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Cost-efficiency benchmarking of European air navigation service providers

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ABSTRACT

This study uses EUROCONTROL data on operating performance of the national air navigation service providers over the 2002–2011 time period to document in detail the efficiency changes across providers and time using data envelopment analysis. Our results suggest that overall providers' productivity improved over the time period covered by the data, driven by improvements in technical rather than allocative efficiency. However, some trend reversals in the post-2008 crisis period are also observed.

1. Introduction

This study examines the cost efficiency and productivity of individual national providers of air navigation services (ANS) within the European airspace. The Performance Review Unit (PRU) of EUROCONTROL – the European organisation for the safety of air navigation – regularly performs and commissions studies with the aim of monitoring performance of national service providers. Those studies use the Tornqvist index to measure the productivity of ANS units over time, and stochastic frontier analysis to obtain a cost function and inefficiency measures. We use the data envelopment analysis (DEA)-Malmquist index which is more general than the Tornqvist index. Following Simar and Wilson (1998, 1999), we make use of bootstrap in order to obtain bias-corrected confidence intervals for the Malmquist index, its components, and efficiency scores.

We apply DEA to the EUROCONTROL PRU 2002–2011 dataset (EUROCONTROL, 2004–2012, 2013a) to evaluate the relative efficiency of individual Air Navigation Service Providers (ANSPs). Our data analysis demonstrates that overall productivity of national ANSPs has increased over the time period covered by the data. In particular, three out of four providers have increased their productivity; and about two out of three have become more cost efficient. At the same time, we also observe a disturbing trend of declining cost and allocative efficiency scores after 2007. In case of allocative efficiency, the average of scores for 2010 is nearly back to its 2002 level.

Unfortunately, published PRU reports do not include efficiency scores for individual navigation service providers. Such information would be of obvious importance, given the discussion about possible consolidation of air navigation services

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in Europe – an important and politically sensitive issue. EUROCONTROL (2006) studied the cost of fragmentation in the European en-route ATM/CNS[1] system, estimating that, on aggregate, a half of the total cost stems from unexploited economies of scale, as many European Area Control Centres happen to be below an optimum economic size. Our study adds to this debate by exploring the efficiency parameters of the current system, including the scale and the governance structure used in providing ANS services.

The rest of the paper is organised as follows. The next section describes air navigation services in Europe, the underlying institutional background, and previous studies on the subject. This is followed by a discussion of DEA method used to estimate efficiency and productivity. Section 4 describes the data, and Section 5 presents and discusses the results of our data analysis exercise. Section 6 concludes.

2. Air navigation services in Europe

Air navigation services in Europe are harmonised and integrated by EUROCONTROL. Headquartered in Brussels, this international organisation supports its member states in reaching the goal of safe, efficient and environmentally-friendly air traffic operations. In addition to all the EU members, ANSPs of Switzerland, Norway, Albania, Armenia, former Yugoslav republics, Georgia, Turkey, Moldova and Ukraine are members of EUROCONTROL.

National air navigation service providers in Europe are responsible for organising and managing the flow of traffic in the air and on the ground in a dedicated airspace. According to EUROCONTROL, in most countries these providers operate as public enterprises, subject to national laws and regulations. As of 2011, among 37 European ANSPs there were 15 state enterprises, 13 joint stock companies (11 of which were fully state owned), five "state bodies" with autonomous budget, two limited liability companies (also state owned), one independent administrative body, and one international organisation (EUROCONTROL, 2013a). This decentralised structure is in stark contrast to that of the United States, where a single government agency (Federal Aviation Administration or FAA) manages the airspace of about the same size. On the surface, FAA appears to do this job more effectively. EUROCONTROL (2013b) states that the US FAA employs nearly 40 per cent fewer staff as compared to EUROCONTROL organisations. Further, FAA has to control 70 per cent more flight hours in an airspace that is nearly twice as dense.

One of EUROCONTROL's declared missions is to facilitate creation of the Single European Sky (SES) – an EU initiative aimed at designing a more efficient air navigation system around "functional airspace blocks" rather than national boundaries.[2] Establishment of such a system may yield redundancies in some of the national ANS providers' workforce and infrastructure. This understandably creates opposition from the corresponding interest groups, with periodic strikes by air traffic controllers working for national ANSPs.

As the European ANS industry function was based on the full cost recovery principle until 2012, the incentives for cost efficiency were minimal.[3] We can therefore expect that costs due to inefficiencies were passed on to the system's users: airlines, and – to the extent competitive pressures allowed the airlines to do so – passengers.

As we noted above, the Performance Review Unit (PRU) of EUROCONTROL is responsible for periodic evaluation of the system's performance, including performing or commissioning studies of providers' efficiency and productivity. Table 1 below summarises some key features of several most relevant previous efforts in the field.

The most important findings of those studies are as follows. Mouchart and Simar (2003) find that the returns to scale in the production process of the ACC are increasing or near constant for small units, and decreasing for larger units. Most of the scale inefficiency can be explained by congestion, an appropriate measure of which is being the number of flight hours controlled per cubic root of the volume of the controlled area. EUROCONTROL (2005) finds that Total Factor Productivity (TFP) increased by about 2 per cent between 2001 and 2003. The NERA (2006) estimated Cobb-Douglas cost function, using a random effects time-invariant model as the preferred specification, regressing total cost on output, input prices, and network size. In general, this produced coefficients that are significant, have the right sign and appear to be robust. However, the model is likely to overestimate inefficiency, due to the lack of variation within the four year sample period in the exogenous control factors (network size, traffic complexity and seasonal variability).

EUROCONTROL (2011) estimates indicated that a 10% increase in output increases costs by 5.7%. A 10% increase in either the ATCO or support staff wages translates in 2.8% increase in costs; very similar elasticities are obtained by the True Random Effects model. The results of both the Pitt and Lee and the True Random Effects models suggest the existence of economies of scale. PRB (2013) suggests significant economies of density in the provision of air traffic management/communication, navigation and surveillance (ATM/CNS) services (a 10% increase in output contributing to a 4.6% increase in costs, according to Pit and Lee model), but also the presence of economies of scale. Cost-inefficiency estimates range between 10% (Greene model) and 70% (Pit and Lee model) in 2011, indicating the strong effect of modelling choice on the efficiency estimates.

[1] Air Traffic Management/Communication Navigation Surveillance.

[2] A functional airspace block (FAB) is a SES notion, defined as "an airspace block based on operational requirements and established regardless of State boundaries, where the provision of air navigation services and related functions are performance-driven and optimised with a view to introducing, in each FAB, enhanced cooperation among ANSPs or, where appropriate, an integrated provider." (European Commission, 2009).

[3] As from 1 January 2012, the *determined cost* method is used to calculate ANS charges in EU member states. It incorporates the risk sharing mechanism, if traffic volume or/and costs deviate from forecasts (European Commission, 2010). It means that revenue shortages will no longer be necessarily covered by increased charges in the following period, and also allows for a certain proportion of revenue excess over determined costs to be kept by ANSPs. The new method thus arguably incentivises the cost-efficiency of EU ANSPs.