Journal of Air Transport Management 15 (2009) 166–174

Contents lists available at ScienceDirect

Journal of Air Transport Management

journal homepage: www.elsevier.com/locate/jairtraman

Effects of competition and policy changes on Chinese airport productivity: An empirical investigation

Andrew Yuen Chi-Lok, Anming Zhang*

Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, Canada V6T 1Z2

Keywords:
Airport
Efficiency
Localization
Competition
DEA
Malmquist index

A B S T R A C T

This paper investigates the influence of competition and aviation policy reform (for example, the airport localization program and listing airports on stock markets) in China on the efficiency of Chinese airports. By using Data Envelopment Analysis, we estimate both the productivity level and its growth for 25 sample Chinese airports. After controlling for hub status and other airports' characteristics, we find that: (i) publicly listed airports are significantly more efficient than non-listed airports; (ii) airports with more competition are more efficient than their counterparts; (iii) the airports' efficiency and the technical progress are positively correlated with the airport localization program; and (iv) the impacts of open-skies agreements and airline mergers on the airports' efficiency are statistically insignificant.

1. Introduction

In the past few decades, rapid economic growth has significantly increased the demands for air services in China; between 1980 and 2005, the number of air passengers and cargo tonnage grew at an average rate of 16.8% and 18.2% per annum, respectively. This increasing air demand has placed enormous pressure on China's airport infrastructure. The situation is expected to get worse, as air travel is forecasted to grow at the still fast rate of 7.4% per year for the Chinese market over the next 20 years.[1] Thus, in addition to the infrastructure investment, there is an urgent need to improve the productivity of Chinese airports in order to relieve the pressure. Furthermore, as the liberalization of the airline industry continues, more foreign airlines will be allowed to operate in China, and will have increasing freedom to choose where they base their gateways in China. This would also put pressure on Chinese airports to further improve their own productivity, as the airlines want to locate at efficient airports in order both to reduce their operating costs and to improve the quality of their service. Thus an empirical investigation of factors affecting Chinese airport productivity has become important.

Assessment of airport productivity has become the focus of a large number of studies. Different methodologies have been used to measure the productivity of airports in different regions around the world (see Oum et al., 2003, for a comprehensive review). Due to a lack of data, however, it is difficult to assess airport productivity in China. A recent paper by Fung et al. (2008) attempted to calculate the productivities for 25 major Chinese airports between 1995 and 2004. They found that over that period, airport efficiency was improving and the productivity among airports from different regions was converging. Using their data Zhang and Yuen (2008) further investigated whether privatization through public listing improves airport performance. Although they found a positive and statistically significant relationship between Chinese airport productivity and public listing, a large portion of the variance in productivity and its growth are still left unexplained by their regression models. Furthermore, their panel data set does not capture the effects of policy changes on Chinese airport productivity after 2004, during which several important industry reform measures have taken place.

This paper investigates the effects of China's competition and aviation policy reform (for example, the airport localization program and listing airports on stock markets) on the efficiency of Chinese airports. Our sample data consist of a panel of 25 major airports for the period from 1995 to 2006. This new data set may provide a better basis for investigating the effectiveness of recent policy changes on improving the Chinese airport productivity. In particular, we use Data Envelopment Analysis to compute efficiency scores for each airport. We then run regressions to examine the effects of the competition and aviation policy reform on the efficiency scores by controlling a set of airport characteristics and event variables.

Our empirical results reveal that airport localization has a strong impact on airport efficiency; the productivity of the localized airports is significantly higher than that of their counterparts. Furthermore, there is statistically significant evidence suggesting

* Corresponding author.
E-mail address: anming.zhang@sauder.ubc.ca (A. Zhang).

[1] A forecast made by Boeing (http://www.boeing.com/companyoffices/aboutus/boechina.html).

0969-6997/$ – see front matter © 2008 Elsevier Ltd. All rights reserved.
doi:10.1016/j.jairtraman.2008.09.003

that airports with more competition are more efficient than their counterparts. There is also strong evidence that publicly listed airports are significantly more efficient than non-listed airports. We do not find, however, any statistically significant correlation between Chinese airport productivity and two specific policy changes at the airline level, namely the signing open-skies agreements, and airline mergers arranged by the China's State Council in 2003. Finally, we use the Malmquist index method to investigate the effects of the competition and aviation policy reform on *changes* in the efficiency of Chinese airports. We find that efficiency growth and its component, technical efficiency, do not have a statistically significant relationship with the airport localization program, competition intensity or stock market listing. However, technical progress – the other component of efficiency growth – is positively and statistically significantly, correlated with the airport localization program dummy.

2. Recent policy changes and airport productivity

As part of the general economic reform, the reform of the aviation industry in China began in the late 1970s (see Zhang, 1998; Zhang and Chen, 2003; Zhang and Yuen, 2008, for reviews). The Report on Civil Aviation Reform Measures, which was passed by the State Council in January 1987, stated that the long-term goal of the industry reform was to separate the Civil Aviation Administration of China (CAAC) as the regulator from direct involvement in airline and airport operations. This goal would be achieved through the airport localization program, in which airports are turned over to local governments. As a pilot program of the airport localization program, operation of the Xiamen Airport and Shanghai Hongqiao International Airport (including all fixed and working capital and all personnel) was transferred to their municipal governments in 1988 and 1993, respectively. The CAAC, however, was still heavily involved in the late 1980s and 1990s. The localization program regained momentum in the early 2000s and was completed by 2003, when the CAAC transferred ownership and control of all its remaining airports, except Beijing and Tibet airports, to their respective local governments.

The airport localization program, on one hand, increased the initiatives for local and private investment in airport capacity expansion. On the other hand, airport productivity was expected to improve after the implementation of the localization program. As pointed out by Zhang and Yuen (2008), as opposed to the soft budget approach taken by the CAAC, the localization program made the airports more financially accountable and consequently improves their efficiency.[2] Furthermore, as the efficiency of airports has significant implications for local economies, local governments may have greater incentives to improve their airport efficiency than would the CAAC.

The second recent policy change that may affect Chinese airport productivity is allowing Chinese airports to be listed on stock markets. Although attracting private funds were one rationale for airport listing, the principal objective was to improve airport efficiency (Zhang and Yuen, 2008). Since the initial public offering (IPO) of Xiamen Gaoqi International Airport, six Chinese airport companies have been listed on stock exchanges in Hong Kong, Shanghai, and Shenzhen. In the literature, there are a number of studies empirically examining the performance of Chinese listed companies. Sun and Tong (2003) found that there was an improvement in state-owned enterprises' earnings ability, real sales and workers' productivity, but not in profit returns or leverage after listing. Wang (2005), on the other hand, found a sharp decline in post-issue operating performance of IPO firms. Zhang and Yuen (2008) investigated the effect of listing on Chinese airport productivity, and found that the listed airports had higher efficiency scores than did unlisted airports, while the correlation between productivity growth and listing was statistically insignificant.

The policy changes in the *airline market* may also affect Chinese airport productivity. One of the prominent changes there is the opening of the market to foreign airlines gradually. For the past 5 years, China has been moving toward a more liberal international policy regime, which has significantly increased the number of international connections for China's airports (Zhang and Yuen, 2008). The bilateral open-skies agreements may increase the passenger and cargo traffic at airports. Given a fixed amount of input, this will imply a productivity improvement. This will, however, also increase the percentage of international traffic at the airports; and Oum et al. (2003) found that the airports with heavy reliance on international passenger traffic had lower gross total factor productivities (TFPs) than average airports.

Another major change in the airline market is the consolidation of the airlines in China. In October 2002, under the State Council's arrangement, the three mega carriers – Air China, China Southern Airlines and China Eastern Airlines – took over 14 relatively minor carriers (most of which were under the CAAC control). This substantial change in the market structure of the downstream carriers may have significant implications for Chinese airport productivity. For example, after the mergers, the bargaining power of the three new airlines groups was likely strengthened in their negotiation with airports. Thus, they might be able to impose more pressure on airports for further improvement of their productivities, leading to a possible reduction of airport charges.

3. Methodology

To investigate the effect of competition and policy changes on Chinese airport productivity, we use a two-stage procedure. See, for example, Ali and Flinn (1989) and Kalirajan (1990) for an application of the two-stage analysis. In the first stage, we calculate the productive efficiency from 1995 to 2006 for each airport. In the second stage, we run regressions to examine the effects of competition and policy changes on the productive efficiency of airports, while controlling for a set of independent variables.

In particular, in the first stage, we need to calculate the productive efficiency of airports, which is reflected by the relationship between the outputs the airport produces and the inputs the airport uses in a given period of time. Empirical applications of the efficiency measurement are feasible by a non-parametric technique known as Data Envelopment Analysis (DEA).[3] A DEA model gives an efficiency score for each airport in each year. For the output-oriented model, the efficiency score has a value between zero and one. Airports with an efficiency score of unity are located on the frontier in the sense that their outputs cannot be further expanded without a corresponding increase in input. Airports with an efficiency score below one are inefficient. The DEA model defines the efficiency score of any airport as the fraction of the airport's output that can be produced for an airport on the efficient frontier with the same level of input.

The DEA approach is widely used in measuring the performance of airports, as it does not require any assumption concerning either the technology or the behaviors of actors (for example, cost minimization) (Pels et al., 2001) and can be done without some detailed operating information (such as input costs). Gillen and Lall (1997)

[2] As part of the localization program, the central government began to phase out its subsidization of airports in 2006.

[3] Useful references on DEA include Farrell (1957), Banker et al. (1984, 1989), Charnes et al. (1978, 1981), Seiford and Thrall (1990), and Lovell (1993).