



# Joint impact of competition, ownership form and economic regulation on airport performance and pricing



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## ABSTRACT

The combined impact of ownership form, economic regulation and competition on airport performance is analyzed using data envelopment analysis to measure cost efficiency in the first stage and regression analysis to measure the impact of the environment in the second stage. The empirical results of an analysis of European and Australian airports over a 10 year timeframe reveal that under relatively non-competitive conditions, public airports operate less cost efficiently than fully private airports. Irrespective of ownership form, regulation is necessary to emulate competitive forces thus pushing airport management towards cost efficiency and reasonable pricing policies. Under potential regional or hub competition, economic regulation inhibits airports of any ownership form from operating and pricing efficiently. Although public and fully private airports operate equally efficiently in a competitive setting, private airports still set higher aeronautical charges. Furthermore, mixed ownership forms with a majority public holding are neither cost efficient nor low price, irrespective of the level of competition.

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## 1. Introduction

Historically, airports were mostly deemed state-owned entities with the objective to provide and operate infrastructure for airlines. Frequently viewed as natural monopolies with large economies of scale, airports were subject to economic regulation in order to prevent abuse of market power. However, the nature of the airport industry has changed over the last two decades. Moving away from viewing the airport as a public utility, airports have begun to operate as modern enterprises pursuing commercial objectives. A number of privatization processes have been actively promoted by governments with the proclaimed intention of reducing government involvement and increasing airport productivity and innovation. However, given the assumed profit-maximizing behavior of private companies working in a natural monopolistic environment, the majority of privatized airports in Europe remain subject to economic regulation (Gillen, 2011).

Whilst some studies have analyzed the separate impact of ownership form, regulatory regime and level of competition from nearby airports on efficiency and the level of airport charges, none have examined their joint effects. In other words, the literature has yet to discuss whether the deregulation of the airline industry and changes in airport ownership and management has affected the competitive situation and cost efficiency to the extent that the benefits of economic regulation

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are potentially unnecessary. For example, deregulation has led to increased competition between gateway hubs (e.g. Frankfurt and Amsterdam) and former military airports have opened to serve low cost carriers within the catchment area of existing airports (e.g. Hahn in Germany), substantially changing the downstream airline market and potentially impacting the airport market too. Furthermore, as a result of increasing commercialization, many airports have augmented their revenues from non-aeronautical sources in order to reduce aviation charges and attract additional airlines and passengers to their airport (Zhang and Zhang, 2010). The aim of this research is therefore to analyze the impact of the structural changes in the aviation markets on airport efficiency and aeronautical charges in order to further our understanding of the most appropriate ownership form and regulatory regime given the level of potential regional and hub competition.

Three well-documented quantitative methods have been applied to analyze the productivity and efficiency of government and private enterprises. A non-parametric, index number approach has been used to measure total factor productivity (Caves et al., 1982), however this approach requires input and output prices and quantities which are not always available. Parametric stochastic frontier analysis (SFA) assesses efficiency utilizing regression analysis and disentangles unobservable random error from technical inefficiency (Aigner et al., 1977; Meeusen and van den Broeck, 1977) based on assumptions as to the distributional forms of the production and efficiency functions and error term. Non-parametric data envelopment analysis (DEA), based on linear programming, categorizes data into efficient and inefficient groups hence produces weaker results than those of SFA, but does not require assumptions with respect to the functional form therefore has been chosen for the purposes of this study. Airport studies of efficiency utilizing all three approaches are reviewed in Liebert and Niemeier (2010).

Various environmental variables that are beyond managerial control at least in the short-term may affect the DEA efficiency estimates. Previous research argues that airport characteristics such as hub status or traffic structure, outsourcing policies, regulatory procedures and ownership structure all may contribute to airport efficiency (Gillen and Lall, 1997; Oum et al., 2006). Banker and Natarajan (2008) demonstrate that two-stage procedures in which DEA is applied in the first stage and regression analysis in the second stage provide consistent estimators and outperform parametric one- or two-stage applications. Published airport studies have applied simple ordinary least squares (Yuen and Zhang, 2009), Tobit regression (e.g. Gillen and Lall, 1997) and truncated regression (Barros, 2008) for this purpose. A recent debate in the literature discusses the most appropriate second stage regression model to be applied when investigating DEA efficiency estimates. Simar and Wilson (2007) argue that truncated regression, combined with bootstrapping as a re-sampling technique, best overcomes the unknown serial correlation complicating the two-stage analysis. Banker and Natarajan (2008) conclude that simple ordinary least squares, maximum likelihood estimation or Tobit regression dominate other alternatives. Combining the arguments of Simar and Wilson (2007) and Banker and Natarajan (2008), we apply robust cluster regression in order to account for the correlation across observations. Furthermore, in order to consider the panel structure of our sample, the random effects model is applied which allows us to consider time-invariant environmental variables.

The second stage analysis of this research considers the impact of efficiency on ownership form, economic regulation and levels of local and hub competition amongst other factors. Such an analysis contributes to the search for the more desirable combinations and may indicate whether potential competition from nearby airports or gateway competition replaces the need for economic regulation. In addition, we examine the combined impact on aeronautical revenues generated from passengers, cargo handling and movements in order to further our understanding regarding the joint impacts on efficiency and pricing.

The dataset in this research consists of European and Australian airports in order to include a sufficiently heterogeneous sample with respect to ownership structure, regulatory mechanism and competitive environment. The empirical results reveal that under relatively non-competitive conditions, airports should be regulated to encourage cost efficiency and dual-till price-cap regulation appears to be preferable to other forms of regulation. Confirming theoretical arguments by Armstrong and Sappington (2006), privately owned and regulated airports operating under monopolistic conditions tend to be more efficient than publicly owned and regulated airports. Furthermore, unregulated airports operating under monopolistic conditions irrespective of ownership form are likely to set higher aeronautical charges than those that are regulated. On the other hand, the existence of potential gateway or regional competition replaces the need for economic regulation, thereby supporting the argument of Vickers and Yarrow (1991) that competition rather than privatization is the key driver of efficiency. Nevertheless, the level of competition in the airport market has not proven to be sufficient to transfer the efficiency gains to consumers. Although unregulated, majority privately-owned and fully private airports tend to set lower aeronautical fees than those facing no competition, they charge higher landing based and passenger related fees than public airports that operate equally efficiently under competitive conditions.

The paper is organized as follows: the theoretical and empirical literature discussing ownership form, economic regulation and competition is presented in Section 2, the methodology and model specifications are introduced in Section 3, the dataset for the two stage analysis is discussed in Section 4 and the results are presented in Section 5. Conclusions and directions for future research are suggested in Section 6.

## 2. Competition, regulation and ownership form

Neoclassical theory states that under monopolistic conditions firms generally seek to maximize their profits by limiting output. The introduction of competition may lead to increased productive and allocative efficiency as a result of lower prices

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