviation Fare Reform Program", launched by the Civil Aviation Administration of China and the National Development and Reform (NDRC) jointly in 2004, provided that airlines which operate domestic scheduled flights can set the unit price (per passenger kilometer) in the range of 55%-125% of the base price (0.75

CNY per passenger kilometer). Furthermore, the Civil Aviation Administration of China set up the government guided price for most routes and announced different pricing regulations on some special domestic routes. These domestic routes can be divided into three categories: i) the domestic tourism routes without price lower limit; ii) the domestic routes with market-regulated price; iii) the domestic exclusive routes without price lower limit. In 2005, the CAAC issued <the Provisions on the Business Licensing for Public Air Transportation Enterprises>, which further deregulated the market entry. Until the end of 2006, the number of new entrants is 13 (Chinese Civil Aviation Statistical Yearbook, 2007). By the end of 2012, there were 36 airlines in China serving in 1,136 domestic routes (Chinese Airline Industry Developed Statistical Bulletin, 2013).

3. Multimarket Contact

When building econometric models of pricing behavior, it is assumed that the firms maximize profits separately in different markets considering their opponents' reaction functions in that market. Even in the models where a firm maximizes profits over many markets at a time, it is usually assumed that the opponents' reaction functions are not related among those markets. This assumption of independence may make sense when a firm competes with different opponents in different markets. However, the assumption becomes invalid if the same firms face each other over multiple markets (Signal, 1996). Similar to the subject firm, its opponents will also maximize their profits in many markets. Hence, the opponents' reaction functions in these markets should be related, rather than independent.

From the mid to late 20th century, multinational firms have gradually dominated the world market. They compete with each other in product markets and geographical markets. For example, Procter & Gamble Company and Unilever Company compete not only in the Asian market, but also in the European market. McDonald's and KFC compete at almost every corner in the world. The similar situation also exists in other industries, such as banking, civil aviation, hospitality, telecommunications, electric power industries, etc. Therefore, multimarket contact that describes such competition among multinational firms gradually formed.

3.1 The Definition of Multimarket Contact

Kahn (1950) and Edwards (1955) first proposed the definition of multimarket contact, which defined that when firms compete with each other over multiple markets, the competition becomes less aggressive since they are interdependent. Multimarket contact expands the scope of competition by giving firms the chances to compete against each other and to depress their opponents' motivation of aggressive act in one market with the possibility of revenge in all the markets where they compete simultaneously (Kang et al., 2010). Moreover, since firms compete in multiple markets, they are more familiar with each other and more conscious of the interdependence among them (Jayachandran et al., 1999). Therefore, firms become more equipped to retaliate their opponents and a phenomenon known as "mutual forbearance" comes into being as firms with multimarket contacts avoid fierce competition (Baum & Korn, 1996; Gimeno & Woo, 1996). That is to say, firms are unlikely to act vigorously because of the possible effective revenge by their opponents in multiple markets (Yu et al., 2009). The "mutual forbearance" has significant effect on the competition of firms and how the "mutual forbearance" works among firms will be introduced.

3.2 The "Mutual Forbearance" Hypothesis

The mutual forbearance hypothesis (Edward, 1955; Feinberg, 1984; Bernheim and Whinston, 1990) states that when firms meet each other in multiple markets, they compete less aggressively. Multimarket contact provides a firm the opportunity to respond to a provocation by an opponent not only in the attacked market, but also in other markets where they meet. As the opponent identifies the possible cross-market retaliation and has expectations of the retaliation (Amit, et al., 1988; Feinberg, 1984; Scherer & Ross, 1990), the threat of retaliation will affect the opponents when they make decisions and reduce the motivation of hostile act (Chen, 1996). “Since the retaliatory power is reciprocal, the forbearance is mutual” (Gemino 1999, page 103). Thus, it can be concluded that the mutual forbearance hypothesis emphases mutual multimarket deterrence (Barnett, 1993) due to expectations of multimarket retaliation. In this way, the competition among firms will be decreased and the salient features of the mutual forbearance hypothesis make airlines maintain relatively higher prices simultaneously.

3.2.1 The Diagram of “Mutual Forbearance”

Firms within “a market may assign different strategic importance to their position in that market, leading to a situation of asymmetric territorial interests” (Gimeno 1999, page 103). The two cases where multimarket contact can lead to “mutual forbearance” are summarized with simple figures characterized by asymmetric territorial interests since opponents in the same market occupy a different level of interest. In these figures, different sizes of boxes represent different interests of firm in market. The firm with more market interests is called “leader” while firm with less market interests is called “challenger”.

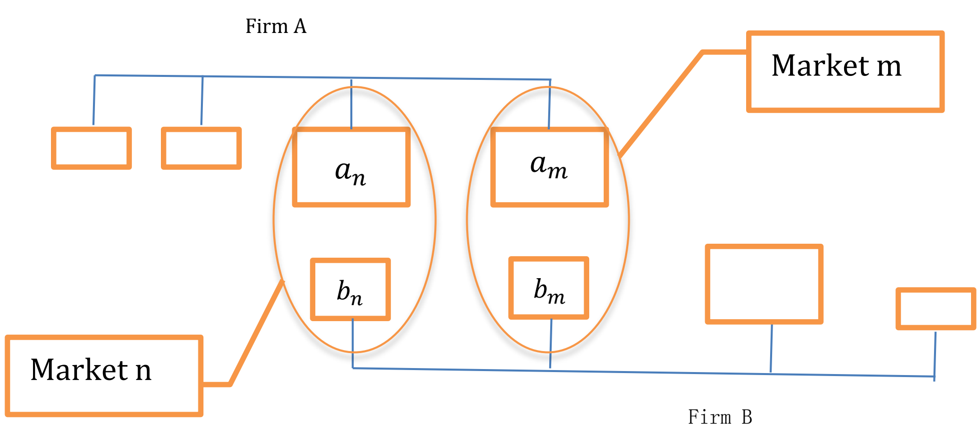

Figure 1. Multimarket contact with asymmetric and nonreciprocal territorial interests

In the Figure1, two firms A and B have contacts in two markets M and N. Firm A is the leader in both market M and N and firm B is the challenger in both markets.

If firm B (the challenger) reduces price in the market M, firm A (the leader) can fight back in the market N. However, since firm B is also the challenger in the market N, it still has the motivation of provoking in that market. Therefore, the chance of revenge in market N brought by multimarket contact can be offset by the motivation of provocation from firm B. This kind of contact is called irrelevant multimarket contact.

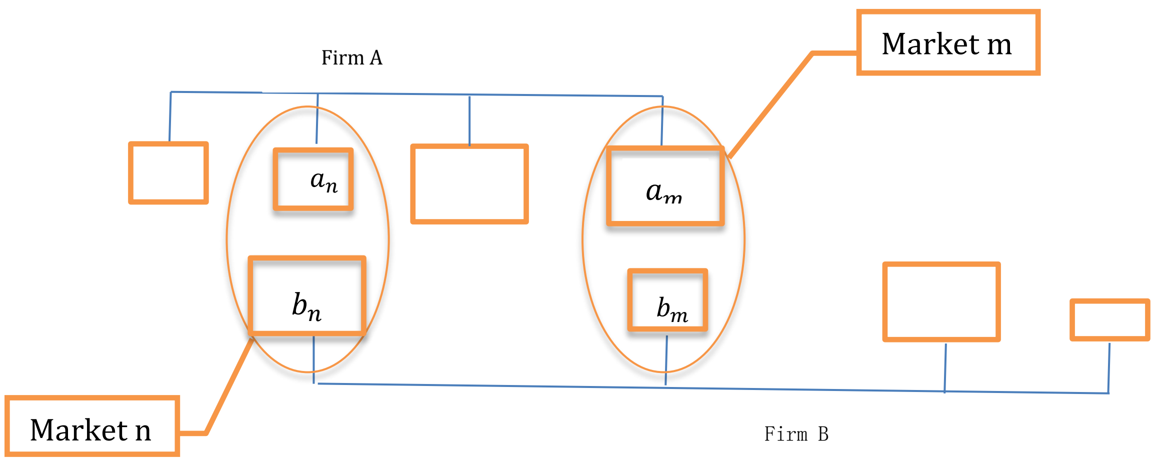

Figure 2. Multimarket contact with asymmetric and reciprocal territorial interests

In the figure 2, two firms A and B have contacts in two markets M and N. Firm A and B are the leaders in market M and N respectively. This situation is the most common one in practice.

If firm B reduces price in the market M, firm A who is the potential challenger in the market N will retaliate against firm B at a low cost. Under this condition, firm B will consider whether firm A would retaliate in market N before it takes provocative actions. Thus, multimarket contact can weaken the initial provocation motivation of firm B. This kind of multimarket contact is likely to cause “mutual forbearance” in the competition between firms. Under this situation, the competition between the firms A and B will be suppressed.

As stated above, the mutual forbearance effect of multimarket contact will appease rivalry among firms. As a result, the challenger hesitates to take aggressive action in the case of reciprocal territorial interests and is inclined to take aggressive actions in the case of nonreciprocal territorial interests. In the figure 2, dominant firms are not likely to act aggressively both in their main market and in their rivals' main market because they worry about price revenge. The "mutual forbearance" depicted in the figure 2 shows that dominant firms prefer to maintain the higher market price other than provoke price war.

This situation is proved by the research of Gimeno (1999) that studies the impact of multimarket contact on US airlines. In his article, market interests of airlines (or market share) are asymmetry as depicted in figure 2. If one firm has considerable market share in its rival's main markets, it will greatly weaken the rival's competitive strength when its rival competes with the firm in other markets. Therefore, airlines can make fully use of their considerable market share in the rivals' main markets (especially the hub of the aviation network) to consolidate the leading position in their own main market.

3.3 Literature Review of Multimarket Contact

The literature related to airfares in civil aviation is more than enough, due to the reason that no other industries like civil aviation have experienced the vast revolution from strict regulation to deregulation (Borenstain, 1992). The natural characteristics of network economies and service product make civil aviation industry a good example of testing the multimarket contact. Literature related to multimarket contact will be reviewed before evaluating the multimarket contact and market price of China's civil aviation.

Though the findings are mixed to a certain extent, a large amount of empirical work supports the "mutual forbearance" effect of multimarket contact (Greve, 2008). For instance, Gimeno & Woo (1996) declared that there exists "mutual forbearance" in U.S airlines and that multimarket contact causes the decrease in the intensity of competition. They also proved that airlines having contacts in multiple markets were capable of maintaining higher airfares in the U.S. civil aviation. Baum and Korn (1996) showed that

California commuter airlines with multimarket contact compete less fiercely with each other, resulting in higher fares. Gimeno (2002) found that in 3,008 city-pair markets of US airlines, the higher the level of multimarket contact, the higher the airfares. Evans and Kessides (1994) analyzed the correlation between airfares and multimarket contact using airfare data of the busiest 1000 routes in the US from 1984 to 1988. The results showed that multimarket contact has positive impact on airfares and multimarket contact is beneficial to tacit collusion among airlines. Signal (1996) studied the impact of the US airlines merger in 1985 on airfares. It turned out that airline mergers have effect on both multimarket contact and market concentration, which further lead to the increase in airfares. Moreover, Bernheim (1990) built a game theory model and found that multimarket contact relaxed the constraint conditions of collusion and expanded the market scope of keeping monopoly price. These empirical tests on the data of civil aviation indicate that multimarket contact has a significant effect on airfares.

Nevertheless, another two empirical tests show opposite result. Smith and Wilson (1995) tested the effect of multimarket contact on airfares among 10 airlines on 112 domestic routes in US, and they found that the multimarket contact had bare effect on airfares. In addition, Morrison & Winston (1996) and Sandler (1988) argued that in the US civil aviation market, higher level of multimarket contact could lead to more intense price competition so that the price will decrease. This study makes the relationship between multimarket contact and competition confused. However, Baum & Korn (1999) analyzed the US airlines with a dynamic model, pointing out that the correlation between multimarket contact and the intensity of competition is not linear, but shows up as a u-shaped curve. That is to say, when firms only have fewer contacts, the intensity of competition will rise with the increase in multimarket contact. If the multimarket contact further increases, multimarket contact can effectively reduce the intensity of competition.

The above literature indicates that airlines are motivated by the potential benefits of multimarket contact to deter rivalry and engage in mutual forbearance. Civil Aviation industry is generally deemed as a typical industry with multimarket contact since it may supply the best ground for breeding multimarket contact. There are few airlines and most of them compete in multiple markets. Moreover, although some heterogeneity can be brought by differences in service quality, safety, frequent flyer programs and etc., the essential homogeneity of the products makes little differentiation among them and makes them substitutable.

China's civil aviation meets the following requirements of multimarket contact theory. They are: i) airlines operate in multiple markets; ii) airlines have market influences in their operating markets; iii) the operating markets of each airline are segmented geographically, but their marketing strategies are interrelated (Hu, et al., 2008). In next chapter, an econometric model will be build to analyze the effect of multimarket contact on airfares in China's civil aviation.

4. Data, Model and Variables

In this section, the effect of multimarket contact on airfares will be tested with related controlled variables. Meanwhile, how the controlled variables including regulatory police, market structure and route characteristic variables affect airfares can be also observed.

According to previous researches, multimarket contact results in the resultant mutual forbearance behavior among firms (illustration from figure 1 and figure 2). It is proved not only in researches of product markets (Anand, Mesquita, & Vassolo, 2009) but also geographical markets (Haveman & Nonnemaker, 2000). In order to capture the theoretical arguments and empirical evidences applicable in China's civil aviation market, the following hypotheses should be made:

Hypothesis 1: multimarket contact has significant impact on airfares due to "mutual forbearance" phenomenon in China's civil aviation.

Hypothesis 2: government regulatory policy, market structure and route characteristic variables have significant effect on airfares.

4.1 Sample and Data

According to the “The Civil Aviation Statistics (2013)” published by the Civil Aviation Administration of China, there are 298 routes that passenger volume is more than one hundred thousand. Combined with the flights and fare information published on China Civil Aviation Administration official website, 244 domestic routes are selected. Flight and airfare information of the sample routes are collected from the June 2nd to the June 22nd in 2014. The sample data of airfares used in the regression model is the mean value of the three weeks and all sample data are the cross-section data. The information is from the following sources:

i) China Civil Aviation Administration official fare inquiry website to track data in real time <www.airtis.net> and <www.qunar.com>
ii) “The Civil Aviation Statistics (2013)” published by the Civil Aviation Administration of China.
iii) Policies and regulations on China Civil Aviation Administration’s official website <www.caac.gov.cn>.
iv) Civil Aviation Resource Net of China, <www.wcarn.com>.
v) China Statistical Yearbook, complied by National Bureau of Statistics of China, < www.stats.gov.cn/tjsj/ndsj/ >.

4.2 Model

The regression model can be written as follows (Equation 4-1):

$$\ln(\text{dependent variable}_i) = \alpha_0 + \ln(\alpha_1 (\text{multimarket contact variables})_i) + \ln(\alpha_2 (\text{regulatory policy variables})_i) + \alpha_3 (\text{market structure variables})_i + \ln(\alpha_4 (\text{route characteristic variables})_i) + \mu_i$$

The dependent variable is market price, represented by the average yield in the regression model. The independent variables include four types: i) the key independent variable—multimarket contact; ii) “regulatory policies variables”, represented by “government guided price”, “the domestic tourism routes without price lower limit”, “the domestic routes with market-regulated price” and “the domestic exclusive routes without price lower limit”; iii) market structure variables, represented by “the number of incumbents”, “market concentration”, and “the number of potential competitors”; iv) route characteristic variables, represented by “transport distance”, “the average load factor”, “the average density of passenger” and “total passenger volume”. For the dependent variable and independent variables, if they have specific values, the logarithmic form on these variables will be taken.

4.3 Variables

4.3.1 The Average Yield

First the meaning and detailed constructing procedures of the dependent variable will be introduced. As stated above, the dependent variable here is set up to be the market price, which is further characterized by the average yield in the domestic airlines market of China's civil aviation.

“The average yield per passenger kilometer” is extensively used as a market price variable in the civil aviation market (Evans & Kessides 1994; Singal, 1996; Gimeno, 1999; Baum & Korn, 1996, etc.). It has clearer economic meaning than the airfares published by the airlines, because the average yield per passenger kilometer is the average price charged to passenger per kilometer, which can be interpreted to be the price that one traveler pay to the airlines for obtaining travel service. This variable takes into account almost all the factors that affect travelers’ actual travel costs, such as discounts, empty seats, etc. It is a comprehensive indicator of the market price.

4.3.1.1 The Constructing Procedure of "the Average Yield" Variable

Due to the lack of data of revenue and revenue passenger kilometers on each route of each airline, the average yield per passenger kilometer on each route of all airlines is calculated through some specific steps as follows:

First, the average ticket price on each route is estimated. According to the market share of each airline on one route, the average ticket price on each route can be calculated in weighted average as below (Ruijuan Hu, 2008)(Equation 4-2):

$$\mathrm{P}_i = \sum_{j=1}^{n_i} P_{ij} \times \frac{F_{ij}}{\sum_{j=1}^{n_i} F_{ij}}$$

Where P_i represents the average ticket price on the ith route, P_{ij} represents the average ticket price of the airline j on the ith route, F_{ij} represents the number of scheduled flights of the airline j on the ith route in a week and n_i represents the number of airlines on the ith route.

Second, the average yield on each route will be estimated. Using the average ticket price calculated in the first step and multiplying it by the average load factor of respective routes, the average yield per passenger on each route is obtained. Then further dividing it by transport distance, the average yield per passenger kilometer can be calculated. The calculating equation is as follows (Equation 4-3):

$$yield_i = \frac{P_i \times LF_i}{Dis_i}$$

Where $yield_i$ represents the average yield per passenger kilometer on the ith route, LF_i represents the average load factor on the ith route and Dis_i represents the transport distance on the ith route. From the above steps, the average yield per passenger kilometer of on each route can be calculated.

4.3.2 The "Multimarket Contact " Variable

There are no accepted measures of multimarket contact. Generally speaking, there are two broad categories of measures being applied, which are probabilities measures and count measures. (Scott, 1982,1991 and Mester, 1987). Sigal (1996) pointed out that in intra-industry researches of multimarket contact, the probability-type measures are rarely utilized while the count measures are extensively used. For example, Sandler (1988) and Evans and Kessides (1994) use count measures for the U.S. civil aviation. Alexander (1985) and Heggestad & Rhoades (1978) rely on such measures for the banking industry. So in this paper, the count measures are used to calculate the multimarket contact. This method is based on the number of times that a pair of firms has contacts, and then use mathematical methods, such as adding or multiplying by some related factors to compute the multimarket contact (Signal, 1996). First, it is necessary to introduce these related factors.

4.3.2.1 The Related Factors of the "Multimarket Contact"

With the factors affecting firms' behavior, the count measure of multimarket contact can thus be developed in this paper. One route is taken as one market. Assume that there are n markets (routes) and m airlines with m_i airlines on ith route. ($\Sigma m_i \neq m$ since the same airline may operate in several different routes). The significance of multimarket contact on one route is influenced by the following four factors.

i) the number of competing airlines on one route

Evans & Kessides (1994) and Feinberg (1985) proposed that measuring multimarket contact significantly depends on the number of incumbents in the market. Signal (1996) noted that if there are only two firms in one market, their contact is much more important than that in the market with three or more firms. In this way, in civil aviation market, the actual number of airline-pairs on one route should be considered in order to standardize the contact between airlines. Since there are m_i airlines on ith route, the number of airline-pairs is $m_i (m_i - 1)/2$.

ii) the magnitude of presence of competing airlines in the market.

Signal (1996) stated that the contact between two firms together occupying a 50% market share is more essential than that between two firms only occupying 30% market share. To reflect this effect, the sum of the market shares, s_k and s_j (s_k and s_j represent the market share of the airline j and k respectively), is introduced. Thus, the "MMC" variable will be standardized by the factor ($s_k + s_j$).

iii) The relative market share of competing airlines on the route.

Contact is more important when the market shares of firms are more dissimilar (Signal, 1996). For instance, if airline A has a share of 60% and airline B has a share of 20%, airline B can hurt airline A more than it hurts itself by a price cut. Here, contact is more significant than when each firm's market share is 40% because airline B can no longer take retaliatory actions towards airline A. To reflect this effect, the square root of the ratio of the market shares is introduced. (Signal, 1996). Consider the airline j and k such that $s_{ij} > s_{ik}$. Thus, the "MMC" variable will also be standardized by the factor $\sqrt{\frac{sik}{sij}}$. It can be seen that the dissimilar shares are important in measuring contact because the threat of retaliation is more effective in such markets (Scott, 1993; Bernheim & Whinston, 1990).

iv) market size of the route.

Multimarket contact in large markets is usually more important than that in small markets (Signal, 1996). In order to reflect this effect, the square root of market size $\sqrt{\frac{T_i \times 100}{T_{total}}}$ (percentage of total passenger volume) is introduced to compute the multimarket contact for an airline-pair in equation 4-5. Here, the market size is characterized by passenger volume, which is in nature similar to the sales variable used by Feinberg (1985).

4.3.2.2 The Constructing Procedure of "the Multimarket Contact"

First step: depend on the four factors listed above, the contact between the airline j and k on the ith route can be calculated as follows (Equation 4-4 and 4-5), which is similar to the equation of Signal (1996).

When $m_i = 1$, $MMC_{ijk} = 0$

When $m_i > 1$, $MMC_{ijk} = \dfrac{D_{ijk}\left(S_{ij} + S_{ik}\right)\sqrt{\dfrac{S_{ij}}{S_{ik}}}}{m_i(m_i - 1)/2} \times \sqrt{\dfrac{T_i \times 100}{T_{total}}}$

That is to say, when $m_i = 1$, there is only one airline having scheduled flights on the ith route. This particular route actually is a monopoly route, because there does not exist other airlines on this route. Therefore, the multimarket contact factor on this particular route is equal to zero.

When $m_i > 1$, there are more than one airlines operating on the ith route, so there exists multimarket contact among the airlines. On the left side of the equation, MMC_{ijk} represents the multimarket contact between the airline j and k on the ith route. On the right side of the equation, D_{ijk} is the dummy variable, representing the airline j and k operating scheduled flights on the ith route simultaneously. The equation of D_{ijk} is as follows: $D_{ijk} = D_{ij} * D_{ik}$. Where, D_{ij} (D_{ik}) is dummy variable either, representing the airline j (k) having scheduled flights on the ith route. If the airline j (k) runs business on the ith route, the value of D_{ij} (D_{ik}) is equal to one and otherwise zero. Therefore, if and only if both D_{ij} and D_{ik} are equal to one at the same time, the value of D_{ijk} is equal to one. Otherwise, D_{ijk} is equal to zero (Evans and Kessides, 1994).

When the value of D_{ijk} is equal to one, the multimarket contact between airline j and airline k on the ith route is given by the above expression taking account of the four factors introduced above: the number of competing airlines m_i (m_i - 1)/2, the magnitude of presence of competing airlines in the market (s_k + s_j), the relative market share of competing airlines on the route $\sqrt{\frac{sik}{sij}}$, and market size of the route $\sqrt{\frac{T_i \times 100}{T_{total}}}$.

Second step: calculating the multimarket contact (MMC) for the airline j and the airline k on all routes, the equation is as below (equation 4-6):

$$\mathrm{MMC}_{\bullet jk} = \sum_{i=1}^{n} MMC_{ijk}$$

The total multimarket contact between the airline j and k is a weighted sum of multimarket contact on each route where the weight is the size of each market. Then we can calculate the multimarket contact on the ith route among all airlines.

Third step: calculate the multimarket contact for all airlines on the ith route (Equation 4-7).

$$MMC_i = \sum_{jk=1}^{m_i(m_i-1)/2} [MMC_{ijk}(MMC_{\bullet jk} - MMC_{ijk})]$$

In equation 4-7, MMC_i represents the multimarket contact for all airlines on the ith route. The first term "MMC_{ijk}" within the summation sign is obtained from the first step. It is the contact between airlines j and k on the ith route. The second term "$MMC_{.jk}$ - MMC_{ijk}" represents the contact between airlines j and k on all other routes. Only if both terms are non-zero, does this pair of airlines contribute to multimarket contact on the ith route. Since the number of airline-pairs is m_i *(m_i-1)/2 on the ith route, the contact of all the airlines on the ith route can be calculated.

Since the multimarket contact can lead to "mutual forbearance" among the airlines, the airlines worried that the decrease of airfares on one route would bring revenges on other routes by their rivals. Airlines prefer to maintain the higher airfares invariably. Therefore, we can infer that the multimarket contact has positive impact on the average yield.

4.3.3 Government Regulatory Policy Variables

4.3.3.1 Government Guided Price ($basep_i$)

Currently the Civil Aviation Administration of China sets the airfares with upper and lower limit based on the basic price of China's domestic routes. In order to further standardize the pricing behavior of airlines, the authority announced government guided price on each route. All the 224 domestic routes selected in the model have the stipulated government guided price. In fact, the government guided price makes it easier for airlines to collude on price, as they prefer to follow the government guided price. Therefore, government guided price has a great impact on the average yield of the airlines and it should be added in the regression model. Here, this variable is represented by $basep_i$. The data of government guided price is from Civil Aviation Resource Net of China, <http://www.wcarn.com/>.

4.3.3.2 The Domestic Tourism Routes without Price Lower Limit ($Dtour_i$)

For the total 262[3] domestic tourism routes without price lower limit, 52[4] routes with government guided price available are selected in the model, which are mainly connecting tourism cities. The seasonal characteristic is obvious and the passenger volume is large during the peak tourist season. It is represented by $Dtour_i$. Since there is no actual value of this variable, it is taken as a dummy variable. If domestic routes belong to the domestic tourism routes without price lower limit, the value of $Dtour_i$ is equal to one, zero otherwise. The routes are selected from <catalogue of domestic tourism routes without price lower limit> on China Civil Aviation Administration's official website <www.caac.gov.cn>.

4.3.3.3 The Domestic Routes with Fully Market-regulated Price ($Dfree_i$)

3 The number is from China Civil Aviation Administration's official website <www.caac.gov.cn>.
4 The detailed routes are listed in the appendix.

For the total 94[5] domestic routes with fully market-regulated price, 17[6] routes with government guided price available are selected in the regression model. These routes are mostly regional short routes, usually within the scope of a province. The distance of these routes is less than 600 kilometers. The Civil Aviation Administration of China does not put any restrictions on the pricing of these routes. Since there is no actual value of this variable, it is considered as a dummy variable and represented by $Dfree_i$. If domestic routes belong to the domestic routes with fully market- regulated price, the value of $Dfree_i$ is equal to one, zero otherwise. The routes are selected from <catalogue of domestic tourism routes with fully market-regulated price> on China Civil Aviation Administration's official website <www.caac.gov.cn>.

4.2.3.4 The Domestic Exclusive Routes without Price Lower Limit (Dmonoi)

For the total 225[7] domestic exclusive routes without price lower limit, 8[8] routes with government guided price available are selected in the regression model. The Civil Aviation Administration of China does not set the lower limit on a part of the domestic exclusive routes. These routes are usually operated exclusively by one airline and thus are considered as the airline-monopolized routes. Similar to the two former variables, this variable also has no actual value either. It is taken as a dummy variable and is represented by $Dmono_i$. If domestic routes belong to the domestic exclusive routes without price lower limit, the value of $Dmono_i$ is equal to one, zero otherwise. The routes are selected from <catalogue of domestic exclusive routes without price lower limit> on China Civil Aviation Administration's official website <www.caac.gov.cn>.

4.3.4 Market Structure Variables

4.3.4.1 The Number of Incumbents (n_i)

[5] The number is from China Civil Aviation Administration's official website <www.caac.gov.cn>.
[6] The detailed routes are listed in the appendix.
[7] The number is from China Civil Aviation Administration's official website <www.caac.gov.cn>.
[8] The detailed routes are listed in the appendix.

Airlines who have scheduled flights between two cities are called incumbents and n_i represents the number of incumbents on the ith route. The more incumbents in the market, the more intense the market competition will be and the lower possibility of successful cooperation (or collusion) among incumbents (Ivaldi, et al, 2003). Thus the market price will be closer to that in the perfect competitive market. That is to say, it is quite low. The number of incumbents has negative effect on the average yield.

4.3.4.2 Market Concentration (HHI_i)

Market concentration is an important variable used to measure the market structure, positively related to market price and the rate of profit (Bain, J, 1956). The factors which facilitate effective collusion were first explored by Stigler (1964), who pointed out that cooperative outcomes are more likely to occur in concentrated markets than less concentrated markets since collusion can be more easily detected. That is to say, price wars are more likely to erupt in a less concentrated market. After a few small airlines merged into four big airlines group: the Air China Group, the China Southern Group, the China Eastern Group and China Hainan Group, the consolidations have granted a joint dominant status to China's big four airlines so that the market concentration of these four airlines is much higher than before. Larger airlines are more likely to raise airfares through market manipulation. Namely, the coefficient of market concentration variable should be positive.

The Herfindahl-Hirschman Index (HHI) is a measure to calculate market concentration. Since the total passenger volume on each route of each airline cannot be collected, the HHI is calculated based on the number of scheduled flights on each route in one week of each airline. The computation equation is as follows (Equation 4-8):

$$\mathrm{HHI}_i = \sum_{j=1}^{n_i}\left(\frac{F_{ij}}{\sum_{j=1}^{n} F_{ij}}\right)^2 \times 10000 = \sum_{j=1}^{n_i}\left(S_{ij}\times 100\right)^2$$

Where, HHI_i represents the market concentration on the ith route, F_{ij} represents the number of scheduled flights of the airline j on the ith route per week, n_i represents the number of airlines operating scheduled flights on the ith route and S_{ij} is the percentage of the scheduled flights that airline j operates on the ith route.

4.3.4.3 The Number of Potential Competitors (n_{ip})

Baumol (1982) proposed that the "hit and run" competition exists in contestable markets. In order to earn excessive profits, firms will increase the prices far beyond the average price level of the market. Under this condition, potential competitors are motivated to step into this market to exploit the price level for easy profit. When the incumbents respond by returning prices to levels consistent with normal profits, the new entrants will exit. Potential competitors can more or less promote market competition (Hu, et al., 2008). Therefore, the number of potential competitors in the market should be considered and it has negative effect on airfares.

First, competitors who meet the following two conditions can be considered as the potential competitors in this model.

i) The airlines do not operate scheduled flights between the certain two cities.
ii) The airlines operate scheduled flights from one of the city belonging to the city-pair to other cities.

The number of potential competitors will be calculated as follows: route i connects two cities O and D, there are m_0 domestic routes starting from city O, and m_d domestic routes finishing at city D. D_{xj} is a dummy variable, representing the airline j having scheduled flights on the route x. If the airline j operates scheduled flights on the route x, the value of D_{xj} is equal to one and zero otherwise. D_{xyj} is also a dummy variable, representing the airline j having scheduled flights both on the route x and y simultaneously. If the airline j operates scheduled flights both on the route x and y, the value of D_{xyj} is to one and zero otherwise. With the above setting, the number of potential competitors could be calculated as follows (Equation 4-9):

$$n_{xp} = \sum_{x=1}^{m_0+m_d} \sum_{j=1}^{n_x} D_{xj} - \sum_{j=1}^{M} \sum_{x,y=1}^{m_0+m_d} D_{xyj} - n_x$$

Where n_{xp} represents the number of potential competitors on the route x and n_x represents the number of incumbents on the route x.

The first term on the right hand is the total number of the airlines operating scheduled flights connecting either the starting point (city O) or the finishing point (city D) (including some double counted, since some airlines operate flights both on city O and city D simultaneously). The second term on the right hand is the number of airlines operating scheduled flights both on the routes connecting the starting point (city O) and the routes connecting the finishing point (city D) simultaneously. The double counted number of airlines can be avoided by dropping out the second term.

Thus, the first two terms of Equation 4-9 calculate the number of airlines that operate scheduled flights on the routes connecting either of the two cities without double counting. After the number of incumbents on the route x is deducted from the above result, the number of potential competitors is obtained.

4.3.5 Route Characteristic Variables

4.3.5.1 Transport Distance (Dis$_i$)

Oliver Hoover (1930) discovered that the transportation outcome features the "tapering with distance" phenomenon. Namely, producing the transportation products (services) usually involves high fixed costs, which do not change with distance. As a result, the unit cost of transportation services (products) tends to decrease with the extension of the transport distance, which is called "economies of distance"(Deardoff, 2001). Kelly & Bryan (1998) pointed out that price per kilometer of many routes does decrease when transport distance increases in the US aviation market. The Civil Aviation Administration of China announced that ticket price is calculated by the following equation: ticket price = base price + unit price * transport distance. Therefore, transport distance is an endogenous technical factor in the cost function so that it should be included in the model. The coefficient of this variable should be negative, which is consistent with "tapering with distance". In this paper, the variable is represented by "Dis" and the data is from Civil Aviation Resource Net of China, <http://www.wcarn.com/>.

4.3.5.2 The Average Load Factor (lf_i)

Generally speaking, the higher the average load factor is, the more seats on one flight are taken up and the higher the average yield will be. Hence, the average load factor should be added in the regression model.

The average load factor in this paper is the passenger load factor on each route in one year. It is calculated as the sum of the number of actually carried passengers divided by the sum of all available seats on all flights. The equation is as follows (Equation 4-10):

$$lf_i = \frac{T_i}{AS_i} \times 100\%$$

Where, lf_i represents the averaged load factor on the ith route, T_i represents the annual total passenger volume on the ith route and AS_i represents the total available seats provided on the ith route in one year. This variable is usually expressed in the form of percentage.

4.3.5.3 The Average Density of Passenger (Des_i)

Mori & Nishikimi (2002) find that traffic density of transportation firms will dramatically influence the unit cost of transportation products. As the unit of supply is transportation vehicle (e.g. an entire aircraft is the unit of supply in airline industry), and the unit of demand is much smaller (e.g. a seat on the plane is the unit of demand in airline industry), the inconsistency between supply unit and demand unit (supply unit is much larger than demand unit) results in frequently idle transportation capacity. In this situation, when the transportation capacity is not saturated (the load factor is less than 100% in aviation industry), the increase of demand unit will decrease the cost of supply unit. This situation is known as "economies of density" or "economies of capacity utilization".

"Economies of density" is quite common in civil aviation industry. Therefore, the average density of passenger on each route should be included in the model. It can be calculated as follows (Equation 4-11):

$$Des_i = \frac{T_i}{Flight_i}$$

Where, Des_i represents the average density of passenger on the ith route, T_i represents the total passenger volume on the ith route in one year and $Flight_i$ represents the total number of the scheduled flights on the ith route in one year.

4.3.5.4 Passenger Volume (T_i)

Passenger volume is the total number of passengers on each route within one year. It can be considered as the total output of each route and the achieved demand. If a commodity is normal consumer goods, the price elasticity of demand should be negative (Andreyeva, 2010). Here, the total passenger volume actually is the demand and the product price is represented by the average yield. Therefore, the coefficient of this variable should also be negative. Namely, the rise of the average yield (price level) will lead to the decrease of consumer demand. This variable is represented by the symbol "T". The airlines passenger volume data used in this regression is also from China Statistical Yearbook, complied by National Bureau of Statistics of China, < http://www.stats.gov.cn/tjsj/ndsj/ >.

4.4 Descriptive Statistics

First, a summary of the dependent and independent variables and their descriptive statistics is provided in the Table 1.

Table 1

Descriptive Statistics of All the Variables.

Variable name	Unit	Observations	Mean	Standard deviation	Minimum	Maximum
The average yield	Yuan	224	0.55	0.11	0.35	1.17
Multimarket contact variable		224	5.78	5.71	0	37.25
The government guided price	Yuan	224	107.73	21.42	43.97	217.42
The number of incumbents		224	2.97	1.51	1.00	6.00
The number of potential competitors		224	5.48	2.29	0.00	10.00
HHI		224	4724.45	1972.87	2237.91	10000
Transport distance	Kilometer	224	1141.79	582.01	167.08	3840.00
The average load factor	%	224	73.93	6.01	47.35	86.20

The average density of passenger	Person per flight	224	109.30	18.62	39.15	174.96
Airlines passenger volume	Ten thousand	224	43.28	45.46	8.07	434.79

In the Table 1, the mean of "the average yield" is 0.55 yuan per passenger kilometer. The base price announced by the Civil Aviation Administration of China is 0.75 yuan per passenger kilometer, and is equal to 0.5545 yuan per passenger kilometer after multiplied by the average load factor (73.93%). It can be seen that these two values are almost the same. This outcome indicates that China's civil aviation airfare is strongly influenced by regulatory policies.

The mean of "the multimarket contact" is nearly 6. The minimum value is 0 and the maximum value is about 37. Singal (1996) used a similar method and calculated the mean of the multimarket contact of the US aviation market from 1984 to 1988, which is between 2.00 and 4.81. Compared with the mean of "MMC", it can be seen that China's civil aviation market has a deeper multimarket contact degree than that in the US market. Therefore, multimarket contact is quite common in China's civil aviation market.

The mean of "the number of incumbents" is close to 3. The minimum value is 1 and the maximum value is only 6. Singal (1996) analyzed the effect of multimarket contact in U.S. civil aviation between 1984 and 1988. From his results, the mean of the number of airlines on one route is 29.6, much greater than that of China. From the view of market concentration (HHI), the mean is 4724.45. According to the "Horizontal Merger Guidelines" published by U.S. Department of Justice and the Federal Trade Commission, if the value of HHI is above 2500, it means that the market is highly concentrated. Also combined with the limited incumbents on each route, it turns out that China' aviation market is nearly a monopoly market.

4.5 Collinearity and Heteroskedasticity

The collinearity in data can produce inaccurate estimator and test. So before running the regression model, the collinearity among all variables should be tested. From the Table 2, it can be seen that the correlation coefficients between “the average yield” and “transport distance” and “domestic routes with fully market-regulated price” are high. The correlation coefficients among the most explanatory variables are low. Therefore, it is verified that there is no multicollinearity among the explanatory variables.

Table 2

The Correlation Among Dependent Variables and Independent Variables.

Coefficient	yield	n_i	n_{ip}	HHI	MMCi	dis	lf_i	Des_i	T_i	Basep	D_{touri}	D_{freei}	D_{monoi}
Yield	1.0000												
n_i	-0.0564	1.0000											
n_{ip}	0.1106	0.1713	1.0000										
HHI	0.0782	0.8082	0.1803	1.0000									
MMCi	0.0604	0.0434	0.1352	-0.0487	1.0000								
Dis	-0.5293	0.1145	0.1067	-0.1115	0.0140	1.0000							
lf_i	0.2098	0.1176	-0.3499	-0.2100	-0.0425	0.1592	1.0000						
Des_i	-0.0993	0.1680	-0.0132	-0.1913	0.1392	0.5152	0.4946	1.0000					
T_i	-0.0227	0.4667	0.2020	-0.3122	0.1989	0.0735	0.0340	0.3585	1.0000				
Basep	-0.1054	0.0468	0.1598	0.0112	0.0442	0.3533	0.0417	0.2120	0.1020	1.0000			
D_{touri}	-0.0318	-0.1165	-0.0503	0.0749	0.1334	0.1154	0.3174	0.3457	-0.0415	0.1417	1.0000		
D_{freei}	0.5193	-0.1965	0.0306	0.3423	-0.0057	-0.3495	-0.2554	-0.3532	-0.0316	-0.1210	-0.1377	1.0000	
D_{monoi}	-0.0846	-0.3346	0.0479	0.5145	-0.1985	0.0350	0.0005	-0.0542	-0.1232	0.0138	-0.0990	-0.0508	1.0000

After making sure no multicollinearity among the explanatory variables, heteroskedasticity is a common problem in cross-section data sets and autocorrelation is rare in cross-section data. Heteroskedasticity among the errors also should be test. Using the White test in Stata, there is no heteroskedasticity among errors at 5% level of significance. Then the ordinary least square regression can be used.

5. Results and Analysis

Table 3 reports the coefficient estimators along with the t-statistics. Since both "the number of incumbents" (n_i) and "market concentration" (HHI_i) are used to measure market structure and they have similar sense, but opposite direction of impact, each model only includes one of them. Model one and three include the variable "n_i" and model two and four include the variable "HHI_i". It can be seen that, except "n_i" and "HHI_i", the coefficients and directions of other variables are consistent. Therefore, the role of "n_i" and "HHI_i" are very close. In some situation, it is feasible to replace these two variables with each other. In model three and four, the variable "domestic exclusive routes without price lower limit ($Dtour_i$)" is excluded since the variable "$Dtour_i$" is not statistically significant at all in the first two models. Meanwhile, "government guided price ($Base_i$)" is also excluded because the variable "$Base_i$" plays a significant airfare leader role in China's civil aviation market. Airlines happen to coincide to follow the government guided price in order to avoid the fierce competition on airfares. It may disturb the effect of multimarket contact on airfares.

Table 3

Ordinary Least Squares Regression of "the Average Yield".

Variables	Model One		Model Two	
	Coefficient	t-value	Coefficient	t-value
MMC_i	0.0022269	1.77	0.0022557	1.69
$\ln Basep_i$	0.0604616	3.07	0.0620973	3.14
D_{touri}	0.42867	2.31	0.0422288	2.27
D_{freei}	0.2341698	6.93	0.2406389	6.95
D_{monoi}	1.384335	0.47	0.0027844	0.00
n_i	0.0209893	2.32		
n_{ip}	0.0066669	1.82	0.0055473	1.79

HHI_{i}			0.0541967	2.23
$\ln Dis_i$	0.2558712	14.60	0.2537184	14.56
$\ln lf_i$	1.08704	10.67	1.065646	10.47
$\ln Des_i$	0.2353008	4.32	0.2287372	4.23
$\ln T_i$	0.0403664	2.74	0.0322882	2.54
Constant	0.4106184	0.93	0.1804311	0.38
Observation	224		224	
R^2	0.7047		0.6902	
F-statistic	51.55		51.42	

From the regression results, all the variables are significant at least 10% levels of significance except for the variable "the domestic exclusive routes without price lower limit". Therefore, the model will be regressed without this variable. The coefficient estimators and the t-statistics present in the Table 4.

Table 4

Ordinary Least Squares Regression of "the Average Yield after Excluding the Variable "Domestic Exclusive Routes without Price Lower Limit"

Variables	Model Three		Model Four	
	Coefficient	t-statistic	Coefficient	t-statistic
MMC_i	0.0024907	1.99	0.0024288	1.93
$\ln Basep_i$	0.0622828	2.84	0.0635237	2.79
D_{touri}	0.041952	2.25	0.0320823	1.79
D_{freei}	0.2398486	5.92	0.245343	6.38
n_i	0.0259439	2.45		
n_{ip}	0.0063768	1.86	0.0063583	1.79
HHI_{i}			0.0446779	1.92

$\ln Dis_i$	0.2543803	14.08	0.2316042	14.05
$\ln lf_i$	1.065165	10.45	1.035977	10.53
$\ln Des_i$	0.2280071	4.21	0.2219563	4.16
$\ln T_i$	0.0254380	2.26	0.0231604	2.17
Constant	0.4764927	1.04	0.469186	1.13
Observation	244		244	
R^2	0.7293		0.7314	
F-statistic	53.82		54.23	

5.1 The Goodness of Fit

From the regression model one and model two, the goodness of fit is within a small range of 0.69-0.70. In the model three and model four, the goodness of fit is around 0.73, larger than before, That is to say, the explanatory variables can explain about 70% changes of dependent variable. After excluding the unrelated variable, the explanatory power of the model is more satisfactory.

5.2 the Coefficients of Variables

The estimators of regression coefficients and the t-statistic for each variable are listed in the Table 3 and Table 4. Now specific analysis is as follows:

5.2.1 The Analysis of “Multimarket Contact”

In the third section of literature review on multimarket contact on civil aviation industry, most studies on the U.S. civil aviation show that multimarket contact can weaken the degree of competition in the market and increase the airfares. In this paper, the coefficients of variable ”multimarket contact ” are positive, which is consistent with the mutual forbearance hypothesis. The t-statistics of “multimarket contact” in model one and two are 1.77 and 1.69 respectively, greater than 1.68. After excluded the unrelated variable “$Dmono_i$”, the t-statistics of “MMC_i” are 1.99 and 1.93 in the latter two models. It is only significant at 10% level of significance in all four models.

Meanwhile, after transforming the equation 4-3 “ $yield_i = \frac{P_i \times LF_i}{Dis_i}$”, the average price ($P_i$) can be calculated from the equation: $P_i = \frac{yield_i \times Dis_i}{LF_i}$. When the variable “multimarket contact” increases by one unit, the average yield is increased by approximately 0.24%[9] (from Table 3 and Table 4) and the average ticket price increases by 3.70%[10]. However, Evans and Kessides (1994) find that in the US aviation market, the average ticket would increase by 4% to 11%, which is higher than that of China’s civil aviation. Due to this comparison, it can further indicate that the effect of “MMC” is not significant enough in China’s civil aviation.

There are two main reasons to this outcome. First, even if no antitrust laws in China, airfare collusion is difficult to be achieved due to the vast and advanced railway system. That is to say, an airline not only competes with other airlines, but also with railway transportation, which is much cheaper. Moreover, the railway system is way more developed and efficient than before so that it has posed a serious threat to airlines. For example, the comparison of the ticket price between rail and air transportation on two routes from Beijing to Shanghai and from Beijing to Guangzhou which are the most two popular routes in China are reported in the Table 5 and Table 6:

Table 5
The Comparison of the Ticket Price Between Rail and Air Transportation from Beijing to Shanghai.

---

[9] The coefficient of “MMC” is within the range of 0.0022269-0.0024907 in the four models; here we use the value of 0.0024.

[10] The value is calculated from the equation $P_i = \frac{yield_i \times Dis_i}{LF_i}$, among them, the value of “yield” is 0.24%, and the values of “Dis_i” and “LF_i” used are the corresponding mean values reported in the Table 1 (1141.79 and 73.93 respectively). Therefore, when the variable “MMC_i” increases one unit, the average ticket price increases 3.70%.

Travel Method	Airline	Railway		
Duration (h)	2	5	11	20
Full Price (Yuan)	1300	553	408	156.5
Market Price (Yuan)	680	553	408	156.5

- **Source:** The full prices of the flight and rail are from <www.caac.cn> and <www.12306.cn>. The market price of the flight is the average price from 2nd June to 22nd June.

Table 6
The Comparison of the Ticket Price between Rail and Air Transportation from Beijing to Guangzhou.

Travel Method	Airline	Railway	
Duration (h)	3	9	21
Full Price (Yuan)	1870	862	251
Market Price (Yuan)	1070	862	251

- **Source:** The full prices of the flight and rail are from <www.caac.cn> and <www.12306.cn>. The market price of the flight is the average price from 2nd June to 22nd June.

In the Table 5, on the route from Beijing to Shanghai, the full price of air transportation is 1300 yuan (tax included) and the average market price is 680 yuan (tax included) with a travel time of 2 hours. For railway transportation, the fastest train only takes 5 hours with a ticket price of 553 yuan (tax included). If the effective is not a priority, the cheapest price is as low as 157 yuan (tax included).

In the Table 6, on the route from Beijing to Guangzhou, the full price of air transportation is 1870 yuan (tax included) and the average market price is 1070 yuan (tax included) with a travel time of 3 hours. For railway transportation, the fastest train only takes 9 hours with a ticket price of 862 yuan (tax included). If the effective is not a priority, the cheapest price is as low as 251 yuan (tax included).

From these two tables, it can be seen that full airfares are more than doubled dearest rail fares and rail transportation provides more flexible options on travel time & travel expense combination. Therefore, airlines have to cut their price deeply to attract customers. Although there is much multimarket contact among airlines, airfare collusion is still impossible due to the pressure from the railway transportation. Under this situation, even if some explicit price-fixing agreements reached among airlines, they usually cannot be expected to last long. Thus, the effect of multimarket contact on airfares is not obvious.

Second, from the overview of the development of civil aviation in China, it is clearly to see that while the Chinese government has demonstrated its intention of transforming the civil aviation in China into a market-oriented and competitive environment, the state still remains a strong influence on the airline industry and the removal of state controls is far from complete. Compared to the U.S. civil aviation with strong market oriented deregulation, the civil aviation in China has been shaped by government-led reforms rather than free market forces. With the unique characteristic of state-led partial deregulation, pricing power of airlines has been partly delegated to the government. Especially after the CAAC published the government guided price on most routes, the freedom of pricing of airlines is further limited by government authorities. In this way, the effect of multimarket contact will be weakened to a certain extent.

5.2.2 The Analysis of “Government Regulatory Policy” Variables

In the four models, the t-statistics of “government guided price variable” are 3.07, 3.14, 2.84 and 2.79 respectively, greater than 2.56. It is significant at 1% level of significance. The coefficients of this variable are positive, which is in consistent with the prediction that airlines usually follow the government-guided prices. Since airlines have made pricing decisions based on government-guided prices, with a certain percentage discount, government-guided prices play a price leader role in China’s civil aviation market in fact. If the government-guided prices increase, the airfares will raise correspondly.

The absolute value of t-statistics of “the domestic tourism routes without price lower limit” are 2.31, 2.27 and 2.25 in model one, two and three, greater than 1.96. It is significant at 5% level of significance. And it is significant at 10% level of significance in model four. The coefficients of the variable are negative. It means that this variable has negative impact on the dependent variable. This result is similar to the phenomenon that happened in US aviation market. When the US government implemented the policy that does not limit the bottom price on popular tourism routes, the airfares of these routes have downward trend (Hurdle et al., 1989;Kim & Singal, 1993; Liu & Lynk, 1999). It turns out that this policy on domestic tourism routes could decline the average yield.

In the two models, the t-statistics of “the domestic routes with market-regulated price” are 6.93 and 6.95 respectively, greater than 2.58. It is significant at 1% level of significance. In the model three and four the same conclusion can be drawn. The coefficients of this variable are positive. These routes almost belong to the short-haul routes, usually within the scope of a province. The market entry and exit barrier is high and there are no economies of distance on these routes. Meanwhile the Civil Aviation Administration of China does not put any restrictions on the price on these routes. Thus, airlines could set up higher airfares in order to increase the average yield. In the US aviation market, when the government relaxed the regulations on the airline ticket prices, some regional unpopular routes airfares raised (Morrison and Winston, 1990). This result is similar to the situation happened in US aviation market.

The t- statistics of “domestic exclusive routes without price lower limit” is 0.47 and 0.00 in the model one and two. It is not statistically significant. Unlike the popular routes, these routes belong to monopoly cold routes and on each route only few airlines run business. Reducing price may not benefit to airlines since the demand of this type route is quite low, even though airlines have monopoly positions on this route. Therefore, the policy that does not limit the bottom price on cold routes has no significant effect on the average yield.

Not all the regulatory policy variables are statistically significant. It can be seen that in China's civil aviation market, government guided price play a critical role in airfares. The regulatory polices for different types of routes have different results: deregulating price lower limit on tourism routes can decrease the average yield but no use on domestic exclusive routes; relaxing price lower and upper limit on some regional routes (namely, routes with fully market-regulated price) can increase the average yield.

5.2.3 The Analysis of "Market Structure" Variables

In model one and three, the t-statistics of "the number of incumbents" are 2.32 and 2.45 greater than 1.96. It is significant at 5% level of significance. The coefficients of this variable are positive and it is opposite to the expectation.

In model two, the absolute value of t-statistics of "market concentration" is 2.23, greater than 1.96. It is significant at 5% level of significance. In the model four, the t-statistics is 1.92, which is significant at 10% level of significance. And the coefficients of this variable are negative. It is opposite to the prediction.

As the number of incumbents and market concentration increases, the market structure is close to perfectly contestable market. The market price should decrease and the average yield should be lower. It can be seen that although market structure in China's civil aviation is close to the oligopoly market even monopoly market, airlines still do not have powerful ability to control the airfares. The results may relate to the airfare that is regulated by the Civil Aviation Administration of China to some degree. For example, the government guided price has great influence on the airline pricing and they need to set up price based on the government guided price. Thus, these two variables have limited effect on airfares, even the opposite effect. Besides, inappropriate construction of variables and lack of the alternative methods also have some effect on the results.

The t-statistics of "the number of potential competitors" in the four models are 1.82, 1.79, 1.86 and 1.79 greater than 1.68. It is significant at 10% level of significance. The coefficients of this variable are positive and it is opposite to the expectation. The reasons can be explained as follows.

Before the 1990s, foreign airlines were not permitted to provide domestic services in China (Li and Jin, 2003). The CAAC had full responsibility to allocate domestic routes to airlines. It gave route rights to airlines based on the location of their regional hubs. There was no way to obtain route rights for new entrants. After the reforms, the CAAC deregulated allocating routes and encouraged states to establish regional carriers. As a result, a number of regional airlines emerged. However, it is still far from the “ultra free entry’ proposed by Shepherd (1984) which requests completely free to entry and exit. First, the entry is not free. New entrants enter the market still under some regulations proposed by CAAC and incumbents that open a new route also need approval by CAAC. Second, the exit is not free as well. The market mechanism of exit is not complete. Once incumbents apply for operating on a new route, they must provide service in accordance with the prior approval and published flight table. If they stop the service, they cannot apply for operating on that route in two years (Hu, et al., 2008). In this case, the pressure of “potential competitor” would be greatly reduced. In addition, airlines prefer to follow the government guided price to avoid price war. It will further weaken the effect of potential competitors on the airfares. In some cases, the effect of potential competitors may even offset and appear the opposite result like in this paper.

5.2.4 The Analysis of “Route characteristic” Variables.

In the four models, the absolute values of t-statistics of “transport distance” are 14.60, 14.56, 14.08 and 14.05 respectively, much greater than 2.56. This variable is significant at 1% level of significance. The coefficients are negative. That is to say, if the “transport distance” increases 1%, the average yield will reduce 0.2316042% - 0.2558712%. The results support “economies of distance” and “tapering with distance” phenomenon (Oliver Hoover, 1930). Hence, transport distance has great negative influence on airfares.

The t-statistics of “the average load factor” in Table 3 are 10.67, 10.47, 10.45 and 10.53 respectively, greater than 2.56. It is significant at 1% level of significance. The coefficients of this variable are positive. Namely, if the average load factor variable increases 1%, the dependent variable grows 1.035977% - 1.087074%. This result proves that the more seats are taken up on the plane, the higher is the average yield.

The t-statistics of “the average density of passenger” are 4.32, 4.23, 4.21 and 4.16 respectively in the four models, greater than 2.56. It is significant at 1% level of significance. The coefficients of this variable are positive. That is to say, if “the average density of passenger variable” grows 1%, the dependent variable increases 0.2219563% - 0.2353008%. These results correspond to “economies of density” and “economies of capacity utilization” which are introduced when the variable is constructed. However, the airlines do not transfer the economic benefits that come from the increasing operating scale to consumers, which are reflected in their higher average yield levels. Hence, the average density of passenger variable has significant positive effect on the average yield in China’s civil aviation market.

In the regression model one, the absolute value of t-statistic of “airline passenger volume” is 2.74, greater than 1.96. It is significant at 1% level of significance. In the latter three models, the t-statistics are 2.54, 2.26 and 2.17 respectively. It is significant at 5% level of significance. The coefficients of this variable are negative. Namely, if the airline passenger volume variable increases 1%, the dependent variable will decrease 0.0231604%- 0.0403664%. If this variable is taken as demand variable and the average yield is taken as the average price on routes, the regression model can be thought as the inverse function of demand. The negative coefficients indicate that demand price elasticity is negative in China's civil aviation market. Thus, the airline passenger volume variable has negative effect on the average yield according with prediction.

All the route characteristic variables are significant at least at 5% level of significance. The transport distance and total passenger volume have negative impact on the average yield and they prove the economies of distance and economies of scale in China’s civil aviation. These two variables are well reflected in the cost structure of airlines. The average load factor and the average density of passenger have positive effect on average yield, which indicate that supply and demand of market are critical factors of market price.

6. Conclusion

The paper first discussed the development of civil aviation in China since 1949. It can be seen that China implemented policies of relaxing regulations on entry, pricing, flight frequency, and routes, which certainly have created a more market-oriented and competitive environment. However, the deregulatory policies also reflect the thinking behind a centrally planned economy rather than that of a free market economy (Shih-Lung Shaw, 2009). Under this background, the effect of multimarket contact on airfares in China's civil aviation is analyzed through the econometric models.

The regression model is built considering the variables affecting the airfares, such as market structure variables, government regulatory police variables and route characteristic variables. The results show that multimarket contact is an influencing factor of airfares in China's civil aviation. However, the regulatory policies issued by the CAAC have more important effect on airfares than multimarket contact within the relevant market. These results can reflect the development of China's civil aviation with the unique characteristic of the state-led partial deregulation and privatization. Although the merger in China can lead to more multimarket contact, the increase in airfares brought by the multimarket contact effect is partially offset by the effect of government regulatory policies. In addition, railway transportation in China is becoming more and more advanced and flexible, which plays an important role in suppressing the airfares, making it more competitive compared to air transportation. Under this pressure, the price collusion among airlines is hard to be established and the effect of multimarket contact will thus be weakened to a certain degree. At last, the high homogeneity of the airlines' products in domestic market should also be noted which lets the airlines compete with each other mainly on airfares and makes the impact of multimarket contact not that obvious.

Appendix

1. The 52 domestic tourism routes with price lower limit selected in the model are listed:

Origin	Destination	Origin	Destination
Beijing	Guilin	Hangzhou	Haikou
Beijing	Haikou	Kunming	Changsha
Beijing	Kunming	Kunming	Guiyang
Beijing	Sanya	Kunming	Guilin
Beijing	Zhangjiajie	Kunming	Haikou
Chengdu	Haikou	Kunming	Hangzhou
Chengdu	Kunming	Kunming	Nanchang
Chengdu	Lhasa	Kunming	Nanning
Chengdu	Sanya	Kunming	Xi’an
Chengdu	Zhangjiajie	Kunming	Xiamen
Guangzhou	Guilin	Kunming	Zhengzhou
Guangzhou	Haikou	Kunming	Chongqing
Guangzhou	Huangshan	Nanjing	Guilin
Guangzhou	Kunming	Shanghai	Guilin
Guangzhou	Sanya	Shanghai	Haikou
Guangzhou	Zhangjiajie	Shanghai	Kunming
Haikou	Changsha	Shanghai	Sanya
Haikou	Guiyang	Shanghai	Wuyishan
Haikou	Nanchang	Shanghai	Zhangjiajie
Haikou	Nanjing	Shenzhen	Guilin
Haikou	Wuhan	Shenzhen	Haikou
Haikou	Xi’an	Shenzhen	Kunming
Haikou	Xiamen	Shenzhen	Sanya
Haikou	Zhengzhou	Xi’an	Guilin
Haikou	Chongqing	Xiamen	Guilin
Hangzhou	Guilin	Chongqing	Guilin

2. The 17 domestic routes with fully market-regulated price used in the model are lised:

Origin	Destination
Chengdu	Jiuzhai
Chengdu	Xichang
Chengdu	Chongqing
Guangzhou	Shantou
Guangzhou	Zhanjiang
Hangzhou	Wenzhou
Kunming	Dali

Kunming	Lijiang
Kunming	Mangshi
Kunming	Xishuangbanna
Shanghai	Ningbo
Shanghai	Wenzhou
Shanghai	Zhoushan
Urumqi	Yining
Xiamen	Fuzhou
Xiamen	Wuyishan
Chongqing	Guiyang

3. The 8 domestic exclusive routes without price lower limit used in the model are listed:

Origin	Destination
Changsha	Guiyang
Qingdao	Changsha
Qingdao	Shenyang
Qingdao	Wenzhou
Shanghai	Lanzhou
Shanghai	Zhuhai
Shenyang	Wenzhou
Chongqing	Zhengzhou

References

Alexander.D.L, 1985. An Empirical Test of the Mutual Forbearance Hypothesis: the Case of Bank Holding Companies," Southern Journal of Economics, 52, 122-140.

Amit, R.,I. Domowitz and C. Fershtman, 1988. Thinking one step ahead: The use of conjectures in competor analysis. Strategic Management Journal, 9(5), 431-442.

Anand, J., Mesquita, L. F., & Vassolo, R. S. 2009. The dynamics of multimarket competition in exploration and exploitation activities. *Academy of Management Journal*, 52(4): 802-821.

Barnett, W.P, 1993. Strategic deterrence among multipoint competitors. Industrial and Corporate Change, 2, 249-278.

Baum, J. A. C., & Korn, H. J. 1996. Competitive dynamics of interfirm rivalry. Academy of Management Journal, 39(2): 225-291.

Baum, J. A. C., & Korn, H. J. 1999. Dynamics of dyadic competitive interaction. Strategic Management Journal, 20(3): 251-278.

Bernheim, B. D. & Whinston M. D. 1990. Multimarket Contact and Collusive Behavior, Rand Journal of Economics, pp1-26.

Borenstein, Severin, 1992. The Evolution of U.S. Airline Competition. The Journal of Economic Perspectives, Vol. 6, No. 2 (Spring), 45-73.

Bowen, J., 2000. Airline hubs in Southeast Asia: national economic development and nodal accessibility. Journal of Transport Geography 8 (1), 25–41.

Bowen, J., 2002. Network change, deregulation, and access in the global airline industry. Economic Geography 78 (4), 425–439.

Bowen, J & Leinbach, T., 1995. The state and liberalization: the airline industry in the East Asian NICs. Annals of the Association of American Geographers 85 (3), 468–493.

Button, K. (Ed.), 1991. Airline Deregulation: International Experiences. David Fulton Publishers, London.

Chen, M.J, 1996. Competitor analysis and interfirm rivalry: Toward a theoretical integration. Academy of Management Review, 21(1): 100-134.

Deardoff. A.V, 2001. International provision of trade service, trade, and fragmentation. Review of International Economics, Wiley Blackwell, 9(2), 233-48, Edwards, C.D. 1955. Conglomerates business as a source of power. In G. J. Stigler (Ed.), *Business concentration and price policy*: 331-352. Princeton, NJ: Princeton University Press.

Evans, W. N., & Kessides, I. N. 1994. Living by the "Golden Rule": Multimarket contact in theUS airline industry. The Quarterly Journal of Economics, 109(2): 341-366.

Feinberg, R. M. 1985. "Sales at risk": A test of the mutual forbearance theory of conglomerate behavior. Journal of Business, 58(2): 225-241.

Gimeno, J. 1999. Reciprocal threats in multimarket rivalry: Staking out 'spheres of influence' in the U.S. airline industry. Strategic Management Journal, 20(2): 101-128.

Gimeno, J. 1994. Multipoint competition, market rivalry and firm performance: A test of the mutual forbearance hypothesis in the US airline industry, 1984-1988. Unpublished Doctoral Dissertation, Purdue University, West Lafayette, IN.

Gimeno, J. 2002. The performance effects of unintended and purposive multimarket contact. *Managerial and Decision Economics*, 23(4-5): 209-224.

Gimeno, J., & Woo, C. 1996. Hypercompetition in a multimarket environment: The role of strategic similarity and multimarket contact in competitive de-escalation. *Organization Science*, 7(3): 322-340.

Goetz, A., Sutton, C., 1998. The geography of deregulation in the U.S. airline industry. Annals of the Association of American Geographers 87 (2), 238–263.

Greve, H. R, 2008. Multimarket contact and sales growth: evidence from insurance. *Strategic Management Journal*, 29(3): 229-249.

Haveman, H. A., & Nonnemkaer, L. 2000. Competition in multiple geographic markets. The impact on growth and market entry. *Administrative Science Quarterly*, 45(2): 232-267.

Heggestad. A. A. & Rhoades. S.A., 1978. Multimarket Interdependence and Local Market Competition in Banking. The Review of Economics and Statistics, Vol.60, No. 4., 523-532.

"Horizontal Merger Guidelines". August 19, 2010. Session 5.3. U.S. Department of Justice and the Federal Trade Commission.

Hu. R.J & Kuang. L, & Wang. X. D, 2008. Empirical analysis on market structure of China's airline industry. Master's Thesis. University of International Business and Economics, Beijing.

Hurdle.G. & Johnson.R.L. & Joskow.A.S. & Werden.G.J. & Williams.M.A.1989.

Concentration, potential entry, and performance in the airline industry. Journal of Industrial Economics, No. 2, 119-139.

Ivaldi.M & Jullien.B & Patrick Rey & Seabright.P & Tirole.J, 2003. The Economics of Tacit Collusion. Interim Report for DG Competition, European Commission.

Jans.I. & Rosenbaum. D. I, 1997. Multimarket contact and pricing: Evidence from the U.S. cement industry. International Journal of Industrial Organization, V15: 391-412.

Jayachandran, S.,Gimeno, J., & Varadarajan,P.R. 1999. The theory of multimarket competition: A synthesis and implications for marketing strategy. Journal of marketing, 63(3): 49-66.

Kang, W., Bayus, B., & Balasubramanian, S. 2010. The strategic effects of multimarket contact: mutual forbearance and competitive response in the personal computer industry. *Journal of Marketing Research*, 47(3): 415-427.

Kasper, D., 1988. Deregulation and Globalization: Liberalizing International Trade in Air Services. Ballinger Publishing Company, Cambridge, Massachusetts.

Kelly.M.E & Bryan. D.L, 1998. Hub location flow economies of scale. Transport Research Part B: Methodoloical 32 (8), 605-616.

Kim, E.H., & Singal.V.,1993. Mergers and market power: Evidence from the airline industry. The American Economic Review, Vol. 83, No. 3, June, 549-569.

Liu, Z. and Lynk. E.L.,1999. Evidence on market structure of the deregulated US airline industry. Applied Economics, 31(2), 1083-1092.

Li, D., and Jin, L., (2003) *Hainan Airlines: en route to direct competition?*, the Darden School Foundation.

Mester, L. J., 1987. Multiple market contact between savings and loans. Journal of Money, Credit, and Banking, 19: 358-549.

Mori. T & Nishikimi. K, 2002. Economies of transport density and industrial agglomeration. Regional Science and Urban Economics 32 (2), 167-200.

Morrison,S.A. & Winston. C, 1996. Empirical Implications and tests of the Contestability hypothesis. Journal of Law and Economics, 28(3), 53-66.

National Bureau of Statistics of China, 2013. China Statistical Yearbook. China Statistics Press, Beijing, China (digital copy available at <http:// www.stats.gov.cn/tjsj/ndsj/>).

Sandler, R.D., 1988. Market share instability in commercial airline markets and the impact of deregulation. Journal of Industrial Economics 36, 327–335.

Scherer, F.M. and D. Ross, 1990. Industrial Market Structure and Economic Performance. Houghton Mifflin Company, Boston, MA.

Scott, J. T., 1982. Multimarket Contact and Economic Performance. Review of Economics and Statistics, LXIV, 368-75.

Singal, V. 1996. Airline mergers and multimarket contact. Managerial and Decision Economics, Vol. 17, No. 6. 559-574.

Singal, V. 1996. Airline mergers and competition: An integration of stock and product price effects. Journal of Business Administration, 69(2): 233-268.

Shaw, S., Lu, F., Chen, J., and Zhou, C., (2009) "China's airline consolidation and its effects on domestic airline networks and competition", *Journal of Transport Geography*, 17(2009), 293-305.

Shen, T., 1992. China’s civil aviation moves ahead under reform. In: Jiang, Z. (Ed.), Reform and Opening in China’s Civil Aviation. International Culture Press, Beijing (in Chinese).

Shepherd. William. G.,1984. Contestability vs. Competition. The American Economic Review, Vol. 74, No. 4, pp. 572-587.

Wang, Y., 2005. Analysis of the Organization and Reform of China’s Civil Aviation Industry. Master’s Thesis. Northeast University of Finance and Economy, Dalian, China (in Chinese).

Williams, G., 1994. The Airline Industry and the Impact of Deregulation. Avebury Aviation, Aldershot, England.

William J. Baumol, John C. Panzar, & Robert D. Willig, 1982. Contestable Markets and the Theory of Industry Structure.

William N. Evans and Ioannis N. Kessides (1994). “Living by the ‘Golden Rule’: Multimarket Contact in the U. S. Airline Industry,” The Quarterly Journal of Economics, 341-366.

Yu, T., Subramaniam, M., & Cannella, A. 2009. Rivalry deterrence in international markets: contingencies governing the mutual forbearance hypothesis. *Academy of Management Journal*, 52(1): 127-147.

Zhang, A., 1998. Industrial reform and air transport development in China. Journal of Air Transport Management 4 (3), 155–164.

Zhang, A., Chen, H., 2003. Evolution of China’s air transport development and policy towards international liberalization. Transportation Journal 42 (3), 31–49.

Zhang, A., Round, D., 2008. China’s airline deregulation since 1997 and the driving forces behind the 2002 airline consolidations. Journal of Air Transport Management 14 (3), 130–142.

Zhang, Y., and Round, D.K., 2011. Price wars and price collusion in China's airline markets, *International Journal of Industry Organization*, 29(2011), 361-372.