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Management of airports in extreme winter conditions—some lessons from analysing the efficiency of Norwegian airports

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ABSTRACT

Managing airports' winter operations has become a very important subject in recent years. Snow and ice have led to major difficulties and flight disruptions at key European hubs and subsequently to losses of revenue and reputation for the aviation industry. With substantially less funds available at regional airports, the management of these entities in often much harsher winter conditions is an even greater challenge. By applying bootstrapped two-stage DEA models to Norwegian airports, we find that regional airports perform on average not worse than the prime example of Oslo airport. Although technical efficiency is often relatively poor (particularly when accounting for costs), the size of remote airports appears not to be a major problem as for many of the small airports we find very little diseconomies of scale. Our results suggest further that good management practices, appropriate training and an enhanced predictability of environment factors can overcome severe winter conditions and can lead to efficient airport management.

1. Introduction

During the winter periods of 2009/10 and 2010/11 some of the key European airports have experienced catastrophic situations with severe disruptions to their operations. As a result, many airports decided not only to increase their spending on equipment and training (most notably in BAA spending £50 m in 2011 to improve their winter operations programme; see BAA, 2011), but also to revise their management plans and decision processes. Given that regional and very small airports have generally (and particularly since many public authorities have now an austerity agenda) significantly less funding available, it is justifiable to assume that the severe winter conditions must have an even stronger impact on their operational performance. As some small and regional airports are owned by large airport groups, hierarchies and appropriate management approaches often matter not only at the airport level, but also at the parent company level. What is similar to airports of all sizes is the need to find the right management approach to the variable possibilities of severe winter.

If the airport invests too much it will find it hard to justify the costs (e.g. just one snow blower costs about €1.5 m). If the airport invests too little or if it has not the necessary management frameworks/plans in place it will suffer from severe disruptions to its operation (flight delays or cancellations), losses of revenues, cost resulting from claims of the airlines and perhaps most importantly damages to its reputation (e.g. Begg et al., 2011). For example, Pejovic, Noland, Williams, and Toumi (2009) estimate that a 1-hour closure of an airport can easily lead to cost in the region of €700,000–€1.25 m that the airport has to bear and another €1.4 m in external costs.

It is therefore extremely important to find the right management approach with regard to harsh winter operations of airports. In this paper, we argue, however, that good management practices can avoid a loss of productivity and efficiency even when the airports face strong winters. We aim to measure the efficiency of airports in Norway, not only the prime example of Oslo airport (when it comes to winter operations) but also the regional and very small airports, particularly in the north of the country. As Norway is a very long country, it has different weather zones (despite most airports being located on the coast, where there are similar weather conditions across the country), different zones of day light during the winter and also a different level of remoteness within the country. Since nearly all Norwegian airports are owned and managed by Avinor, there is no need to control for differences in ownership structures. A key research question of this paper is whether the Avinor management approach (including winter operations) is similarly successful across Norway or whether there are differences and lessons to be learnt particularly from regional airports. We analyse the overall efficiency of major and regional airports and determine whether the geographic location (north–south), the remoteness as well as the size of airports and the populations in their catchment area impact on the airports' efficiency. Finally, we analyse whether particularly regional airports have a specific management approach to winter operations that could be applicable to airports across Europe.

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The paper is structured as follows. Section 2 will briefly discuss some of the existing literature and discussion on the impact of winter operations on European airports. Section 3 and 4 detail our methodology and the data. Section 5 discusses the results whilst Section 6 derives some scholarly contributions and management implications of our findings.

2. Winter operations and their impact on European airports

The quality and quantity of service provision at airports has become of interest to many stakeholders and is widely discussed in the literature (see, e.g. Graham, 2008). Although airports in Europe are regulated (Forsyth, 2010), some airports experience disruptions to their operations, inefficiencies and poor management practices that affect both, the airport's commercial activities and the airlines on-time performance. As the latter gets increasingly important to the airlines several studies have been undertaken to investigate the reasons behind the interruptions of airport operations (e.g. Pejovic et al., 2009; Wu, 2010). Fig. 1 reveals that meteorological issues and in particular severe winter conditions (such as snow, ice and low visibility) contribute substantially to light delays in Europe. It is therefore unsurprising that the resulting travel chaos brings not only cost to the society (the snow travel chaos of the 2011 winter in the UK is estimated to have cost £280 m a day; see BBC, 2011), but also a substantial financial burden to the airports (e.g. Jenkins, 1999; more recent data show that the 2010/11 snow chaos at Heathrow cost the airport £20 m). It is widely acknowledged that privately managed and also publicly owned airports (e.g. Gesell, 1999) suffer from the impacts of severe winter conditions.

In terms of management of winter operations, most authors focus on discussing suppressive and preventive measures (e.g. Wells & Young, 2004) and on the importance of strategic planning to achieve minimum service levels (e.g. Caves & Gosling, 1999). Gillen and Lall (1997) use a non-parametric approach to show that US airports in "snow belts" are generally less efficient than those operating in more favourable winter conditions. A detailed study on winter operations (Kazda & Caves, 2007) highlights a large range of problems that can evolve from severe winter conditions at airports and shows the benefits of snow management plans. More recent recommendations on management plans and investment into ground equipment are discussed by IATA (2011).

The most obvious financial burden to the airports is the loss of landing fees, but also regulatory penalties and compensation claims from airlines can be substantial. As the majority of non-aeronautical revenues (increasingly important) come from franchise and rental fees, the immediate impact of flight disruptions is felt more strongly by the shops that operate at the airport compared to the airport itself. It is therefore understandable that the airport management focuses most on the impact of winter condition on its operations, and in particular on landing and take-off, taxiing (and parking, de-icing etc.), ground handling, surface access, stock levels, communications and air traffic management.

While one could argue that unfavourable winter conditions are predictable, the management of these conditions requires skills, appropriate investment and a strategic approach. Begg et al. (2011) specify what a crisis management plan for such incidents should include. In addition, to responsibilities (e.g. for de-icing of different parts of the airport) it also includes priorities for snow removal process (usually runways first, then taxiways, aprons, holding bays and then all other areas) as well as clearly defined hierarchies and contact points for communication with stakeholders and the media. According to their study a good crisis management plan is supposed to involve simplified processes that are revised and tested on a regular basis and that are in line with current regulations. It further has to engage all key stakeholders, to clearly define realistic conditions which should trigger its initialisation and to sufficiently plan for appropriate communication and information exchange of all stakeholders. A good crisis management plan is finally ensuring that sufficient resources are allocated to enable the execution of the planned processes including not only mechanical equipment (such as snow ploughs or blowers) or chemicals, but also appropriate staff resources. The latter is supposed to consider in addition to pure staff numbers also competency, leadership capabilities (as crisis management involves decision making at all levels of airport management) and training. A large number of these aspects are specified in international guidelines (e.g. ICAO Annex 14) and often regulated by national bodies. In the UK, for example, the management of events arising from severe winter conditions is regulated by the Civil Aviation Authority and governed by the "CAP 168 Licensing of Aerodromes" which sets out the standards required at UK licensed aerodromes relating to its management systems and operational procedures.

Despite these regulations, when it comes to cost control and managing the risk of snowy conditions, managers usually base their decisions on cost-benefit-evaluations. The well-publicised case of Oslo airport shows that once appropriate management systems are in place, the impact of winter conditions can be reduced to a minimum. While Oslo Gardermoen airport (OSL) had to close down during two winter days only (01.02.2008 and 07.02.2009; both days for a couple of hours), since it opened (despite a total of 1.58 metres of snow in 2010/11), Heathrow airport had to close down for several days (39.5 hours in total) in the winter of 2010/11 alone, which resulted in the cancellation of some 4000 flights. This paper is, therefore, interested in whether also the other, usually much smaller and more remote Norwegian airports are as efficient as Oslo airport.

3. Method of empirical application

An airport is a complex entity and its efficiency is subject to good management practice and also to the effects of many exogenous factors, including severe weather conditions. Benchmarking has been proven to be a useful tool with which to compare and evaluate the performance of airports. In that sense benchmarking can be seen as a diagnostic as well as a predictive tool in airport planning and control. Merkert, Odeck, Bråthen, and Pagliari (2012) have shown in a systematic literature review that non-parametric benchmarking methods, such as Data Envelopment Analysis (DEA), that go beyond simple partial productivity measurement, are appropriate and useful in the regional and small airport context. We, therefore, apply in the first stage of our analysis a number of DEA models that evaluate the relative performance of individual organisations or decision-making units, in our case our analysed airports. Efficiency is in this paper defined as the performance of the airport management in minimising their inputs at given outputs (specifically we evaluate the ratio of the weighted sum of its outputs to the weighted sum of its inputs).

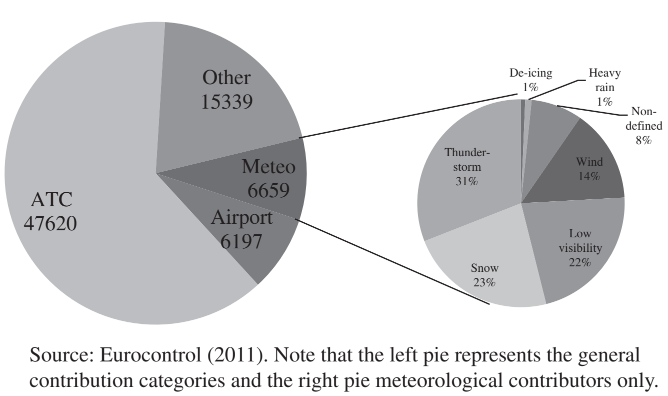

Fig. 1. Contribution of winter conditions to flight delays in Europe in 2010. Source: Eurocontrol (2011). Note that the left pie represents the general contribution categories and the right pie meteorological contributors only.