**Key determinants of airline pricing and air travel demand in China and India: policy, ownership, and LCC competition**

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**Abstract**

As two of the fastest-growing economies, China and India share many similarities. However, the air transport sector of the two countries exhibits substantial differences 30 years after deregulation. Private and low-cost airlines have become dominant players in the Indian airline market while the state-owned airlines still enjoy a dominant status in the Chinese market. The econometric analysis of this research suggests that the presence of a low-cost carrier (LCC) on a route has the effect of reducing the airfare and stimulating the demand for air travel in India, no matter the LCC presence is measured by market shares or dummies. Chinese LCCs have similar competitive effects only when the LCC entry is measured by dummy variables. Airport concentration in India could lead to cost savings and thus lower airfares, but this did not occur in China due largely to the lack of a culture of antitrust compliance. In both countries, airport concentration is positively associated with traffic demand. In India this may imply an increase in consumer welfare as airport concentration increases while in China this could mean that consumers would not be able to explore their welfare benefits to the full potential since concentration is positively associated with airfares. We also find that the absolute value of the price elasticity of the Indian market is much larger than that in the Chinese market, probably due to the high LCC penetration rates in India.

**Key words**: China, India, airline pricing, private airlines, low-cost carriers, government policy

1. **Introduction**

China and India are two of the fastest-growing economies in the world. Since 2007 China has been the second largest aviation market in the world in terms of passenger and freight traffic volumes in the domestic market. In 2016 the whole industry handled 488 million passengers and 6.7 million tons of air cargo, an increase of 10.7% and 6.2% from the previous year, respectively (CAAC, 2017). It is expected that in 2017 the number of air passengers handled will reach 536 million, and around 7 million tons of cargo traffic will be carried. India’s civil aviation industry has also been growing at a frenetic pace of over 7% in this new century. In the 2015-16 financial year, the passenger traffic increased to 104 million from the previous year’s 87 million, an increase of 19.5%. It is expected that India will become the third largest aviation market by 2020 after the United States (US) and China.

 Both countries commenced airline deregulation in the 1980s (the development background of the two countries will be discussed in Section 2). In the process of formulating new aviation policies, state-owned airlines in both countries could exercise a significant influence on the aviation authorities’ decisions, which led to checkered deregulation processes and inconsistent policies at times (Hooper, 1998; Zhang, 1998; Saraswati, 2001; Taneja, 2004; Findlay and Goldstein, 2004; Zhang and Round, 2008; Zhang and Findlay, 2010). However, since the beginning of the new century, the two airline markets have moved in very different directions. More specifically, the air transport sector of the two countries now exhibits very different results in industry structure and airline ownership: In China, four state-owned airline groups dominated the domestic market with an aggregate market share of 90% in 2016 whilst in India, the private airlines commanded a market share of around 80% in recent years, with low-cost carriers (LCCs) gaining a share of about 65%.

Comparative studies between China and India are voluminous in academic research and even more popular in public media, given that they are two most populated countries in the world (Liu and Jayakar, 2012). However, comparative analyses into the development of air transport policies, market structure, airline competition behavior and performance in China and India remain relatively sparse. The original structure–conduct–performance (SCP) paradigm proposed by Mason (1939, 1949) and Bain (1951, 1956) suggests that the structure of a market influences the conduct of the firms that operate in it, and in turn this conduct influences the performance of those firms. However, later SCP contributors believe that feedback effects exist: the performance variables may also affect conduct and structure, and conduct variables can influence structure. In addition, government policy and technological progress can change the conditions of supply and demand, which, in turn, can shape market structure and eventually have an impact on conduct and performance (Phillips, 1976; Lipczynski, et al., 2005). In the airline industry, the structure variables usually include the number of competitors, market concentration, product differentiation (e.g., full-service carriers (FSCs) versus LCCs), and the entry and exit conditions; the conduct mainly refers to airline pricing and non-price competition strategies; the performance indicators can be efficiency, profitability or the overall industry performance such as the potential benefits or welfare implications to passengers.

There is no doubt that deregulation, competition and privatization policies have played a key role in shaping the Chinese and Indian airline markets, in terms of changing the market structure, the airline conduct, and the overall performance of the industry. In particular, deregulation in market access in both countries was the key driver for the emergence of dozens of new airlines in the last three decades (Zhang and Zhang, 2016, 2018). The policy of allowing private capital into the airline industry has greatly improved the efficiency of this sector (Al-Jazzaf, 1999; Zhang and Zhang, 2018). Zhang and Zhang (2018) show that that Indian carriers tend to be more efficient than their Chinese counterparts. Most of the former are privately owned while most of the latter are majority government-owned. It is expected that the different policy environments in the two countries have had an impact on the market structure, which influences airline pricing and eventually consumer welfare. Therefore, the main objectives of this research include an examination of the key determinants of airline pricing behavior in both countries based on a review of the development of air transport policies and airline markets. The study will further employ demand equations to estimate the price elasticity for the two markets and the determinant factors for traffic demand.

Numerous theoretical and empirical studies have attempted to examine the pattern of airline pricing and price variation. In the airline economic literature, price discrimination has long been regarded as one of the sources of price variation (Borenstein, 1985). Most airline routes are oligopoly markets. Oligopolistic strategies used by the airlines on a typical oligopoly route is another source of price variation. Bilotkach et al. (2010) reported noticeably different pricing strategies used by competitors in the same market. Game theorists have illustrated that a change in demand conditions can lead to price wars and price collusion between competitors (Green and Porter, 1984; Rotemberg and Saloner, 1986), which is consistent with the empirical evidence from the US and Chinese airline markets (Brander and Zhang, 1993; Zhang and Round, 2011). Numerous literature has shown that demand attributes such as population, income and the share of business passengers, and product differentiation such as the services offered by FSCs and LCCs have significant effects on airline price competition (e.g., Mantin and Koo, 2009; Fu et al., 2015).

Airline pricing and market power issues in China’s airline market have been studied in Zhang and Round (2009a, 2009b, 2011) and Zhang (2012). The general conclusion is that airline consolidations in the early 2000s did not confer China’s three airline groups (China Eastern, China Southern and Air China) with any significant market power in both the short and longer terms, largely owing to the implementation of other forms of deregulation in the last two decades – including the relaxation of entry to and exit from markets, inviting private capital into the aviation sector and the emergence of LCCs (Zhang and Zhang, 2016). However, after examining the merger case between China Eastern and Shanghai Airlines in 2009, which resulted in a rise in departure-day prices by 22%, Zhang (2015) warned that China’s antitrust authorities should remain vigilant in handling airline mergers when numerous parallel routes are involved. The market power issue was also noted in Zhang et al. (2014), whose Lerner indices for the period 2010-11 confirmed the existence of a certain degree of market power in China’s airline market. Compared with the case of China, studies into the pricing behavior of Indian airlines are rare. To the best of our knowledge, Dutta and Santra (2016) is probably the only one that analyzes the dynamic price dispersion of the Indian domestic airline industry based on a small number routes. The authors found that route characteristics affect airfare movement as well as airfare dispersion. As departure date nears, airlines tend to charge higher prices.

 In the next section, we will briefly discuss the evolution of the air transport sector in China and India. Section 3 will present the methodology and data, followed by a discussion of the results in Section 4. The last section concludes.

1. **Background--Air Transport in China and India**

2.1 China

Before the mid-1980s, Chinese airline operations were under the name of CAAC (the abbreviation of the Civil Aviation Administration of China) that also acted as a government department and a regulator of the civil aviation. In the late 1980s, the CAAC’s governmental, administrative and regulatory role was separated from the direct management of the day-to-day operations of commercial airlines and airports (Le, 1997; Zhang, 1998; Zhang and Round, 2008). Between 1987 and 1991, six trunk airlines based in the regional capital cities were established: Air China (based in Beijing), China Eastern (Shanghai), China Northwest (Xi’an), China Northern (Shenyang), China Southwest (Chengdu), and China Southern (Guangzhou). Some local airlines were also established in that period by local governments such as Xiamen Airlines and Shanghai Airlines.

Until the 1990s, the airline industry was regulated in every aspect of air services provision, including market entry and exit, frequency, pricing, aircraft purchase, and international services (Zhang, 1998; Zhang and Chen, 2003). Controls on airfares were gradually relaxed from 1997 (Zhang and Round, 2008). As a result, airfares became cheaper and more flexible in the domestic market. Price wars became prevalent between airlines, resulting in heavy financial losses to the whole industry. This was not something that the regulator, CAAC, wanted to see. Then came the decision of consolidating the state-owned airlines in 2002, i.e., merging CAAC-controlled nine airlines into three airline groups: the Air China Group, the China Eastern Group, and the China Southern Group.

China’s first LCC, Spring Airlines, was launched by private investors in 2005 after the CAAC allowed private sector to participate in the civil aviation industry, and increased the limit on foreign ownership participation in Chinese airlines from 35% to 49% in 2004. By 2007 some 20 new private airlines had been approved in China including Shanghai-based Spring Airlines and Juneyao Airlines. Although most of the private airlines established around 2005 quickly failed due to the lack of experienced pilots and skilled personnel, along with the high costs and taxes associated with aircraft purchases, jet fuel and airport charges (Zhang et al., 2008; Zhang and Lu, 2013), they brought intense competitive pressure to the domestic aviation market. In 2007 the CAAC decided to suspend the approval of new domestic entrants until 2010. In fact, the suspension policy was not repealed until 2013. From 2013 to 2016, another wave of private airlines emerged including Ruili Airlines, Zhejiang Loong Airlines, Qingdao Airlines, and Jiuyuan Airlines. During this period, the four major airline groups also established their own subsidiaries, largely with the local governments that recognized the economic benefits of having a local carrier. For example, Hainan Airlines launched several subsidiaries together with the local governments including Urumqi Airlines, Fuzhou Airlines, Beibuwan Airlines, and Guilin Airlines.

Spring Airlines and Juneyao Airlines are two of the most successful private airlines in China, owing partly to the fact that they are based in Shanghai--the largest commercial city of China. Spring was the only LCC in China’s domestic market until the year 2010,[[1]](#footnote-1) and has been regarded as a role model of efficiency since its inception thanks to strict cost control. By the end of 2016, China had 59 commercial airline companies, including 44 state-owned airlines and 15 privately owned or controlled airlines. Seven airlines were publicly listed. Twelve had foreign equity participation. The four major airline groups commanded a market share of about 87.8% of the total traffic measured in ton-kilometers with other airlines (mainly private carriers) carrying the rest.

2.2 India

From 1953 to 1994, India’s aviation market was dominated by two government-owned airlines: Indian Airlines was the main player in the domestic market while Air India primarily served the international market. India’s private airlines emerged almost 20 years earlier than their Chinese counterparts. The Minister of Tourism and Civil Aviation announced that private airlines were allowed to operate charter and non-scheduled services under the Air Taxi Scheme in 1986, subject to some strict restrictions including not publishing time schedules. Following the repeal of the Air Corporations Act 1953 in 1994, six “air taxi” (a name referring to new airlines in India) operators were given permits to operate scheduled services in October 1994. The 1994 reform corporatized Air India and Indian Airlines, and allowed new private companies to provide services as fully-fledged airlines including East West Airlines, Jet Airways, Damania Airways, and ModiLuft (Hooper, 1998; Findlay and Goldstein, 2004). However, only Jet Airways and Sahara Airlines survived and continued to operate into the new century (Jain and Natarajan, 2015).

The government-owned Indian Airlines dominated the domestic market until 2001 when Jet Airways’ market share surpassed it. In 2003 three private airlines, Jet Airways, Air Sahara, and Air Deccan, carried more than half of the passenger traffic in the domestic market. Figure 1 shows that Jet Airways remained to be the largest Indian airline until 2012 when another private carrier, IndiGo, took the first place. In the 2015-16 financial year, major private carriers such as Jet Airways, SpiceJet, IndiGo, Vistara, AirAsia India, and Go Air carried 82 million passengers and 647,000 tons of cargo, representing a market share of 79% and 77%, respectively.[[2]](#footnote-2)

India’s domestic market is characterized by the heavy presence of LCCs. Air Deccan was India’s first low-cost airline based in Bangalore. Its commencement in 2003 was a landmark event for the industry (Jain and Natarajan, 2015), which spurred the entry of many other LCCs in [India](http://en.wikipedia.org/wiki/India) between 2005 and 2007, including [SpiceJet](http://en.wikipedia.org/wiki/SpiceJet), [IndiGo](http://en.wikipedia.org/wiki/IndiGo_Airlines), [GoAir](http://en.wikipedia.org/wiki/GoAir), and JetLite. Jain and Natarajan (2015) noted that the year 2005 was a watershed year for the Indian civil aviation sector as several private LCCs and FSCs such as Kingfisher, IndiGo, SpiceJet, GoAir, and Paramount launched their services. Even the national airline Air India introduced its LCC arm, Air Indian Express in 2005. The private LCC, IndiGo, has become the largest Indian airline since 2012. Its market share exceeded 40% by the end of 2016 (see Figure 1). The whole industry is currently dominated by LCCs as opposed to 10 years ago when the market was dominated by FSCs.

Similar to China, in 2004 the Indian government raised the limit on foreign equity in airline companies from 40% to 49%. However, equity from foreign airlines was not allowed – either directly or indirectly – in domestic transport services. At the same time, based on the government’s 5/20 rule, a new airline was not permitted to fly international routes unless it had had five years of domestic flying experience and at least 20 aircraft in its fleet. This 5/20 rule closed the door for new carriers to grow through operating international flights, thereby protecting the incumbent national airlines. However, with private carriers being the main players in the aviation market, there was no point to keep the rule that stifled the growth of new carriers. In 2016 the 5/20 rule was modified, and new airlines like Vistara and AirAsia India are allowed to commence international operations if they have 20 aircraft or 20% of total capacity, whichever is higher for domestic operations. Also in 2016, India announced that 100% foreign direct investment in Indian airlines was allowed, and foreign airlines could own up to 49% equity in Indian airlines.

 For many years, the performance of the national airlines was a headache to the Indian government. As early as 1995, the government set up a commission to diagnose the problems of Air India and Indian Airlines, but to no avail (Findlay and Goldstein, 2004). Privatization was considered, but was strongly opposed by the trade unions. Then the government resorted to airline consolidation as did by the Chinese government--in July 2007 Air India and Indian Airlines merged under the name of Air India. The government-owned airlines’ merger was a catalyst for a series of mergers among the private airlines. In 2007, Jet Airways took over the failing Air Sahara and renamed it as JetLite. Deccan was taken over by Kingfisher Airlines in 2008.

Figure 1 Passenger traffic carried by major Indian airlines 2007-2016

Note: 1. From 2011-12, the data for Air India have included the traffic of Indian Airlines; 2. Air Sahara was taken over by Jet Airways in 2007 and renamed JetLite;

Source: Directorate General of Civil Aviation (DGCA)

2.3 A summary

Zhang and Findlay (2014) constructed a comprehensive aviation policy comparison framework in which the aviation policy indices of 19 economies were compiled. The policy indicators considered for the policy indices include ownership conditions (for private equity and fore foreign equity), the number of established LCCs and effective passenger airlines (reflecting the ease of entry in the domestic market), multiple designation of local airlines on international routes, the presence of Open Skies agreements and the grant of the so-called 7th freedom rights for cargo services. The aviation policy indices considered both domestic and international aviation policy dimensions, marking it possible to compare the policy environment of the 19 economies. The index scores range from 0 to 7. The higher the score, the higher the level of restrictiveness. India received a score of 2.5 and ranked number 6 among the 19 economies while China ranked at the bottom with a score of 4.17, indicating that China has a very restrictive aviation environment. The policy indices complied in Zhang and Findlay (2014) have proved quite robust in estimating the relationship between aviation policy and passenger traffic flows (Zhang, 2015a). As the present research mainly compares the domestic markets of China and India, the updated domestic aviation policy indicators are summarized in Table 1. It should be noted that the competition policy embodied in a country’s antitrust laws plays a vital role in facilitating the development of the airline industry as it seeks to promote competition and to prevent abuses of market power by dominant airlines (i.e., influencing firms’ conduct) in the country, which will eventually foster innovation and improve customer choice (i.e., influencing firms’ performance). Therefore, we also include a competition policy indicator in Table 1. It is apparent that India has a much longer antitrust enforcement history. More discussion on the competition policy will be presented in the following sections.

< Table 1 Here >

**3. Airline pricing and demand models and data**

Referring to Dresner et al. (1996) and Hofer et al. (2008), we consider the following log-linear demand and supply (pricing) simultaneous equations. The structural demand equation is from air passengers’ utility maximization given airfares, and it is a function of airfare , route distance, and demand characteristics such as route endpoint cities’ population and GDP per capita. The effect of route distance on airline demand is indeterminate *a priori* (Zhang and Zhang, 2017): on the one hand, longer route distance discourages inter-city travel as longer travel time means some time waste for consumers. On the other hand, airlines have comparative advantage in travel time over other transport modes such as high-speed rail (HSR), conventional rail, and car, making it more attractive for long-distance travel. Therefore, the distance variable has both negative and positive impacts on the demand. In addition, we include the HSR dummy in our demand equation as it is an effective substitute for air transport on the short- and medium-haul routes and sometimes even on the long-haul routes (Zhu et al., 2017). It is expected that passengers’ utility level is influenced by airfares. The coefficient measures the price elasticity of the travel demand, which is another interest of this research.

 The structural “supply” (or pricing) equation is derived from airlines’ profit maximization (under a given market structure), and it is a function of cost variables, demand variables and market variables that capture potential or actual competitors (Peteraf and Reed, 1994). The traffic demand is included as it is a variable from both the demand and cost sides (Oum et al., 1993). On the cost side, higher passenger density could bring about cost economies and thus lower prices. Airlines operating at more concentrated airports (measured by Herfindalh-Hirshman Index, or ) tend to offer more capacity and thus enjoy economies of density, which could lead to lower prices. The distance variable is included as an airline’s average operating cost falls with the flying distance (Zhang and Zhang, 2017). The price equation also includes variables reflecting inter-airlines competition intensity such as route HHI () and the market share of LCCs ().

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| --- | --- | --- |
|   |  | (1) |

|  |  |  |
| --- | --- | --- |
|  |  | (2) |

The definitions of the explanatory variables are as follows:

* : the flying distance of route ;
* : the route-level HHI for route at time ;
* : the market share of the LCCon route at time ;
* : the HHI at the endpoint airports at time for airports and , respectively;
* and : the population of the endpoint cities at time ;
* and : the GDP (USD) per capita of the route’s endpoint cities;[[3]](#footnote-3)
* : the dummy for high-speed rail presence in the OD market at time ; [[4]](#footnote-4)
* : the vector of yearly dummies to control the yearly time effect;
* : the vector of monthly dummies to control the monthly time effect.

From the above structural airline demand and supply (pricing) equations (Eq. (1) and Eq. (2)) it is apparent that the airline traffic and price variables, and , are simultaneously determined and thus endogenous. We obtain the reduced-form demand and supply (pricing) equations by replacing the endogenous variable by all the exogenous variables of the system in the demand equation, and replacing the endogenous variable by all the exogenous variables of the system in supply (pricing) equation, respectively.

The reduced-form pricing and demand equations to be estimated for major Indian and Chinese domestic routes take the form shown in Eq. (3). The subscript indicates the endpoint airport , and subscript the other endpoint airport, and subscript time period .

|  |  |  |
| --- | --- | --- |
|  |  | (3) |

 For the airline pricing equation, the dependent variable is defined as:

* : the route-level average yield for route at time . Airline yield is calculated by dividing the airfare by flying distance of the route.

 For the air travel demand equation, the dependent variable is:

* : the number of passengers on route at time .

The panel data fixed effects (FE) and random effects (RE) models are used to estimate the reduced-form yield and demand equations.

**3.2 Data description**

The major Indian and Chinese domestic routes were selected for our price and demand estimations. The sample of the Indian case contains domestic routes linking India’s top-20 most populous cities. The routes connecting China’s top-20 largest airports are included in the China sample. The airport list is shown in Appendix 1. The airfare, the passenger number and the route distance can be retrieved from the AirportIS database of IATA. The route is defined as a non-directional city-pair such that the dual airports in one city, for example, Shanghai Pudong and Hongqiao airport have their data merged as one market. We collect monthly data from January 2012 to December 2015 for our sample routes, resulting in a total of 4,387 observations for the Indian market and 7,865 observations for the Chinese market.[[5]](#footnote-5) Our fare data are for the premium economy class and discount economy class. The airport HHI is calculated using the share of each operating airline’s passenger share at that airport, with the data available in AirportIS database as well. The LCCs that operate in the Indian sample routes include GoAir, IndiGo, Spicejet, Jetlite, AirAsia India, and TruJet. For the sample of Chinese routes, Spring Airlines, West Air, Chengdu Airlines, 9 Air, and Urumqi Airlines are the operating LCCs. The population and GDP data for Indian cities are from the Open Government Data Platform of the Indian government.[[6]](#footnote-6) For China, the city population and GDP data are retrieved from the annual statistics year book published by the local governments.

**4. Results and Analysis**

4.1 Descriptive statistics

The descriptive statistics of the variables are shown in Table1. It can be seen that the mean yield is much higher in the Chinese market than in India even though the average route distance is longer. Interestingly the average route HHI in India is substantially higher than in China and India’s airport concertation measured by airport HHI is also slightly higher. A stark difference between the two markets is that the market share of LCCs (mainly private carriers) is 71% for the Indian sample while this figure is only 3.5% for the Chinese sample.

< Table 2 Here >

4.2 Results for reduced-form yield and demand equations

The reduced-form airline yield and route-level demand estimations are presented in Table 3. The Hausman tests were conducted to see whether the random effects model or the fixed effects model is preferred. The Hausman test results are also reported in Table 3. As expected, the fixed effects models are preferred. However, for comparison purpose, we also report the results of the random effects models. We obtained mixed results for the population and income variables and in most instances, they are not statistically significant. We will then focus on the effects of other variables. In the Indian market, the prevalence of LCCs has helped reduce the airfare and promote air travel demand, which is suggested by the significantly negative sign of the LCC share in the reduced-form price equation and significantly positive sign of LCC share in the reduced-form demand equation. This is consistent with what was observed in the liberalized developed country markets (Dresner et al., 1996; Morrison, 2001). But for the Chinese sampled routes, the LCC sector only accounts for about 3.5% market share. The LCC share variable does not have a significant effect of lowering the prices of FSCs and promoting passenger volumes. This finding is consistent with Fu et al. (2015) and Wang et al. (2017b) who found that the largest LCC in China has only accounted for a small market share, and has not imposed competitive pressures on the FSCs. However, we notice that on most of the routes in the Chinese market, the LCC market share varies between 0 and 10%, which is relatively small. The lack of variation in LCC market share in the Chinese sample could result in inaccurate estimation results. Therefore, as a robustness check, apart from using the LCC share, we also use a dummy for the LCC presence to estimate the LCC effects in the reduced-form pricing and demand equations. The estimations using the LCC dummy are presented in Table 4. The results show that the LCC presence has a significant effect in reducing price and increasing airline traffic in China in the new estimations. But the magnitude of the LCC effects in China is still much smaller than that in India. In China, the LCC entry only caused a price drop by 2%, while in India this figure is 7%. Airline traffic increased by about 10% as a result of the LCC entry in China, whereas in India, the increase was about 15%. The results of other variables are largely consistent with those reported in Table 3.

 Fischer and Kamerschen (2003) pointed out that the sign for route HHI on airfares is theoretically ambiguous. One the one hand, a higher price is more easily maintained in a market where one dominant firm competes against a fringe of small firms, giving a smaller HHI (for example, a firm with 50% market share together with 5 small firms with 10% respectively), than where there are two well-established firm with similar size but a higher HHI (for example, each firm commands a market share of 50%). On the other hand, in the second scenario, it is more convenient for the two firms to engage in collusion and raise prices. Another possible case is that instead of exercising market power, if the dominance of the firm in the first scenario stems from technological advantages, cost savings could result and then a lower price could follow (Fischer and Kamerschen, 2003). Therefore, the sign of HHI is indeterminate. All these scenarios are highly possible in the airline industry. Actually, Fischer and Kamerschen (2003) found a negative and significant effect of route HHI on yields. However, in many other studies including Ito and Lee (2003), and Lijesen and Nijkamp (2004), the effect of route concentration as measured by HHI was not significant. In our study as shown in Table 3, for both Indian and Chinese samples, the route-HHI is positive and statistically significant in the airfare equations, and its effect is negative and significant in the demand equations. When the LCC dummy is used in place of the LCC share, the route HHI is not statistically significant (Table 4) for the India sample. Lower HHI usually implies a more liberalized market with little restriction on market access. Fu et al. (2015) discussed the recent deregulation moves taking place in China, which empowered airlines with more autonomy in route entry, network development and competition. Our finding suggests that these deregulation policies are effective and beneficial in promoting traffic demand for both markets. This further confirms the finding in Fu et al. (2010) that air transport liberalization has led to substantial economic and traffic growth.

Market power associated with airport dominance was first investigated by Borenstein (1989), Morrison and Winston (1989), Berry (1990) and Evans and Kessides (1993) who found a positive relationship between airport dominance and airfares. However, other studies suggest that such effects might have been overstated in the absence of controlling for factors such as the presence of LCCs (Morrison and Winston, 1995). In fact, Borenstein (2012) shows that in the last two decades, the impact of airport dominance has greatly declined with the direct impact becoming negative in the period 2006-2010. It is interesting to see that in our study, airport dominance, measured by airport HHI, helps reduce airfares in the Indian market. It is likely there exist significant cost savings of hub operations and economies of scope in the Indian market, which is consistent with the observation by Borenstein (2012). However, for the Chinese market, airport dominance could possibly raise airfare according to Tables 3 and 4, indicating a possible hub premium enjoyed by Chinese airlines.

Compared to China, India has had a relatively long history of antitrust enforcement. The Monopolies and Restrictive Trade Practices Act was in place from 1970 to 2002 and was then replaced by the Competition Act in 2003. In addition, India also has sectorial regulations with regard to anti-competitive practices such as the Electricity Act of 2003 and the Telecom Regulatory Authority of India Act of 1997 (Round and Zuo, 2008). In contrast, there is an absence of a culture of antitrust in China. China’s Anti-Monopoly Law (AML) was passed in 2007 and became effective since 1 August 2008. Zhang (2015) notes that China’s new antitrust enforcement agencies have limited resources and little experience in dealing with antitrust cases at this stage. That is why ten years after the enactment of the Anti-Monopoly Law, none of the airline mergers in China’s domestic market has been challenged. No airline has come under scrutiny for potential infringements of the Anti-Monopoly Law, even though reports on Chinese airlines’ price-fixing activities were not rare in public media. In 2015, the Competition Commission of India imposed fines on Jet Airways, IndiGo and SpiceJet for alleged collusive actions in setting fuel surcharge for air cargo services. Similar stories have never been heard in China. It is likely that in India there is a stronger deterrence of antitrust law infringements than in China and thus the antitrust law has a more powerful effect on the conduct of airline companies.[[7]](#footnote-7) Therefore, it is not surprising to see that airport concentration in India is associated with lower airfares while in China, this has not been observed.

Borenstein (2012) reports that recently passengers still demonstrate a strong preference for the local dominant airline as they did in the 1990s, and much more than in the 1980s. Vlachos and Lin (2014) show that frequent flyer program is statistically significant in building business traveler loyalty in China’s aviation market. Therefore, we cannot exclude the possibility that Chinese travelers tend to use the services of the carriers dominating the local market for the purpose of accumulating more frequent flyer points, which can confer the dominant airlines with a certain degree of market power as a result. Interestingly, in both countries, airport concentration is positively associated with traffic demand. For India, this may represent an increase in consumer welfare as airport concentration is negatively associated with the airfare while in China this could mean an increase in producer welfare at the expense that consumers would not be able to expand their welfare benefits to the full potential.

For the Chinese market, the reduced-form demand estimations show that the HSR presence decreased the demand for air travel by about 20%. Wan et al. (2016) and Zhang et al. (2017) also found that the HSR entry caused significant decline in airline traffic and eventually resulted in capacity withdrawal in the Chinese market. However, the prices charged by Chinese airlines seem not to be significantly affected by HSR. This finding is consistent with those reported in Wang et al. (2017c). In fact, airlines rarely attempted to match the HSR prices which were relatively fixed. Their main response to the entry of HSR was to develop new strategies such as reducing frequency and capacity, and charging higher prices to price-insensitive passengers as HSR may not be a good substitute to these passengers.

< Tables 3 and 4 Here>

4.3 Price elasticity of demand

We adopt a two-stage least square (2SLS) approach to estimate price elasticities based on the structural demand equation (Eq. (1)). At the first stage, the route-level and airport-level HHI, and the share of LCCs are used as the instrument variables (IVs) for the airline yield in the demand equation. At the second stage, the fitted values of the airline yield are used for the demand regression.

 The estimation results are collated in Table 5, with the first-stage estimation result shown in Table 6. The Hausman test suggests the superiority of the fixed effects model for the Indian market, but there is no significant difference in coefficient estimates between the fixed and random effects models for the China sample. We thus mainly rely on the random effects model for interpretation for the Chinese markets. Table 5 shows that the demand elasticity is about -2.6 for the Indian market and this figure is about -1.2 for the Chinese market. The elasticity in India is about twice as large as that of China in absolute value, which is considered rather high. Previous demand estimations for the developed economies show that the values of air travel price elasticities range from -0.8 to -2.0 (Oum et al., 1992, 1993). Brons et al. (2002) conducted a meta-analysis and found that the price elasticity values are from 0.2 to -3.2, with the majority varying between -1.0 and -2.0. Therefore, the major Indian routes have a very price-elastic demand compared with other aviation markets in the world. For China, our demand elasticity estimate is somewhat similar to Zhang et al. (2014) and Wang et al. (2017a) whose estimates are around -1.00 by using data prior to 2012. The large difference in income between China and India may in part help explain the large difference in the values of price elasticity. Table 2 suggests that China has a much higher level of GDP per capita, which implies that expenditures on air travel are a relatively small proportion of consumers’ total budget and thus the demand is less elastic. In addition, the Chinese market is dominated by state-owned FSCs which could effectively use such tools as frequent flyer program (FFP) to retain customers, whilst in India the prevalence of LCCs means that the FFP is either absent or less attractive. [Mumbower](http://www.sciencedirect.com.ezproxy.usq.edu.au/science/article/pii/S0965856414001177) et al. (2014) pointed out that with the increasing importance of Internet as a distribution channel and the market penetration of LCCs, airline pricing has become more transparent, making it easier for consumers to compare prices across multiple competitors and tailor travel plans to take advantage of lower fares. Such transparency will undoubtedly make demand for air travel more elastic.

< Table 5 & 6 Here >

1. **Conclusion and discussion**

For many years until recently, surface transport modes were more important than air transport in both China and India, and the relatively expensive air travel only belonged to the elite group. Both countries share many other similarities. For example, both countries initiated air transport deregulation in the 1980s and the air transport sector in these two countries has been experiencing rapid growth over the last decade. However, due to different market regulatory conditions and growth strategies adopted by each individual carrier, there is a big difference in LCC penetration rates between the two markets. Private airlines and LCCs have become dominant players in the Indian airline market while LCCs in China only command a relatively small market share. This research has found that the presence of an LCC on a route has the effect of reducing the airfares and promoting the demand for air travel in both countries when the LCC dummy is used. However, when the presence of the LCC is measured by the LCC market share, we did not find any significant competitive effect from LCC in the Chinese market. The pricing and demand models also suggest that route-level competition and the resultant lower route HHI have the effect of promoting passenger traffic flows in both countries. Airport concentration in India could lead to cost savings and thus lower airfares, but this did not occur in China.

 This study shows that the price elasticities differ greatly in the two markets. Apart from the difference in income, the heavy presence of LCCs in India’s aviation market might be the key factor resulting in a more elastic demand in India. However, the determinants of the price elasticities are not a research focus of this study. Rigorous research in this area is needed in future studies as such information will assist airlines and aviation authorities to determine how to charge additional fees such as fuel cost and airport tax without substantially decreasing the demand.

 The dominant status of LCCs in India and its implication to the competition outcome and consumer welfare do not come by chance. Zhang and Zhang (2018) analyzed the policy environments in which private airlines and LCCs operate, which could help explain the findings revealed in this study. First, India opened the aviation sector to private investors in the mid-1980s while China only did so in 2005. Second, price-fixing was tacitly allowed and sometimes encouraged by CAAC. Zhang and Round (2011) reported that airfare collusion in China was not a secret. Sales managers of major Chinese airlines such as Air China, China Southern and China Eastern met regularly to coordinate prices. This was still the case even after the introduction of China’s Anti-Monopoly Law in 2008. China’s state-owned airlines could enjoy a certain degree of market power either through explicit and implicit collusion, or mergers and acquisitions to defend their market share and eliminate potential competition from private carriers including privately owned LCCs (Zhang, 2015b). Third, Chinese government has encouraged and guided mergers between state-owned carriers. The LCC and private carriers did not have a chance to have their voice heard when such mergers occurred. For example, the merger between China Eastern and Shanghai Airlines in 2009 was not challenged, nor were any conditions imposed, such as giving up some slots at Shanghai Pudong and Shanghai Hongqiao airports. Finally, China’s airport slot allocation and management system at key airports such as Beijing, Shanghai and Guangzhou is far less transparent and fair compared with the case of India (Zhang and Zhang, 2018), which has led to rampant corruption and bribery and stifled the growth of LCCs and private carriers.

The findings of the research show the importance of government policies and regulations in shaping an industry’s market structure and firms’ conduct. China can learn a lot from India’s experience: it is vital for China to formulate appropriate air transport policies to unleash the potential of LCCs and private carriers; it is also necessary to promote an awareness of antirust compliance among Chinese airlines; most importantly, an effective and legitimate enforcement of the existing Anti-Monopoly Law is urgently needed to facilitate competition and promote consumer welfare in the air transport sector.

**References**

Al-Jazzaf, M.I., 1999. Impact of privatization on airlines performance: an empirical analysis. Journal of Air Transport Management, 5(1), 45-52.

Bain, J.S., 1951. Relation of profit rate to industry concentration: American manufacturing 1936–1940. Quarterly Journal of Economics, 65(3), 293–324.

Bain, J.S., 1956. Barriers to New Competition. Harvard University Press, Cambridge, MA.

Berry, S.T., 1990. Airport presence as product differentiation. [American Economic Review](http://econpapers.repec.org/article/aeaaecrev/), 80(2), 394-399.

Blair, R.D. and Durrance, C.P., 2008. Antitrust sanctions: deterrence and (possibly) overdeterrence. Antitrust Bulletin, 53, 643-662.

Bigoni, M., Fridolfsson, S.O., Le Coq, C. and Spagnolo, G., 2015. Trust, leniency, and deterrence. The Journal of Law, Economics, and Organization, 31(4), 663-689.

Brons, M., Pels, E., Nijkamp, P., Rietveld, P., 2002. Price elasticities of demand for passenger air travel: a meta-analysis. Journal of Air Transport Management, 8, 165-75.

Borenstein, S., 1985. Price discrimination in free-entry markets. RAND Journal of Economics, 16, 380–397.

Borenstein, S., 1989. Hubs and high fares: dominance and market power in the US airline industry. RAND Journal of Economics, 20(3), 344-365.

Borenstein, S., 2012. What happened to airline market power? Unpublished manuscript, available at http://faculty.haas.berkeley.edu/borenste/AirMktPower2013.pdf.

Brander, J.A. and Zhang, A., 1993. Dynamic oligopoly behaviour in the airline industry. International Journal of Industrial Organization, 11, 407–435.

CAAC 2017. 2016 Civil Aviation Development Statistics Bulletin. Civil Aviation Administration of China, Beijing, China.

Clougherty, J.A., Duso, T., Lee, M. and Seldeslachts, J., 2016. Effective European antitrust: does EC merger policy generate deterrence?. Economic Inquiry, 54(4), 1884-1903.

Dutta G. and Santra, S., 2016. An empirical study of price movements in the airline industry in the Indian market with power divergence statistics. Journal of Revenue and Pricing Management. 2006, 1-15.

Dresner, M., Lin, J. and Windle, R., 1996. The impact of low-cost carriers on airport and route competition. Journal of Transport Economics and Policy, 30, 309−328.

Evans, W.N. and Kessides, I.N., 1993, Localized market power in the US airline industry. Review of Economics and Statistics, 75(1), 66-75.

Findlay, C. and Goldstein, A., 2004. Liberalization and foreign direct investment in Asian transport systems: the case of aviation. Asian Development Review, 21(1), 37–65.

Fischer, T. and Kamerschen, D.R., 2003. Measuring competition in the US airline industry using the Rosse-Panzar test and cross-sectional regression analyses. Journal of Applied Economics, 6(1), 73-93.

Fu, X., Lei, Z., Wang, K. and Yan, J., 2015. Low cost carrier competition and route entry in an emerging but regulated aviation market- the case of China. Transportation Research Part A: Policy and Practice, 79, 3–16.

Gale, I., 1993. Price dispersion in a market with advance-purchases. Review of Industrial Organization, 8, 451–464.

Hofer, C., Windle, R.J. and Dresner, M.E., 2008. Price premiums and low cost carrier competition. Transportation Research Part E: Logistics and Transportation Review, 44(5), 864-882.

Hooper, P., 1998. Airline competition and deregulation in developed and developing country contexts—Australia and India. Journal of Transport Geography, 6(2), 105–116.

Jain, R.K. and Natarajan, R., 2015. A DEA study of airlines in India. Asia Pacific Management Review, 20, 285–292.

Le, T.T., 1997. Reforming China’s airline industry: from state-owned monopoly to market dynamism. Transportation Journal, 36, 45−62.

Lipczynski, J., Wilson, J. and Goddard, J.,2005. Industrial Organisation: Competition, Strategy, Policy, 2nd ed., Prentice Hall, Harlow, UK.

Liu, C. and Jayakar, K., 2012. The evolution of telecommunications policy-marking: comparative analysis of China and India. Telecommunications Policy, 36, 13–28.

Mason, E.S. 1939. Price and production policies of large-scale enterprises. American Economic Review, 29, 61–74.

Mason, E.S. 1949. The current state of the monopoly problem in the United States. Harvard Law Review, 62, 1265–1285.

Morrison, S.A., 2001. Actual, adjacent, and potential competition: estimating the full effect of Southwest Airlines. Journal of Transport Economics and Policy, 35, 239−256.

Morrison, S.A. and Winston, C., 1989. Enhancing the performance of the deregulated air transportation system. Brooking Papers on Economic Activity: Microeconomics, 61-123.

Morrison, S.A. and Winston, C., 1995. The Evolution of the Airline Industry. The Brookings Institution, Washington, DC.

Mumbower, S., Garrow, L.A. and Higgins, M.J., 2014. Estimating flight-level price elasticities using online airline data: a first step toward integrating pricing, demand, and revenue optimization. Transportation Research Part A: Policy and Practice, 66, 196-212.

Oum, T.H., Waters, W.G. and Yong, J.S., 1992. Concepts of price elasticities of transport demand and recent empirical estimates: an interpretative survey. Journal of Transport Economics and Policy, 26, 139-154.

Oum, T.H., Zhang, A. and Zhang, Y., 1993. Inter-firm rivalry and firm-specific price elasticity in airline markets. Journal of Transport Economics and Policy, 27, 171–192.

Peteraf, M.A. and Reed, R., 1994. Pricing and performance in monopoly airline markets. The Journal of Law and Economics, 37(1), 193-213.

Phillips, A., 1976. A critique of empirical studies of relations between market structure and profitability. Journal of Industrial Economics, 24(4), 241–249.

Round, D.K. and Zuo, A., 2008. The welfare goal of antitrust laws in Asia: for whom should the law toil?. Asian‐Pacific Economic Literature, 22(2), 31-56.

Saraswati, S.K., 2001. Operating environment for a civil aviation industry in India. Journal of Air Transport Management, [7(2](http://www.sciencedirect.com/science?_ob=PublicationURL&_tockey=%23TOC%236044%232001%23999929997%23226054%23FLA%23&_cdi=6044&_pubType=J&_auth=y&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=15d51c26b3185d27cc1416a96214a2f2)), 127–135.

Stavins, J., 1996. Price discrimination in the airline market: the effect of market concentration. Review of Economics and Statistics, 83, 200–202.

Taneja, N., 2004. Simpli-flying, Optimizing the Airline Business Model, Aldershot, England: Ashgate Publishing Limited.

Wan, Y., Ha, H.-K., Yoshida, Y. and Zhang, A., 2016. Airlines’ reaction to high-speed rail entries: empirical study of the Northeast Asian market. Transportation Research Part A: Policy and Practice, 94, 532–557.

Wang, K., Fu, X. and Oum, T.H. 2017a. Airline competition and air travel demand analysis in a market with legacy regulation- the case of China. Working Paper, Sauder School of Business, University of British Columbia, Vancouver, BC, Canada.

Wang, K., Xia, W. and Zhang, A. 2017b. Should China further expand its high-speed network? Consider the low-cost carrier factor. Transportation Research Part A: Policy and Practice, 100, 105-120.

Wang, K., Xia, W., Zhang, A. and Zhang, Q., 2017c. Effects of high-speed rail speed on airline demand and price: theoretical analysis and empirical evidence from a quasi-natural experiment. Working paper, Sauder School of Business, University of British Columbia, Vancouver, BC, Canada.

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

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

Zhang, A., Hanaoka, S., Inamura, H. and Ishikura, T., 2008. Low cost carriers in Asia: deregulation, regional liberalization and secondary airports. Research in Transportation Economics, 24, 36–50.

Zhang, A. and Zhang, Y., 2017. Airline economics and finance, in: Anne Graham and Nigel Halpern (eds.)**,** The Routledge Companion to Air Transport Management, Chapter 8.Routledge. forthcoming.

Zhang, A., Zhang, Y. and Zhao, R., 2001. Impact of ownership and competition on the productivity of Chinese enterprises. Journal of Comparative Economics, 29, 327-346.

Zhang, Q., Yang, H., Wang, Q. and Zhang, A., 2014. Market power and its determinants in the Chinese airline industry. Transportation Research Part A: Policy and Practice, 64, 1−13.

Zhang, Q., Yang, H., Wang, Q., 2017. Impact of high-speed rail on China’s Big Three airlines. Transportation Research Part A: Policy and Practice, 98, 77–85.

Zhang, Y., 2012. A retrospective analysis of the effects of airline, mergers on China Eastern’s lifeline routes: a difference-in-differences approach. Journal of the Asia Pacific Economy, 17, 464−475.

Zhang, Y., 2015a. International arrivals to Australia: determinants and the role of air transport policy. Journal of Air Transport Management, 44, 21-24.

Zhang, Y., 2015b. Merger between airlines in financial distress: does the merger save them? Competition and Regulation in Network Industries, 16, 66−81.

Zhang, Y. and Findlay, C., 2010. Air transport liberalization, in: E. Ghani (ed.), The Service Revolution in South Asia, Oxford University Press.

Zhang, Y. and Findlay, C., 2014. Air transport policy and its impacts on passenger traffic and tourist flows. Journal of Air Transport Management, 34, 42-48.

Zhang, Y. and Lu, Z., 2013. Low cost carriers in China and its contribution to passenger traffic flow. Journal of China Tourism Research, 9, 207−217.

Zhang, Y. and Round, D.K., 2008. China's airline deregulation since 1997 and the driving forces behind the 2002 airline consolidations. Journal of Air Transport Management, 14, 130−142.

Zhang, Y. and Round, D.K, 2009a. Policy implications of the effects of concentration and multimarket contact in China's airline market. Review of Industrial Organisation,34(4), 307-326

Zhang, Y. and Round, D.K, 2009b. The effects of China's airline mergers on prices. Journal of Air Transport Management, 15, 315−323.

Zhang, Y. and Round, D.K., 2011. Price wars and price collusion in China's airline markets. International Journal of Industrial Organization, 29, 361–372.

Zhang, Y. and Zhang, A., 2016. Determinants of air passenger flows in China and gravity model: deregulation, LCCs, and high-speed rail. Journal of Transport Economics and Policy, 50(3), 287–303.

Zhang, Y. and Zhang, A., 2018. Air transport development: a comparative analysis of China and India, in: M. Finger and K. Button (eds.), Air Transport Lateralization: A Critical Assessment. Edward Elgar, forthcoming.

Zhu, Z., Zhang, A. and Zhang, Y., 2017. Connectivity of intercity passenger transportation in China: a multi-modal and network approach. Journal of Transport Geography, in press.

Table 1. Key policies influencing the airline industry

|  |  |  |
| --- | --- | --- |
| Aviation policy indicators  | China | India |
| Air transport deregulation time | Started in the 1980s | Started in the 1980s |
| National airline ownership  | Partly privatized and all the big three government-controlled airlines (Air China, China Eastern and China Southern) are publicly listed. | Air India is still 100% owned by Indian Government  |
| Foreign equity participation in domestic airlines | The maximum share of foreign equity in Chinese airlines was raised from 35% to 49% in 2002. | The share of foreign equity in airline companies was raised from 40% to 49% in 2004. In 2016, 100% foreign direct investment in Indian airlines was allowed, and foreign airlines could own up to 49% equity in Indian airlines. |
| Policy on private airlines  | The first private airline was established in 2005. In 2016 the market share of private airlines in China was less than 10%. | The first scheduled private airline was established in 1991. In 2016 the market share of private airlines was about 85% |
| Policy on LCCs  | The first LCC (Spring Airlines) took off in 2005. In 2016, the market share of LCCs was less than 10%. | The first LCC (Air Deccan) took off in 2003. In 2016, the market share of LCCs was around 65% |
| Competition policy  | The Anti-Monopoly Law of China came in effective in 2008. | The Competition Act was enacted in 2003 to replace the Monopolies and Restrictive Trade Practices Act, 1969.  |

Table 2. Descriptive statistics for the variables for the airline yield and demand estimation

|  |  |  |  |
| --- | --- | --- | --- |
|  | India | China |  |
|  | No. of Obs. | Mean | Std. dev. | No. of Obs. | Mean | Std. dev. |  |  |
| Yield (USD/Km) | 4,387 | 0.091 | 0.063 | 7,865 | 0.117 | 0.048 |  |  |
| Passenger volume on the route | 4,387 | 15,640 | 24,031 | 7,865 | 33,581 | 24,031 |  |  |
| Route distance (Km) | 4,387 | 946 | 481 | 7,865 | 1,224 | 527 |  |  |
| HHI of the route | 4,387 | 5,806 | 2,998 | 7,865 | 3,414 | 2,998 |  |  |
| Population (person) | 4,387 | 6,898,711 | 3,259,604 | 7,865 | 1,009,000 | 646,268 |  |  |
| GDP per capita (USD per person) | 4,387 | 1,733 | 517 | 7,865 | 13,260 | 3,529 |  |  |
| HHI of the OD airports | 4,387 | 1,825 | 494 | 7,865 | 1,575 | 278 |  |  |
| LCC share on the route | 4,387 | 0.710 | 0.315 | 7,865 | 0.035 | 0.063 |  |  |
| HSR | NA | NA | NA | 7,865 | 0.246 | 0.430 |  |  |

Note: The HSR variable is not included in econometric models for the Indian market as there was no HSR in India during the study period,

Table 3. Estimation results of the reduced-form airline yield and demand equations

|  |  |  |
| --- | --- | --- |
|  | Yield (reduced-form) | Demand (reduced-form) |
|  | India | China | India | China |
|  | Fixed Effects | Random Effects | Fixed Effects | Random Effects | Fixed Effects | Random Effects | Fixed Effects | Random Effects |
| lnDistance |  | -0.619\*\*\* |  | -0.416\*\*\* |  | -0.382\*\*\* |  | 0.861\*\*\* |
|  |  | (0.013) |  | (0.016) |  | (0.085) |  | (0.116) |
| lnHHI\_Route | 0.040\*\*\* | 0.065\*\*\* | 0.134\*\*\* | 0.140\*\*\* | -0.820\*\*\* | -0.841\*\*\* | -0.256\*\*\* | -0.337\*\*\* |
|  | (0.013) | (0.011) | (0.009) | (0.008) | (0.018) | (0.018) | (0.031) | (0.031) |
| LCC\_Share | -0.135\*\*\* | -0.166\*\*\* | 0.016 | 0.020 | 0.166\*\*\* | 0.188\*\*\* | 0.005 | 0.016 |
|  | (0.018) | (0.015) | (0.053) | (0.049) | (0.025) | (0.025) | (0.187) | (0.188) |
| lnHHI\_Airport | -0.215\*\*\* | -0.147\*\*\* | 0.197\*\*\* | 0.224\*\*\* | 0.626\*\*\* | 0.487\*\*\* | 0.431\*\*\* | 0.546\*\*\* |
|  | (0.047) | (0.027) | (0.033) | (0.027) | (0.065) | (0.061) | (0.117) | (0.113) |
| lnPopulation | 0.463\* | -0.017 | -0.183\*\* | 0.053\*\*\* | -0.028 | 1.704\*\*\* | 0.358 | 0.781\*\*\* |
|  | (0.255) | (0.022) | (0.087) | (0.012) | (0.351) | (0.125) | (0.306) | (0.087) |
| lnGDP\_Capita | -0.225 | -0.032 | -0.130 | 0.105\*\*\* | -1.062\*\*\* | 0.113 | 0.338 | 0.741\*\*\* |
|  | (0.200) | (0.029) | (0.087) | (0.014) | (0.276) | (0.156) | (0.303) | (0.090) |
| HSR |  |  | 0.007 | 0.009 |  |  | -0.232\*\*\* | -0.236\*\*\* |
|  |  |  | (0.006) | (0.006) |  |  | (0.024) | (0.024) |
| Constant | -7.028\* | 2.52\*\*\* | -2.339 | -3.471\*\*\* | 19.109\*\*\* | -12.950\*\*\* | 0.105 | -9.811\*\*\* |
|  | (3.940) | (0.446) | (1.456) | (0.312) | (5.435) | (1.857) | (5.128) | (1.938) |
| No. of Obs. | 4,378 | 4,378 | 7,865 | 7,865 | 4,378 | 4,378 | 7,865 | 7.865 |
| Year dummies | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Month dummies | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Hausman test |  |  |  |  |  |  |  |  |
| Chi-squared | 67.04 | 19.17 | 212.34 | 390.11 |
| Prob>Chi-squared | 0.000 | 0.0238 | 0.000 | 0.000 |

Note:

1. Since there is no HSR operation in India, the HSR variable is omitted for estimation of the Indian market.

2. Standard errors are in parentheses. \* 10% significance, \*\* 5% significance, \*\*\* 1% significance.

Table 4. The estimation of the reduced-form airline yield and demand equations using LCC dummy

|  |  |  |
| --- | --- | --- |
|  | Yield (reduced-form) | Demand (reduced-form) |
|  | India | China | India | China |
|  | Fixed Effects | Random Effects | Fixed Effects | Random Effects | Fixed Effects | Random Effects | Fixed Effects | Random Effects |
| lnDistance |  | -0.632\*\*\* |  | -0.411\*\*\* |  | -0.371\*\*\* |  | 0.834\*\*\* |
|  |  | (0.013) |  | (0.016) |  | (0.087) |  | (0.116) |
| lnHHI\_Route | 0.010 | 0.025\*\* | 0.129\*\*\* | 0.136\*\*\* | -0.774\*\*\* | -0.790\*\*\* | -0.235\*\*\* | -0.317\*\*\* |
|  | (0.013) | (0.012) | (0.009) | (0.008) | (0.018) | (0.018) | (0.031) | (0.031) |
| LCC dummy | -0.071\*\*\* | -0.124\*\*\* | -0.023\*\*\* | -0.018\*\*\* | 0.149\*\*\* | 0.162\*\*\* | 0.111\*\*\* | 0.107\*\*\* |
|  | (0.018) | (0.015) | (0.006) | (0.006) | (0.025) | (0.025) | (0.022) | (0.023) |
| lnHHI\_Airport | -0.201\*\*\* | -0.137\*\*\* | 0.184\*\*\* | 0.211\*\*\* | 0.617\*\*\* | 0.483\*\*\* | 0.486\*\*\* | 0.602\*\*\* |
|  | (0.047) | (0.027) | (0.033) | (0.027) | (0.065) | (0.061) | (0.116) | (0.113) |
| lnPopulation | 0.511\*\* | -0.018 | -0.178\*\* | 0.055\*\*\* | -0.064 | 1.701\*\*\* | 0.343 | 0.770\*\*\* |
|  | (0.256) | (0.021) | (0.087) | (0.012) | (0.352) | (0.128) | (0.305) | (0.087) |
| lnGDP\_Capita | -0.209 | -0.036 | -0.125 | 0.107\*\*\* | -1.079\*\*\* | 0.099 | 0.324 | 0.730\*\*\* |
|  | (0.201) | (0.028) | (0.086) | (0.014) | (0.276) | (0.159) | (0.302) | (0.090) |
| HSR |  |  | 0.006 | 0.009 |  |  | -0.230\*\*\* | -0.233\*\*\* |
|  |  |  | (0.006) | (0.006) |  |  | (0.024) | (0.024) |
| Constant | -7.790\*\* | 2.903\*\*\* | -2.283 | -3.399\*\*\* | 19.467\*\*\* | -13.297\*\*\* | 2.683 | -10.069\*\*\* |
|  | (3.957) | (0.441) | (1.452) | (0.210) | (5.439) | (1.892) | (5.093) | (1.938) |
| No. of Obs. | 4,378 | 4,378 | 7,865 | 7,865 | 4,378 | 4,378 | 7,865 | 7.865 |
| Year dummies | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Month dummies | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Hausman test |  |  |  |  |  |  |  |  |
| Chi-squared | 89.74 | 24.77 | 206.8 | 396.83 |
| Prob>Chi-squared | 0.000 | 0.0032 | 0.000 | 0.000 |

Note:

1. Since there was no HSR in India, the HSR variable is omitted for estimation of Indian markets.

2. Standard errors are in parentheses. \* 10% significance, \*\* 5% significance, \*\*\* 1% significance

Table 5. 2SLS estimation of the structural demand equation

|  |  |  |
| --- | --- | --- |
|  | India | China |
|  | Fixed Effects | Random Effects | Fixed Effects | Random Effects |
| lnYield | -2.600\*\*\* | -2.585\*\*\* | -1.150\*\*\* | -1.255\*\*\* |
|  | (0.350) | (0.323) | (0.197) | (0.193) |
| lnDistance |  | -2.151\*\*\* |  | 0.406\*\* |
|  |  | (0.250) |  | (0.178) |
| lnPopulation | 1.473\* | 2.310\*\*\* | -0.085 | 0.761\*\*\* |
|  | (0.789) | (0.202) | (0.314) | (0.114) |
| lnGDP | -1.050\* | 0.234 | -0.040 | 0.789\*\*\* |
|  | (0.601) | (0.268) | (0.308) | (0.116) |
| HSR |  |  | -0.231\*\*\* | -0.231\*\*\* |
|  |  |  | (0.024) | (0.024) |
| Constant | -13.899 | -22.072\*\*\* | 8.138\* | -8.402\*\*\* |
|  | (12.147) | (2.783) | (4.902) | (2.298) |
| No. of Obs. | 4,387 | 4,387 | 7,865 | 7,865 |
| Year dummies | ✓ | ✓ | ✓ | ✓ |
| Month dummies | ✓ | ✓ | ✓ | ✓ |
| Hausman Test |  |  |  |  |
| Chi-squared | 168.52 | 19.20 |
| Prob>Chi-squared | 0.000 | 0.3799 |

Note:

1. Since there was no HSR in India, the HSR variable is omitted for the India sample.

2. Standard errors are in parentheses. \* 10% significance, \*\* 5% significance, \*\*\* 1% significance.

Table 6. The first-stage regression of the structural demand equation

|  |  |  |
| --- | --- | --- |
|  | India | China |
|  | Fixed Effects | Random Effects | Fixed Effects | Random Effects |
| lnHHI\_route | 0.040\*\*\* | 0.044\*\*\* | 0.134\*\*\* | 0.137\*\*\* |
|  | (0.013) | (0.012) | (0.009) | (0.009) |
| lnHHI\_airport | -0.215\*\*\* | -0.213\*\*\* | 0.197\*\*\* | 0.211\*\*\* |
|  | (0.047) | (0.041) | (0.033) | (0.031) |
| LCC\_share | -0.135\*\*\* | -0.141\*\*\* | 0.016 | 0.009 |
|  | (0.018) | (0.017) | (0.053) | (0.052) |
| lnDistance |  | -0.625\*\*\* |  | -0.423\*\*\* |
|  |  | (0.045) |  | (0.042) |
| lnPopulation | 0.463\* | 0.00009 | -0.183\*\* | 0.026 |
|  | (0.255) | (0.068) | (0.087) | (0.031) |
| lnGDP | -0.225 | -0.105 | -0.130 | 0.077\*\* |
|  | (0.200) | (0.088) | (0.086) | (0.031) |
| HSR |  |  | 0.007 | 0.008 |
|  |  |  | (0.007) | (0.006) |
| Constant | -7.028\* | 3.471\*\*\* | -2.246 | -2.850\*\*\* |
|  | (3.940) | (1.041) | (1.453) | (0.677) |
| No. of Obs. | 4,387 | 4,387 | 7,865 | 7,865 |
| Year dummies | ✓ | ✓ | ✓ | ✓ |
| Month dummies | ✓ | ✓ | ✓ | ✓ |

Note:

1. Since there was no HSR in India, the HSR variable is omitted for the India sample.

2. The Hausman test for 2SLS was only done for the second-stage regression, while not for the first-stage regression on the endogenous variable.

3. Standard errors are in parentheses. \* 10% significance, \*\* 5% significance, \*\*\* 1% significance.

Appendix 1. List of sample airports

|  |  |
| --- | --- |
| Indian airports | Chinese airports |
| Airport code | City | Airport code | City |
| BOM | Mumbai | PEK | Beijing |
| DEL | Delhi | CAN | Guangzhou |
| CCU | Kolkata | PVG | Shanghai |
| MAA | Chennai | SHA | Shanghai |
| BLR | Bangalore | CTU | Chengdu |
| HYD | Hyderabad | SZX | Shenzhen |
| AMD | Ahmedabad | KMG | Kunming |
| PNQ | Pune | CKG | Chongqing |
| STV | Surat | XIY | Xi'an |
| JAI | Jaipur | HGH | Hangzhou |
| KNU | Kanpur | XMN | Xiamen |
| LKO | Lucknow | CSX | Changsha |
| NAG | Nagpur | WUH | Wuhan |
| DEL | Ghaziabad | TAO | Qingdao |
| IDR | Indore | URC | Urumqi |
| CJB | Coimbatore | NKG | Nanjing |
| COK | Kochi | CGO | Zhengzhou |
| PAT | Patna | SYX | Sanya |
| CCJ | Kozhikode  | HAK | Haikou |
| BHO | Bhopal | DLC | Dalian |

Note:

 1. Delhi and Ghaziabad share the same airport DEL;

2. The data for Shanghai’s Pudong (PVG) and Hongqiao (SHA) are aggregated as the market is defined as city pair.

1. Only in recent years have several new LCCs emerged. However, these LCCs are all subsidiaries of the incumbent FSCs, and were established to provide differentiated services for their parent FSCs to gain a competitive edge (Wang et al., 2017). For example, Hainan Airlines, the fourth largest FSC in China, owned three LCC subsidiaries: namely, West Air, Lucky Air, and Urumqi Air. China Eastern owns China United as its LCC off-shoot. Sichuan Airlines is the major shareholder of Chengdu Airlines, an LCC based in Chengdu and formerly known as United Eagle. Juneyao established its own LCC, Jiuyuan Airlines. [↑](#footnote-ref-1)
2. See the statistics compiled by Directorate General of Civil Aviation (DGCA) at http://dgca.nic.in/reports/Traffic-ind.htm. [↑](#footnote-ref-2)
3. The GDP per capita data for the Indian market are at the state (province) level, as the city level GDP per capita is not available. [↑](#footnote-ref-3)
4. The HSR variable helps capture the competitive effect that HSR imposes on the airline market in China. At the end of our study period (year 2015), China had built a total of 19,838km of HSR network, longer than the HSR lines of the rest of the world combined. India has yet developed HSR, however, although it just signed a contract with Japan to jointly launch the Mumbai-Ahmedabad HSR project, using the Shinkansen technology. The construction of this 500km HSR line is expected to begin in 2017. [↑](#footnote-ref-4)
5. This is a period during which both countries’ air transport policy was relatively stable and the aviation industry had just recovered from the negative impact of the global financial crisis. In addition, this study period was chosen because we wish to avoid the noise of several airline mergers taking place in both markets between 2007 and 2010 including the Air Indian/Indian Airlines merger in 2007 and the China Eastern and Shanghai Airlines merger 2009. [↑](#footnote-ref-5)
6. See https://data.gov.in/catalog. [↑](#footnote-ref-6)
7. A large volume antitrust literature (e.g., Blair and Durrance, 2008; Bigoni, et al., 2015; Joseph, et al. 2016) has shown that the deterrence effects of antitrust sanction is real and effective. [↑](#footnote-ref-7)