Transportation Research Part E 80 (2015) 20–38

Contents lists available at ScienceDirect

Transportation Research Part E

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

Competition and efficiency in the Italian airport system: new insights from a conditional nonparametric frontier analysis

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ARTICLE INFO

Article history:
Received 2 February 2015
Received in revised form 30 April 2015
Accepted 1 May 2015
Available online 2 June 2015

Keywords:
Italian airports
Competition
DEA
Conditional efficiency
Two-stage analysis

ABSTRACT

We analyse the effect of competition on technical efficiency of Italian airports by applying a novel conditional nonparametric frontier analysis for the first time to the airport industry. We find that competition affects mostly the frontier of best performers, whilst airports that are lagging behind are less influenced. A novel two stage approach shows that, on average, competition has a negative impact on technical efficiency. We estimate a measure of *pure efficiency*, whitened from the main effect of the competition, whose distribution has a bi-modal shape, indicating the existence of two differently managed groups of airports.

1. Introduction

The nature of the airport industry has changed over the last few decades. The deregulation process has led to increased competition among carriers, decreased average fares, increased frequency, and new route services (D'Alfonso and Nastasi, 2014; Fu and Oum, 2014; InterVISTAS, 2006). Some new entrant airlines have been exploiting the opportunities offered by secondary airports (Thompson, 2002). Moreover, the low-cost business model, which has a relevant driver in airport costs, has enabled low-cost carriers (LCCs) to shop around airports (Dresner et al., 1996; Pels et al., 2009). In parallel, a major strategic action taken by full service carriers has involved the proliferation of alliances, both international and domestic, which is resulting in a more concentrated airline industry and new routes services (Czerny and Zhang, 2012; Jiang et al., 2015). The development of high-speed rail (HSR), interregional bus transportation and transport networks is an additional factor influencing competition among airports (OECD, 2009). Finally, many airports have been involved in a privatization[3] and a commercialization process: non-aeronautical revenues have been growing to the point that they have become the main income source for many airports (Bracaglia et al., 2014; Graham, 2009).[4] In this context, airports, many of which were treated as public service organizations directly controlled by government administrations, have increasingly been restructured to attract

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[3] According to Poole (2013), which reports data on Global Airport Privatizations happened in 2011–2012, airport privatization has taken place in Europe, Asia, Australia and New Zealand, Latin America and the Caribbean where major airports have been privatized. Several planned airport privatizations in Portugal, Spain and Greece were put on hold due to the depressed state of these European economies, still recovering from the financial crises. See Albalate et al. (2014) for further details on partial privatization in the European airport industry.

[4] The global airport benchmarking study by the Air Transport Research Society (ATRS, 2013) reports that non-aviation revenues account for 40–80% of total revenues for 50 major airports around the world in 2012.

http://dx.doi.org/10.1016/j.tre.2015.05.003
1366-5545/

private investments, search for new sources of revenues and attract (competing) full service or low-cost carriers (Starkie, 2002). As a result, competition among airports has been growing and this has questioned the natural monopoly approach to regulation and has led to a much more competitive outlook on the part of airport managers.

In this scenario, airport benchmarking is of increasing concern and source of debate for both academics and practitioners (Liebert and Niemeier, 2013). The comparison of decision-making units (DMUs), such as airports, has become a popular tool to enhance their efficiency and make airports survive in a competitive environment. Most of the efficiency analysis literature has focused on the estimation of the production frontier that provides the benchmark against which airports are evaluated. There has been a growing number of studies using Data Envelopment Analysis (DEA) to benchmark airport efficiency (Adler et al., 2013; Arocena and Oliveros, 2012; Barros and Dieke, 2007, 2008; Curi et al., 2010, 2011; Fung et al., 2008; Gillen and Lall, 1997, 2001; Fernandes and Pacheco, 2002, 2003; Gitto and Mancuso, 2012; Wanke, 2012a, 2012b; Wanke, 2013). Some others analyse airport efficiency using stochastic frontier models (SFA) (Abrate and Erbetta, 2010; Assaf et al., 2012; Barros, 2008a, 2008b; Martin-Cejas, 2002; Oum et al., 2008; Scotti et al., 2012; Yoshida and Fujimoto, 2004; Yu et al., 2008). Other papers compare the DEA model with the SFA model (Pels et al., 2001, 2003). Some studies use total factor productivity measures (Hooper and Hensher, 1997). Recent studies are concerned with the explanation of efficiency differentials by including in the analysis environmental factors that, unlike the inputs and the outputs, cannot be controlled by the airport but may influence the production process. This is particularly relevant for the airport industry, characterized by regulatory constraints (Rate of Return, Price Cap, Single Till or Dual till), downstream market structure (high or low airline concentration), type of competitive environment (competitive versus monopolistic airports, HSR pressure), type of ownership (private, public, mixed) and so on. Generally speaking, these factors can be included in the analysis as exogenous variables that can help to detect and analyse influential factors which may affect airports' productivity patterns, to explain the (in-)efficiency differentials, as well as to improve policy decisions.

However, whilst lot of studies have analysed the impact of ownership form on efficiency (e.g., Barros and Dieke, 2007; Cruz and Marques, 2011; Lin and Hong, 2006; Oum et al., 2006, 2008), as well the effect of the regulation regime (e.g., Bel and Fageda, 2010; Marques and Brochado, 2008; Oum et al., 2004), few works have examined the relationship between efficiency and the level of competition from nearby airports. In fact, whether competition positively affects airport efficiency is still an open question. Dmitry (2009) builds an index of competition based on overlapping catchment areas into a SFA model and finds a positive effect of competition pressure on efficiency for a sample of European airports. Dmitry (2010) extends the results with a multi-tier model of competition and finds that the effect of competition on airport efficiency can be either positive or negative depending on a distance tier. Adler and Liebert (2014) investigate the combined impact of ownership form, economic regulation and competition on airport cost efficiency. They find that, under relatively non-competitive conditions, public airports are less cost efficient than fully private airports. Furthermore, under potential regional or hub airport competition, economic regulation inhibits airports of any ownership form from operating and pricing efficiently. Ha et al. (2013) measure Chinese airport efficiency and investigate the impact of competition among airports (from other modes of transportation, such as HSR), measured by means of a dummy variable that indicates whether there is another airport competing significantly with the airport in concern (whether there is HSR operation near a sample airport). They find that competition among airports and competition from substitutable transportation modes always have a positive impact on efficiency scores of airports.[5] Scotti et al. (2012) suggest an index of competition between two airports on the basis of the share of population living in the overlapped region of the airports' catchment areas. Using a multi-output SFA model in a parametric framework, the authors find that the intensity of competition has a negative impact on Italian airports' efficiency in the period 2005–2008.

The aim of this paper is to fill this gap by assessing the impact of competition on airport efficiency, that is, we evaluate whether airports are more efficient when the intensity of competition is higher. We take into account the fact that airports differently located may be subject to heterogeneous environmental conditions. We ground on the recently introduced conditional efficiency measures (Daraio and Simar, 2005, 2007a, 2007b), which have rapidly developed into a useful tool to explore the impact of exogenous factors on the performance of DMUs in a nonparametric framework. In particular, this methodology does not rely on the separability condition between the input–output space and the space of the external factors, and hence it does not assume that these factors have no influence on the frontier of the best practice. Moreover, it is based on partial frontier non-parametric methods which are more robust than traditional full frontier non-parametric methods because they are less sensitive to extreme data and outliers. Finally, they do not suffer from the problem of the curse of dimensionality, which requires big datasets to provide estimates of a reasonable precision (for more details see Daraio and Simar, 2007a).

To the best of our knowledge, Marques et al. (2014) is the only paper which has applied conditional efficiency measures for the assessment of the efficiency of the airport sector by using the probabilistic approach proposed by Daraio and Simar (2005).[6] In our paper, we make a methodological step further – with respect to Marques et al. (2014) – in the application of conditional efficiency measures to the airport sector. Indeed, we implement for the first time the new

[5] See also Chi-Lok and Zhang (2009) for similar conclusions.

[6] In that paper, the influence of the operational environment on airport efficiency is examined in a sample of 141 international airports. The conclusions show that the operational environment indeed matters and that privatization, regulation, traffic transfer and the existence of a dominant carrier have a positive effect on efficiency, whereas aeronautical revenues influence it negatively. However, the impact of competition on airport efficiency is not investigated.