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# Technical efficiency and productivity changes in Spanish airports: A parametric distance functions approach

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ABSTRACT

This paper contributes to the airport benchmarking literature in two ways. To our knowledge, this is the first attempt at using a stochastic distance function to measure airports' productivity changes while considering multiple outputs. Secondly, we calculate the evolution and decomposition of the Total Factor Productivity (TFP) for Spanish airports. The average rate of productivity showed a slight annual improvement of 0.9%, and the core engine of this was 3% increase in technical progress rather than through efficiency. Results, by airport, identify those needing improvement, to be more attractive in the Spanish airport restructuring program.



## 1. Introduction

An airport is more than a mere interchanger of transport modes; it is a system that serves a wide and complex range of needs related to the movements of people and items worldwide. A performance measurement of the airport industry becomes crucial, to guarantee that those services are provided correctly. However, the evaluation of airport performance has been, for quite some time, neglected by transport research. Recently, a wide variety of airport studies have been carried out, in order to fill this gap in transport literature; see Table 1 in Section 2.

One reason for the recent interest in airport performance could be the worldwide trend towards airport privatization. This privatization process makes the evaluation of performance in order to ensure that resources are used effectively. Governments have to verify that the best use is made of national resources, and that airports provide the required services at a fair price without taking advantage of their monopolistic or quasi-monopolistic position.

Spain has a centralized network of state ownership airports. AENA is the public business body entrusted with the planning, development, building, installation, operation and management of all the 47 airports included in the Spanish Network. Recently, the Government of Spain announced that AENA will be restructured in two ways. Regional governments will participate in the management of airports located within their territories and private companies will also take part.

Some argue that the airports should be ceded entirely to Spain's autonomous regional governments, which would mean the disappearance of AENA. The Government's intention seems to be that AENA retains day to day management, and that regional officials will participate in key planning decisions; for example commercial space allocation, infrastructure investment, and so on.

Although details regarding the participation of private companies are not yet known, the reform does not seem to be oriented towards full privatization. On the contrary, the Government's intention seems to be to allow private companies buy up to 49% of the shares of AENA, so the airports are kept under public control.

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**Table 1**
Summary of airport performance studies.

| Year | Authors | Methodology | | | Measures | Data | Observations |
|---|---|---|---|---|---|---|---|
| | | Frontier? | Parametric? | Model | | | |
| 1997 | Gillen and Lall (1997) | Yes | No | DEA | TE | 21 USA airports (1989/1993) | Explain ET through Tobit |
| | Hooper and Hensher (1997) | No | No | PIN | TFP | 5 Australian airports (1988/89–1991/92) | Estimate two regression models for estimating output adjusted-TFP |
| 1999 | Salazar (1999) | Yes | No | DEA | CE | 16 Spanish airports (1993/1995) | |
| | Parker (1999) | Yes | No | DEA | TE | 22 UK airports (1988/89–1996/97) | |
| | Murillo-Melchor (1999) | Yes | No | DEA | TE, TFP | 33 Spanish airports (1992/1994) | Use a Malmquist index (and decompose it) |
| 2000 | Sarkis (2000) | Yes | No | DEA | TE | 44 USA airports (1990/1994) | ET scores are analyzed using Mann–Witney test |
| | Nyshadham and Rao (2000) | No | No | PIN | TFP | 25 European airports (1995) | Use a translog Multilateral index |
| 2001 | Adler and Berechman (2001) | Yes | No | DEA | TE | 26 Worldwide airports (1996) | Use principle component analysis and applied superefficient DEA model |
| | Pels et al. (2001) | Yes | No | DEA | TE | 34 European airports (1995/1997) | |
| | | Yes | Yes | SPF | TE | | Use a Cobb–Douglas function |
| | Martín and Roman (2001) | Yes | No | DEA | TE | 37 Spanish airports (1997) | |
| | Gillen and Lall (2001) | Yes | No | DEA | TE, TFP | 22 USA airports (1989/1993) | Use a Malmquist index (and decompose it) |
| 2002 | Abbott et al. (2002) | Yes | No | DEA | TE, TFP | 12 Australian airports (1989/90, 1999/2000) | Malmquist index (and decompose it), explain TFP's variations through Tobit |
| | Fernandes and Pacheco (2002) | Yes | No | DEA | TE | 35 Brazilian airports (1998) | |
| | Martín-Cejas (2002) | Yes | Yes | DCF | TE | 40 Spanish airports (1996–1997) | |
| 2003 | Bazargan and Vasigh (2003) | Yes | No | DEA | TE | 45 USA airports (1996–2000) | ET scores are analyzed using Kruskal–Wallis and Mann-Witney tests |
| | Oum et al. (2003) | No | Yes | EW-TFP | TFP | 50 World airports (1999) | Further analyzing TFP by regression models |
| | Pels et al. (2003) | Yes | No | DEA | TE | 34 European airports (1995/1997) | |
| | | Yes | Yes | SPF | TE | | Use a Translog function and explain de inefficiency |
| 2004 | Yoshida et al. (2004) | Yes | No | DEA | TE | 67 Japanese airports (2000) | Explain ET through Tobit |
| | | No | Yes | EW-TFP | TFP | | Explain ET through OLS |
| | Oum and Yu (2004) | No | Yes | EW-VFP | VFP | 76 Worldwide airports (2000–2001) | Further analyzing VFP by regression models |
| | Barros and Sampaio (2004) | Yes | No | DEA | TE, AE | 13 Portuguese airports (1990–2000) | Explain CE through Tobit |
| | Yu (2004) | Yes | No | DEA | TE | 14 Taiwan airports (1994–2000) | Undesirable (noise) are taken into account |
| | Sarkis and Talluri (2004) | Yes | No | DEA | TE | 44 USA airports (1990–1994) | |
| | Pathomsiri and Haghani (2004) | Yes | No | DEA | TE | 63 Worldwide airports (2000, 2002) | Use paired-sample *t*-test to test differences in ET scores before/after September-11 |
| | Yoshida (2004) | No | Yes | EW-TFP | TFP | 30 Japanese airports (2000) | Further analyzing TFP by regression models |
| 2005 | Pathomsiri et al. (2005) | Yes | No | DEA | TFP | 72 Worldwide airports (2000, 2002) | Parametric and non-parametric test to test ET differences before/after September-11 |