Transportation Research Part E 46 (2010) 693–708

Contents lists available at ScienceDirect

Transportation Research Part E

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

Efficiency and patterns of service mix in airport companies: An input distance function approach

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ARTICLE INFO

Article history:
Received 21 November 2008
Received in revised form 22 September 2009
Accepted 19 November 2009

Keywords:
Airport industry
Efficiency measurement
Input distance function
Cost complementarities
Outsourcing

ABSTRACT

In this paper an input distance function approach is used to evaluate efficiency and technological characteristics of Italian airport companies for the period 2000–2005. This approach is robust to deviations from neoclassical paradigm in terms of cost-minimizing behavior. Duality relationship between the input distance function and the shadow cost function is exploited to derive cost complementarities among outputs. Empirical findings are used to discuss the economic implications connected to changes in airport organization, involving in particular outsourcing of handling operations and development of commercial activities.

1. Introduction

In the last years the air transport industry experienced a rapid growth worldwide. At the same time, competition among airlines increased, placing on airports a more severe demand for efficient and good-quality services. Despite the nature of local monopoly typically attributed to airports, managers have become recently involved in the reorganization of airport operations. In this context, the application of appropriate benchmarking tools can be useful in order to develop consistent measures of airport performance and investigate on the reasons which may favor efficiency improvements.

From a production perspective, airports are multi-output organizations providing a wide range of services. Doganis (1992) classified airport activities into three broad categories: essential operational services, traffic-handling services and commercial services. The first category refers to all aeronautical activities that allow movements of aircrafts and include, for instance, runway services, flight control duties and aircraft parking. Handling services relate to all landside activities directly associated with the processing of passengers and freights within the terminal area. Finally, commercial services are associated with a wide range of businesses such as concession of spaces, for instance, for shops, duty-free, restaurants, car parking.

Airports' involvement in the above-mentioned activities is highly variable. Many of them provide most handling services themselves whereas others extensively resort to contracting out formula. For instance, many airports, especially in the US and in Asia, recently outsourced a number of landside operations to airlines or specialized operators. In addition, many

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doi:10.1016/j.tre.2009.12.003

airports are intensively upgrading their commercial business, though the latter may not be traditionally considered as core activity (Oum et al., 2003).

The issue of the organization of airport operations recently received greater attention also by policy makers. In the last decade ground handling services were liberalized in Europe as well as worldwide. The guidelines released by the European Directive 67/1996 aimed at ensuring the opportunity for all potential operators in handling services to enter the market without restrictions. Since then a growing tendency towards the creation of an open market for handling services at European level emerged.

The role of empirical analysis appears crucial in order to assess whether scope exists for joint provision of different activities. However, as far as to our knowledge, while only few studies investigated the impact on efficiency of airport organization, in terms of involvement in handling and commercial activities, no one addressed this issue providing empirical estimation of cost complementarities.[1]

Applying an econometric input distance function to a dataset composed of 26 Italian airports observed over a six-year period (from 2000 to 2005), the main purpose of this paper is to quantify the potential synergies between aeronautical, handling and commercial operations. At the same time, this methodological framework enables us to provide fresh evidence about the debated topics of returns to scale and technical efficiency in airport industry. Results may be relevant to decision makers, both at regulatory and managerial level, especially in the light of the recent evolution of the sector.

The Italian context seems suitable to our purposes given that the liberalization process – enforced by law in 1999 (Legislative Decree 18/1999) – induced many airports to outsource handling operations. As a result, the share of handling revenues declined considerably on average (from 47% in 2000 to around 31% in 2005). At the same time, many Italian airports developed a higher involvement in commercial activities, whose revenue share increased from 16% to 22%.

The paper is organized as follows. Section 2 presents the literature background concerning the evaluation of airports' performance. Section 3 focuses on the representation of airport production and on the strategic opportunities for airport managing firms in terms of outsourcing of handling operations and diversification towards commercial activities. Section 4 describes the dataset as well as the input and output variables used in the analysis. Section 5 discusses some properties of the input distance function and illustrates the model specification. Results are shown in Section 6, and in Section 7 some concluding remarks are made.

2. Previous studies on airport performance

Following Farrell (1957), efficiency estimation is performed by representing technology as a bounding frontier that reflects the best practice production. A firm is regarded as efficient if it operates on the best practice frontier. Several methods have been developed in order to assess firms' performance involving TFP (Total Factor Productivity) index, DEA (Data Envelopment Analysis) and SFA (Stochastic Frontier Analysis). All of these methods have been used to evaluate airport performance, as shown in Table 1.

In one of the first studies Hooper and Hensher (1997) used conventional TFP index to measure airport productivity. A more advanced specification of TFP index, in which outputs and inputs are endogenously weighted by means of a parametric and stochastic approach, was adopted by Oum et al. (2003), Yoshida and Fujimoto (2004) and Fung et al. (2008b). In the last two studies endogenous weighted TFP (EW-TFP) indices were matched with technical efficiency DEA scores. In another study Oum et al. (2004) compared international airports by means of a variable factor productivity (VFP) index. Other parametric applications include those by Pels et al. (2001, 2003) – in which technical efficiency measures were estimated by means of a stochastic production frontier model and then compared with technical efficiency scores derived using DEA – and by Martín-Cejas (2005), Craig et al. (2005), Oum et al. (2007) and Barros (2008a,b) – in which production technology was described using a cost function approach. In particular, in Barros (2008a) a random parameters frontier model was used to capture heterogeneity among airports while Barros (2008b) defined a cost frontier with the inclusion of a specific time trend to account for and decompose technical change over a long time period.

As already mentioned many studies used DEA to evaluate airport efficiency. Studies using this approach, under different technology specifications, include Gillen and Lall (1997), Parker (1999), Salazar De La Cruz (1999), Sarkis (2000), Martin and Roman (2001), Abbott and Wu (2002), Pacheco and Fernandez (2003), Barros and Sampaio (2004), Curi et al. (2008), Malighetti et al. (2007), Fung et al. (2008a). Some of the aforementioned studies applied DEA both in static and dynamic framework. In the latter case a Malmquist index (Färe et al., 1994) was computed in order to measure productivity changes over time. More recently, Yu (2004), Yu et al. (2008) and Pathomsiri et al. (2008) used both conventional DEA and a non-parametric directional output distance function in order to account simultaneously for desirable and undesirable outputs like noise and delayed aircraft movements. Finally, Barros (2008c) and Barros and Dieke (2008) applied the Simar and Wilson two stage procedure based on bootstrap estimation method in order to investigate efficiency determinants.

The above-mentioned studies delineated different input and output sets. As shown in Table 1, many studies used aircraft movements, passengers and cargo to represent aviation activities, essentially concerning runway facilities for aircraft

[1] As argued by Pulley and Humphrey (1993), cost complementarities differ from the more comprehensive concept of economies of scope as defined by Baumol et al. (1982). Cost complementarities describe the variation of marginal cost of production of one good or service due to the production of an additional unit of other goods or services.