Journal of Air Transport Management 57 (2016) 168–183

Contents lists available at ScienceDirect

Journal of Air Transport Management

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

Comparing efficiency of holding business model and individual management model of airports

Diogo Cunha Ferreira [a], Rui Cunha Marques [a], Maria Isabel Pedro [b, *]

[a] CESUR, CERIS, Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais, 1049-001 Lisbon, Portugal
[b] CEG-IST – Center for Management Studie, Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais, 1049-001 Lisbon, Portugal

ARTICLE INFO

Article history:
Received 22 March 2016
Received in revised form
21 July 2016
Accepted 26 July 2016

Keywords:
Airports
Holding and individual airports
Efficiency
Data envelopment analysis
Malmquist index decomposition

ABSTRACT

This research compares the efficiency of holding business model to individual management model of airports, employing some robust non-parametric partial frontier-based methods to compare the statistical distributions of efficiency, under different scenarios, to find out which group of airports yields better global performance. The comparison between groups will follow a Malmquist index decomposition, which seems to be the most appropriate tool for within- and inter-group performance comparison. For this purpose, a sample of 145 airports from three continents is utilized. The results provide evidence that European airports are the most productive ones, and within this cluster, the individual management model presented a significant frontier shift with respect the holding cluster frontier, meaning that the former is much more productive than the latter.

1. Introduction

The rapid growth of air transport has been one of the most significant landmarks in transport services in recent years, both in the EU and all over the world (Eurostat, 2015). A strategically important sector that makes a vital contribution to the EU's overall economy and employment, aviation supports 5.1 million jobs and contributes €365 billion, or 2.4%, to European GDP. Despite the current economic crisis, global air transport is expected to grow by around 5% annually until 2030 (European Commission, 2015a).

However, airports are victims of their own success and, due to traffic growth, many of Europe's most important airports are now facing a capacity crunch. Of all delays to flights, 70% are already caused by problems on the ground rather than in the air. Based on present trends, nineteen European airports will be unable to accommodate any more flights by 2030 (European Commission, 2015b).

One of the worldwide phenomena that has become apparent over the past few years, with special focus since the 1990s, is the total or partial privatization of airports, which until recently were exclusively public domain. It all started in the UK, when the local government decided to privatize the British Airports Authority (Marques and Brochado, 2008). This privatization preceded many others elsewhere in Europe, and the degree of investment and private management in each airport can span from totally private management to the management of outsourced parts of the airport (Qin, 2010).

Concerning the airports infrastructure management, one may account for several models, namely, state-owned airports (e.g. AENA in Spain[1] and Finavia Oyj in Finland), airports managed by public entities through public-private partnerships (PPPs) (e.g. London Luton Airport in England), contractual types (mainly concession contracts) (e.g. Naples International Airport in Italy) and partially or fully privatized airports (PPP institutional type) (e.g. Adelaide Airport Limited in Australia). However, the privatization of activities within its value chain already exists. One example is the ground-handling companies, such as Groundforce Portugal and similar companies in other European countries (Cruz and Marques, 2011).

The reason for the change in the type of management at airports is related to the fact that airports are not limited to serve just as a support structure for the aeronautical industry but are the basis for an entire business with huge involvement and tremendous regional economic impact. This comes from a paradigm in which

* Corresponding author.
E-mail addresses: diogo.cunha.ferreira@tecnico.ulisboa.pt (D.C. Ferreira), rui.marques@tecnico.ulisboa.pt (R.C. Marques), ipedro@tecnico.ulisboa.pt (M.I. Pedro).

[1] AENA was privatized by means of the Royal Decree of 4th July 2014. All given examples for management models concern to 2010.

http://dx.doi.org/10.1016/j.jairtraman.2016.07.020
0969-6997/

airports were considered as mere public services, where the key was to have the airport operational for takeoffs and landings, trying the best to cover the cost of these activities, to a new paradigm in which the airport is seen as a lever of the economy, which seeks to satisfy all the needs of users, with a more careful approach to the logistics involving its operations (Ashford et al., 1979).

For this reason, a consortium of investors in the airports business, which becomes responsible for the administration, totally or in cooperation with local governments, began to emerge. Currently, groups such as Vinci, responsible for the concession of several airports in France and in Portugal, the Fraport or CAI (Changi Airports International), responsible for the management of airports around the world, are some of the largest companies involved in the air transport market.

In the EU and in Asia, there are large numbers of airports whose ownership or management is done by groups (holdings) and not by an isolated company. These groups are investors that can stay with or without majority shareholding. In the US, most airports are government owned (locally) but effectively privately operated, with a high degree of contracting out.

For example, the main public and private business groups, which are responsible for management of more than one airport in the EU, are shown in Table 1 (ATRS, 2012). Some groups are present in more countries than the one mentioned here.

Regardless of who manages the airport, it is intended that they are efficient so that they can be more profitable. However, in most cases, measuring performance becomes harder, due to the lack of reliable and valid measurement techniques that have become standardized. Data envelopment analysis (DEA), developed by Charnes et al. (1978), is one of the most frequently used methods. DEA is a mathematical programming method for evaluating the relative efficiency of decision-making units (DMUs) with multiple outputs and multiple inputs. By using DEA, a single index (namely, efficiency score) can be obtained from the ratio of weighted outputs to weighted inputs, as an assessment of a DMU's overall performance (Zhang et al., 2014).

Considering all these facts, from the importance of aviation to the economic development of the market of each region, through the increase in global air traffic forecasts and the recent change in the management structure of airports, including efficiency, the performance of airports becomes of utmost importance. This exercise will not just assess the current situation but will also allow setting goals and priorities for improvement. The literature is abundant, concerning efficiency studies in the airport sector (see, for example, Gillen and Lall, 1997; Pels et al., 2001; Marques and Barros, 2010 or Curi et al., 2011). However, the comparison between groups of airports is scarcer (Oum et al., 2006; Gong et al., 2012; Zoua et al., 2015). This research aims to estimate the efficiency and its determinants in airports of Europe, Asia Pacific and North America. In particular, the paper compares the efficiency of managing airports as a holding or as an individual company, which, as far as the authors know, was not studied in the literature.

Therefore, the contributions of this paper are diverse. The first one concerns the novelty of investigating the determinants of efficiency using non-parametric methods, particularly the influence of a different management model in the airports efficiency, such as individual and holding companies.[2] By employing some robust non-parametric partial frontier-based methods to compare the statistical distributions of efficiency, under different scenarios, we will be able to disclose which groups of airports present better global performance. Group comparison will follow a Malmquist index decomposition, which seems to be the most appropriate tool for within- and inter-group performance comparison. To the best of our knowledge, so far there is no other study in this field that employs such robust tools for airport group performance evaluation, which constitutes a relevant gap in the literature. Accordingly, this study aims to fulfil it and simultaneously contribute to further political and managing discussions concerning the airports management.

The paper is organized into five main sections. After this brief introduction, the second section presents the literature review sector, and the third section provides the methodology applied. The fourth section comprises the case study, description of the sample, model specifications, the results obtained and their discussion. The paper ends with concluding remarks.

Table 1
Business groups present in Europe.

Business group	Country	Airport (no.)
Aéroports de Paris (ADP)	France	14
Aeroporti di Roma (ADR)	Italy	2
Aeropuertos Españoles y Navegación Aérea (AENA)	Spain	46
Aeroportos de Portugal (ANA)	Portugal	10
Avinor	Norway	46
British Airport Authority (BAA)	United Kingdom	6
Flughafen Berlin-Schonefeld GmbH (FBS)	Germany	2
Dublin Airport Authority (DAA)	Ireland	3
Finavia Oyj	Finland	25
Fraport AG	Germany	13
Manchester Airport Group (MAG)	United Kingdom	4
Polish Airports' State Enterprise (PPL)	Poland	2
Schiphol Group	Netherlands	3
Società Esercizi Aeroportuali (SEA)	Italy	2
Swedavia	Sweden	11
Tepe-Akfen-Ventures Investment Holding Co. (TAV)	Turkey	10

2. Methodology

2.1. The DEA method

Performance measurement is crucial for the efficiency assessment of a group of observations. In general, performance methodologies can be divided into parametric or non-parametric models, which, in turn, can be separated according to the use of an efficiency frontier (De Witte and Marques, 2010).

DEA is one of those methods, and it is characterized as a non-parametric model that uses an efficiency frontier. According to Cullinane et al. (2005), DEA allows an efficiency assessment of a group of observations. In turn, observations are defined as an entity that consumes a certain quantity of inputs to produce a certain amount of outputs, and its efficiency is measured according to the conversion of inputs into outputs.

DEA models have been developed to assess efficiency in different ways: input-oriented models and output-oriented models. Input-oriented models are based in the minimization of inputs assuming the same level of outputs, while output-oriented models are based in the maximization of outputs assuming the same level of inputs (Barros and Athanassiou, 2004).

It is worth mentioning that, under the output-oriented framework, inefficient units, laying below the frontier, have an efficiency score over 1, while efficient units have a unitary efficiency score.

The calculation of efficiency of observations from a problem of

[2] Some other studies have already investigated the airport group's performance, e.g. Halpern and Pagliari (2007) and Adler et al. (2013). Nevertheless, in the present case, the aim is to study the differences between the holdings and the individual airports, by employing some innovative and robust methods.