International Transport Forum

Air Transport Services in Remote Regions

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INTERNATIONAL TRANSPORT FORUM

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EXECUTIVE SUMMARY

In this author's view, the main elements of interest for air transport in remote regions are:

The need for public support. The existing programs for public support have been made with reference to the need for essential air transport services for providing local communities with lifeline transport services. However, the criteria for giving public support (via the programs in USA, Canada and Europe) allows for quite wide interpretation of the terms "remote regions" and "lifeline services". In some places, subsidies are given to routes with quite heavy traffic where the potential for ordinary commercial services could have been offered. In other subsidy programs, air services' role as lifeline transport can be questioned because there are modes of surface transport that probably can serve these lifeline needs. A clearer set of criteria for "remoteness" and "lifeline services" could perhaps be developed. The allocative efficiency of the services should be focused, i.e. that the level of service are aligned with market needs and regional policy objectives. There should also be a coordinated approach to the funding of services to remote regions across relevant transport modes.

Air fares. In many cases, the air fares are set at a maximum level, and with discounts for special travel needs. The pricing regimes are of importance. If the prices are defines at a maximum level, problems may occur in peak periods, where excess demand may result because the maximum fares are too low. On the other hand, maximum prices may be too high in off-peak periods. If the fares are set according to a "maximum average" level, the operator will better be able to carry out some form of peak/off-peak pricing. This can be done on the basis of cost models for different aircraft operations. In addition, a study from Norway indicates that reducing the high air fares in subsidized air transport may improve the allocative efficiency. Air fares could be set under a "Ramsey pricing" framework, based on marginal aircraft operating costs, demand elasticity in relevant market segments and the desired level of subsidies.

Aircraft operating costs and airport costs. There are different cost models that can be applied to determine these costs. The marginal costs of off-peak operations are low, but average costs may be high because in most cases there are high fixed costs and low demand. The two important aspects are to determine the costs of operations, and also to enhance the productivity of these operations. This can be done by means of selecting appropriate aircraft given the market conditions, optimizing the level of service and the route network, by considering more efficient air navigation systems, by addressing airport operation issues (like sharing fire and rescue services with the local community and to consider remote tower operations), and by considering carefully the airport structure. The internal efficiency of airline and airport services is the issue at stake here, and studies are needed to address these issues properly through e.g. benchmarking studies. Such studies could also facilitate the development of performance indicators.

The subsidy level. The level of subsidies depends on aircraft and airport operating costs, the market's willingness to pay, and the minimum level of service that should be offered. Given that fairly robust criteria of "remoteness" and "lifeline services" are fulfilled and the markets willingness to pay is known (can be derived from travel surveys and demand modelling), one can derive the necessary subsidy level based on the points 1-3 above. This can also be done the other way round: if a target level for the subsidies is set for specific operations (as indicated in point 2), the fares and level of service can be determined.

The invitations to tender and the level of competition. There have been issues about the tender processes and whether these processes have affected the level of competition. In some parts of the world (like in Norway), the bids have been few and the subsidy level has increased substantially. One reason may have to do with special operating conditions e.g. in areas with demanding weather conditions and other barriers to entry. In this respect, one should be careful with defining terms like e.g. type of aircraft or navigation system if a) this is not needed for market or safety reasons, and b) if it will allow only a limited number of airlines to bid. Another issue has been claimed by some airlines that it has been too short time between invitations to tender and commence of aircraft operations. A third issue has been the level of competition. It is likely that one reason why the competition for the tenders has been rather weak in some areas has to do with the short (around 800 metres) runways. Extended runways may allow a larger number of airlines to bid for the tenders. A reduced number of airports may in some areas allow for extended runways on the remaining ones. Cost-benefit analyses or other assessment methods may be applied to identify relevant cases for airport closures or airport mergers.

The design of the tender contracts and distribution of risk. In many of the supporting programs, the minimum service level and the fare level are published in a tender, and the airlines have to bid for the right to serve the route or the bundle of routes for a given period of time. Under the PSO system in Europe, the duration of the contracts is 4 years at present. The contracts should have the necessary amount of flexibility, predictability and they should also give the airlines incentives to improve the allocative efficiency of their services. The contracts should also be clear about the risk sharing. In short, the player who is in the position of controlling the risk should be allowed to bear it. In case of indifference with respect to risk control, the party with the largest possibility of diversifying the risk should be the responsible part. The operators' willingness to bear the risk may also be stimulated by longer contracts than 4 years, particularly in cases where barriers to entry may be perceived as substantial, e.g. in areas with demanding weather conditions or with special aircraft needs.

Remote areas and economic development. Remote areas may contain valuable natural resources and connected industries. The air transport dependency may be quite high, albeit not materializing in sufficient demand to allow for commercially viable air transport services, at least not in the shorter run. These industries may not be "foot loose", and hence air transport may be important to ensure a productive exploitation of such resources. Policies for regional balance may also give reasons to use air transport for ensuring necessary accessibility and regional welfare, e.g. with respect to VFR travels. Studies have underlined how residents and businesses valuate access to more central areas and to e.g. hospital treatment. Nevertheless, a keen eye should be kept on the necessary level of service and alternative modes of transport, as stated above.

1. INTRODUCTION

Air transport services are a key factor in the transport system in remote regions. They allow human and natural resources to be used more efficiently. Air transport is very important for long distance travels and for connecting remote areas to the rest of the world. In order to provide air transport, the air transport industry utilises primary resources, like labour and capital, as well as intermediate products. Air transport itself is a product which is delivered partly as intermediate products for other industries, partly as final demand like leisure travels (Halpern and Bråthen 2010).

The air transport industry, as well as other production activities, has impacts for resource allocation as well as for value added and income. Air transport services also contribute as a catalyst in industrial development particularly in connection with exploitation of location-specific natural and human resources. These catalytic impacts could very important both from an economic efficiency and regional balance perspective. They are further discussed in Section 7.

To be able to provide efficient air transport services, it is important to have an adequate balance between level of service, air fares and subsidies. Excessively high prices may cause undesirable traffic deterrence and hence the benefits of the resources that are put into the air transport services are not fully utilised. On the other hand, if fares are set too low and/or the level of service is too high, then this may give excess demand and too many resources may be put into the air transport system.

This paper deals with air transport in remote regions. There is no unambiguous definition of "remoteness". The discussion of air transport provision in regions is limited to situations where there is a claimed need for some kind of third party involvement to make the services viable. This involvement is most often done by means of subsidies from central or local authorities. Hence, neither questions about airport and air service provision in general nor theoretical issues related to e.g. demand modelling will be the issue at stake here.

There is limited research within the area of air transport in remote regions, and hence a variety of sources from presentations, reports and journal articles are used.

The sequence of sections is given in the Contents list above.

2. USA AND CANADA: ESSENTIAL AIR SERVICES IN REMOTE REGIONS

2.1 The framework

2.1.1 USA

After deregulation in the U.S., the conditions for small communities have been an issue of concern. The Essential Air Service Program (EAS) has been the most important instrument for supporting small communities. EAS subsidizes carriers to provide service on specific routes. The carriers are selected through a competitive tendering process, where the airlines submit proposals containing response to minimum requirements defined by EAS. Such requirements

are connected to number of daily flights, weekend frequencies, size of the connecting hub, aircraft equipment and fare schedule. EAS funding is provided by FAA's revenues from user fees. In order to qualify for EAS, a community is required to have received services since the time of the Airline Deregulation Act (1978) or the Airport and Airway Safety and Capacity Expansion Act (AASCEA, 1987). The community needs to be located at least 70 miles from the nearest hub. Other communities may also join EAS if the local or state government or other parties agree to pay 50% of the compensation costs. Communities not served in 1991 are not eligible for EAS payments unless they are located more than 200 miles from a hub. In that case, a 50% state or local government share is required. A community cannot receive more than $200 per passenger, unless they are located at least 210 highway miles from the nearest alternative transportation centre. In 2009, 35 states received EAS funds. Excluding Alaska, EAS funding was around $150 million for 107 communities (U.S. DOT (2009), in Metrass-Mendes and Neufville (2010). Reynolds-Feighan (1995) also gives an extensive description of the history and the structure of the EAS program.

There is also another program, the Small Communities Air Service Development Program (SCASD), which is small ($6.5 million in 2009). It allows flexible use of the funds like traffic studies, financial incentives for carriers (maximum of 3 years), marketing expenses etc. This program will not be subjected to further comments.

If another carrier proposes a commercial service without subsidies on an EAS route, the DOT may give the incumbent carrier a notice to discontinue its operations, given that the new carrier satisfies minimum financial and operational requirements for sustainable operations (Reynolds-Feighan 1995). The new carrier has to offer the minimum service level that was specified in the EAS tender for the route.

2.1.2 Canada

Metrass-Mendes and Neufville (2010) has examined Canada's institutional framework for the provision of air transport services in remote regions. In 2006, rural Canada covered 99.8% of the nation's territory and accounted for 24% of its population. Establishing surface transport to meet the needs of thinly populated areas are extremely challenging, and hence remote Canada is dependent on air transport services as apparently the most efficient mode of transport. The infrastructure costs are modest, but it is well known that the operational costs are substantial. The deregulation of air transport has caused a restructuring of the airline industry and cross-subsidization of thin routes has become less feasible for airlines. In short, the National Airport policy (NAP) consists of the following elements that are relevant to airports in remote Canada (based on information from Transport Canada, www.tc.gc.ca):

- Ownership of regional/local and other smaller airports will be transferred to regional interests. Locally-owned and operated airports are able to function in a more commercial and cost-efficient manner, are more responsive to local needs and are better able to match levels of service to local demands. Recent experiences of the four existing airport authorities and the numerous airports that have existed without federal support since their inception clearly demonstrate these realities.
- Remote airports which provide exclusive, reliable year-round access to isolated communities and which currently receive federal assistance will continue to be supported.

While the US has imposed full deregulation and a minimum level of service, Canada has originally maintained light regulation with a gradual deregulation and transfer of thin routes to public financial support. While the US (like the European PSO) tenders out contracts in a

competitive bidding system, Canada goes further in tailoring the support to specific needs, like shipments of food, medication, mail, tools and equipment and medical requirements. The support is also tied to specific travel purposes, like medical care. The ownership and operations of the infrastructure is decentralised, and the support to carriers is also decentralised (no Federal programs as opposed to the centralised EAS system in the US).

2.1.3 Evaluation

Metrass-Mendes et al (2011) and Metrass-Mendes and Neufville (2010) state that after deregulation, the need for equitable air services and public support to their provision to remote regions otherwise underserved by a deregulated industry, has been recognized in both countries. Furthermore, the authors state that the smaller communities are now served more efficiently by small commuter airlines with smaller aircraft. This support is given by subsidies for both aircraft and airport operations. Like in Europe, the lack of unambiguity with respect to classification of "remoteness", failure to include changing conditions (like changes in surface transport) and the lack of coordination with other transport modes are seen as areas for improvement. These points are also underlined in Transport Canada (2007), where in addition the need for reviewing the airports' fee structure, for collecting financial data for bench-marking purposes and to coordinate funding of services to remote regions across different transport modes are mentioned as important points.

In a spatial analysis of air transport access and the EAS program in the U.S., Grubesic and Matiziw (2011) point to the problem of redundancy in service coverage. They claim that the 70 miles critical access standard may be too liberal. This is in many cases equal to a 1 hr drive by car. They also point to the fact that the spatial distribution of population in the U.S. has changed since the EAS program was implemented in 1978, which has caused some areas of EAS support to get above the "critical mass" for commercial air transport services. The authors also discuss the need for EAS services in the light of market leakage to larger airports, as is done in Lian and Rønnevik (2011) for the PSO system in Norway.

3. EUROPE: PUBLIC SERVICE OBLIGATION IN REMOTE AIR TRANSPORT

3.1 The framework

Williams (2010) state that "In order to enable governments to maintain essential air services, Articles 16, 17 and 18 of Regulation (EEC) No 1008/2008 define a system of public service obligations which can be imposed on carriers operating on designated routes. In essence, the legislation allows Member States to impose a public service obligation (PSO) in respect of scheduled air services between any airport in the Community and an airport serving a peripheral or development region within its territory or on a thin route to any airport in its territory considered vital for the economic and social development of the region served by the airport. If no airline is willing to provide a service under the conditions imposed, the government may restrict access to the route to a single carrier and award financial compensation to the carrier in return for compliance with the PSO. While a PSO can be imposed by a Member State for a route between its territory and that of another Member State, over 90% of public service obligations are in respect of domestic services.

In the Czech Republic, Finland, Greece, Ireland, Portugal and Sweden, national government departments administer air transport public service obligations, while in France, Germany, Italy and Spain, administration is in the hands of regional authorities. In the UK, the Scottish Government is responsible for administering the routes operated from Glasgow and the respective regional authority for services provided in Orkney, Shetland and Western Isles, while in Wales it is the Welsh Assembly Government." In addition, Norway, Iceland and Lichtenstein adapt to this program as members of the European Economic Area (EEA).

This description indicates that to a large extent it is up to the Member States to decide upon which routes are "essential air services" and to decide upon whether the Central Government or the Regional Governments should have responsibility for the PSO tenders. This has led to a certain degree of diversity in the PSO practice, which will be elaborated a bit below.

3.2 Short description of PSO routes

Norway has the largest number of PSO routes (61), followed by France with 41. Spain, Portugal and Scotland have 10-12 routes each. The share of domestic seats that are offered under the PSO regime is highest in Portugal (40%) and Ireland (23%). Several other countries, like France and Norway has around 10% (Lian et al 2010)[1].

The average legs vary between about 600 km (France) and 200 km (Norway). The average seating capacity varies between larger aircraft of 110-70 seats (Portugal and France), 50-35 seats (Spain, Sweden and Germany) while Scotland are using smaller aircraft down to 10-15 seats. Norway has 15 seats as minimum, most aircraft are 37 seats.

The average subsidy level in Germany is around EUR 120 per passenger, for Norway, Sweden and Scotland it is around EUR 60 per passenger, while France and Portugal had subsidies of slightly above EUR 20 per passenger.

3.3 Some PSO policy issues

Williams and Pagliari (2004) presented and discussed how different European Economic Area member states have adopted and made use of the PSO mechanism in air transport. This study gives a comprehensive overview and provides a good support for understanding the variation with respect to how the PSO regime is applied. This study suggests that this variation may be larger than optimal in the sense that the use spans from thin routes in remote areas (like Scotland and Norway), via heavily trafficked tourist routes to islands and to routes where surface transport appears as a viable alternative. An interesting question is also connected to the non-use of PSO in areas where a number of lifeline airline services may be vulnerable to adverse pricing and scheduling decisions. The authors claim that at the time of writing, "major inconsistencies in the approach and commitment to social air service provision across the European union … may undermine broader policy initiatives designed to enhance mobility and accessibility". Mainly for this reason, the authors claim that there are convincing arguments for centralizing the administration and funding of PSOs at EU-level. They also claim that investigation of price elasticities of demand for various routes will be required to be able to do proper considerations about pricing, level of service and subsidy level.

Hervik et al (1999) claimed a slightly different perspective, where they recommended a more decentralized responsibility for air transport PSO in Norway. At the time of writing as well as today, the responsibility for PSO tenders is carried by the Ministry of Transport and

1. A full list of current PSO routes can be found at http://ec.europa.eu/transport/air/internal_market/doc/2009_12_pso-eu_and_eea.pdf.

Communications. Over the years, the competition for the tender contracts in Norway has been rather weak, with Widerøe's Flyveselskap ASA (a subsidiary of the SAS group) as the dominant operator. The counties and the local communities are demanding the best possible quality of the PSO services, but the responsibility for providing the funds rests with the Ministry. Hence, one cannot exclude the possibility that the local and regional interest groups have gained from this asymmetric situation by being in position of advocating demand for PSO services without being responsible for the funding. The recommendation of a decentralized responsibility for tendering and funding of the PSO services was based on a potentially better adaptation between claimed local/regional needs and funding responsibilities. In addition, a more diversified tendering regime based on local needs was seen as a means for attracting new entrants.

In this author's view, the pros and cons with decentralized versus centralized administration and funding of air transport PSOs leaves some open questions that are not readily answered. One important step that perhaps should be taken is to establish a set of clearer criteria for routes to be considered eligible for PSO.

O'Fee and Merkert (2011) have addressed the different uses of aviation PSOs across Europe by means of a survey to 16 transport authorities on the national or regional level across Europe (Finland, France, Germany (2 regions), Iceland, Ireland (2 regions), Italy, Norway, Portugal, Scotland (4 regions), Sweden and Wales). They investigated issues such as the transparency of the subsidy amount, the risk sharing with the operator, the vetting of the operator and use of specialist advice during the tender process. They also explored various aspects of the obligations the authority impose upon the route and the operator, like the fare structure (maximum fares, social discounts), ticketing, timetabling, size of aircraft and air cargo requirements. The authors observed that in general, the PSO venture should be made more attractive to the operators, like incentives to grow patronage and to have an equitable risk sharing based on sound principles. This may lead to increased competition also with participation from foreign operators. Their statement is that too many contracts have just one bidder (like in Norway), and even two bidders could make a significant difference. It is also important to monitor the operator's performance and to have a continuous dialogue in order to achieve improvements by means of e.g. marketing efforts and better scheduling. If the operators becomes more efficient and increased patronage increases revenues, less need for subsidies could be the likely result. Based on the survey, the authors give some recommendations.

O'Fee and Merkert (op cit) claimed that the regional authorities (where applicable) should be more pro-active in between tenders to attract new entrants by means of e.g. bringing down real and perceived entry barriers. Transparency and openness is important in facilitating competition and ensuring level playing fields. Keeping a keen eye on the marketing efforts including collaboration possibilities with e.g. local development agencies is also suggested. The responsibility for the marketing may be in the hands of the operator (like in Norway) or the responsible authority. One important matter is the duration of the contracts, where longer contracts may allow new operators (who might need more time than an incumbent operator to write off start-up costs and aircraft depreciation costs) to earn some profits. Within the PSO regulations, the maximum duration is 4 years.

For the airlines, O'Fee and Merkert (op cit) pointed out that a transparent process will make it easier for them to challenge the standard contracts because these may be subjected to local interpretations, and also to achieve productive systems for cost/risk sharing. Airlines should also consider route development activities together with the regional authorities and other local parties.

For national regulators (which in many cases are those responsible for the contracts) and EC, the recommendations from these authors are to decide upon whether consistency or diversity should be applied in the applications of the contracts. Diversity may perhaps lead to a higher rate of innovation in the application of the legislation. In general, different cases (like different competitive environment and different level of asset specificity connected to the contract) may call for a certain degree of diversity. From the national government and EC, systems for more transparency and better incentives to the operators should be provided. It is also recommended to increase the EC's role as a watchdog to ensure that PSO are fulfilling the intentions in the EC 1008/2008 regulations, and also that a central information point for the PSO regime is developed. There is also an issue of slot allocation to remote routes on congested airports, where the recommendation from O'Fee and Merkert (op cit) is to practice some self-regulation by the airports in order to give access to such routes to avoid the possibility of legislative intervention. However, slot allocation under capacity constraints entails economic welfare effects for all parties involved. Gains for passengers on a prioritized route to a remote region may be more than offset by losses for passengers on a denser route that will have to be diverted to a less attractive slot. Ideally, the willingness to pay for the slots should be the decision criterion for slot allocation. If other criteria should be applied, these should be vindicated by some kind of market failure or distribution of welfare from a policy perspective. Therefore, in this author's view such issues should be addressed carefully by means of formal analyses (e.g. cost-benefit analyses) to address whether there are sound cases for giving regional carriers priority on airports with constrained slot capacity.

Noal et al (2005) discusses subsidy regimes in connection with small market air services. These are not only PSO and EAS-like services, but also subsidy regimes connected to route expansion in small market areas where the local communities engage in direct financial support. They discuss theoretical properties for different subsidy regimes. In essence, these are (1) lump sum per route, (2) per passenger subsidy, (3) protected route packages where thin and thicker routes are combined in return for a guarantee of minimum service on the thin routes, and (4) revenue guarantees where subsidies are tied to some kind of pre-negotiated revenue target. Based on simulations of a small route network, the authors seem in favour of a modified form of revenue guarantees called an Air Travel Bank, where public and private parties can fill the gap between route operation costs and an agreed revenue target. They find this system appropriate for short-term confirmation of latent demand for a route, whereas a longer-term commitment to the small market air service requires is likely to require more standard revenue guarantees. In this author's view, the revenue guarantees in Noal et al can be compared with the subsidy levels that result from a competitive tendering process, preferably combined with some kind of incentive contracts to encourage the airline to work with their markets.

4. THE AIRPORT NETWORK IN REMOTE AREAS

Airport capacity has been an issue of concern in countries like Norway. The reason for this is twofold. Firstly, the improvements in surface transport have improved the accessibility to some remote areas. This has resulted in that the residents choose to go via other airports than their local one, and hence reduce the basis for the PSO service. Secondly, some of the smaller airports have short (800 metres) runways. There have been initiatives to merge airports and to upgrade the remaining airport with a longer runway. This is likely to improve the possibilities for

a larger variety of aircraft, give more direct routes to central areas and also to increase competition on the PSO services because a larger variety of aircraft may be used. One could also foresee the possibility that some of the air services could survive outside the PSO regime.

Bråthen and Eriksen (2007) presented a framework for analysing airport closures and upgrading of the remaining local airports, based on the cost-benefit analysis framework presented in Bråthen et al (2000). They also provided some results of an analysis of ten prospective cases for airport closures in Norway, where five out of these ten cases seemed suitable for closure. The Norwegian Government proposed to close three airports, based on this analysis. So far, none has been closed.

Lian and Rønnevik (2011) have addressed the passengers' choice between local airports with PSO services and larger regional airport in Norway. The choice situation for a passenger is often to compare a relatively high PSO fare on the connecting route to a regional airport with the use of surface transport to the regional airport and then flying further on from there. Their findings are that many residents in remote regions prefer to use their car to the larger airport, and that this in turn can undermine the PSO services at the local airport. The authors point to an important PSO characteristic in Norway, namely that PSO does not cover "through fares". This fact combined with improved surface transport and good accessibility to private cars for the citizens has been the main drivers for the "leakage" from smaller local airports to larger regional ones.

5. THE AIR FARE STRUCTURE FOR REMOTE AIR SERVICES

5.1 Policy issues

For commercial viability, air fares should cover the costs of running the airports, communication and navigation systems and costs of aircraft operations. From theory, the social optimal fare level is where the passengers pay the marginal cost of use. The air transport industry has fixed costs connected to airports, communication/navigation and aircraft operations. However, the marginal costs per passenger are low (in-cabin service, extra fuel). Hence, the air transport industry is characterised by having economies of scale. Under such circumstances, marginal cost pricing would incur financial losses, because the fixed costs are not covered. A fare level equal to average costs would give total cost coverage, but a number of passengers willing to pay marginal costs will not travel with fares set at average cost levels. On routes with thin traffic, fares equal to average costs would mean a fare level significantly above the marginal costs (Bråthen and Williams 2010). Subsidies can be used to reduce fares and compensate public service obligations that would otherwise render services unprofitable.

In Norway and Scotland, the maximum PSO fare level on the different routes is often set by the authorities as a part of the tender requirements. The advantage is that for equity reasons, the upper price limit is defined, and nobody will have to pay more than that. In other countries (like France), the airlines have to state their fares as a part of the tender. Sweden has a system with maximum average fares. For Norway, Lian et al (2010) have shown that the maximum fares vary significantly between routes, and the variations seems partly incidental. The fares do also seem to increase more with flight distance than can be justified from an aircraft operation cost model. In addition, they found that a decrease in maximum fare level of 20% in Northern Norway did not entail a systematic and corresponding decrease in average fares.

Lian et al (2010) discuss the merits of maximum fares versus maximum average fares in PSO contracts. Maximum fares may not be feasible in periods where demand exceeds the available aircraft capacity. In such cases, a maximum average fare seems to be better in the sense that the airlines will have better possibilities to adjust the fares in line with the demand conditions, to avoid excess capacity or giving inadequate signals to the market about aircraft capacity costs. A PSO service monopoly needs to be regulated, and albeit there are some practical issues connected to calculations and monitoring, this maximum average fare system is recommended by the authors.

5.2 Reducing the fare level in remote areas – a case study

In 2006, the Ministry of Transport and Communications in Norway commissioned a study to examine the effects of a fare reduction on the Norwegian PSO routes.

The effects of the fare reduction are measured by means of a transport network model (Jansson 2007). This comprehensive model describes the whole transportation network, including roads, railways and sea transport. The transport costs for each transport mode is specified in detail for each route and link, also including elements like the user's own time costs, fares and vehicle operating costs. The model then predicts how the users of the whole system react to the fare reduction. These reactions may include an increased number of air trips, a change of transport mode, a change of route or even a change of destination.

The output of the analysis gives the network effects from the air fare reductions for the following elements:

- Change in consumer surplus for all transport users.
- Change in producer surplus for all transport companies.
- Change in public sector income, spending and cost of public funding.
- External (environment) effect.

Together, these numbers add up to show the total socio-economic effects of the air fare reduction. The analysis was done in two stages. Firstly, the effects of a fare reduction were analysed. Secondly, because the fare reduction causes changes air transport demand on remoter routes, a scenario were analysed where the number of aircraft seats were adjusted in combination with the fare adjustment, to ensure a fair adaptation between capacity and demand. Table 1 shows the results of the final analysis.

Table 1. **Socio-economic effects of reduced air fares in the Norwegian PSO network. Annual change, NOK (2006)**

Element	Million NOK/year (2006)
Consumer surplus (mainly benefits from fare reductions)	241
Producer surplus, airlines and other transport companies	13
Government revenues (= increased subsidies)	-135
Costs of increased public funding (subsidies)	-25
External effects (emissions to air)	12
SUM socio-economic effects	**106**

Source: Jansson; (2007).

The table shows that the PSO fare reduction would entail increased subsidies of approximately 135 million NOK. This would correspond to an increase of around 40% as compared to the 2006 subsidy level. On the other hand, user benefits and to some extent capacity adjustments (like some smaller aircraft on the larger routes) will give a net positive socio-economic contribution of some NOK 100 million per year.

What can be learned from this is that even if the subsidy level may need a significant increase to compensate the airlines for revenue losses, the overall positive economic effects seem to justify this. Furthermore, the economic effects of the fare reduction are estimated to be most beneficial for people living in the remote areas, like western and northern Norway. The main objective for the PSO regime is to contribute to improved regional balance, and the research done by Jansson (2007) indicates that this objective can be further achieved by reducing the PSO fares. However, attention should be paid to the specific PSO routes in question and the attributes, because demand elasticities may differ.

6. AIRCRAFT AND AIRPORT OPERATING COSTS IN REMOTE REGIONS

6.1 Aircraft operating costs

Santana (2009) discussed airline costs in PSO and EAS areas and compared them with the cost of services outside these programs, by using panel data from 1991 and 2002. Her findings indicate that the PSO program adversely affects the economic performance of carriers in terms of higher costs of operations, whereas the EAS program in the U.S. did not show such effects. Operations under PSO did also show higher costs than for comparable carriers on commercial routes in Europe. The author claimed that a centralized program like the EAS with an option to convert subsidized routes to commercial operations during the duration of the contract performs better in terms of operator's efficiency than the more decentralized PSO program without such termination clauses[2]. This was supported by the finding that the European carriers outside PSO were not significantly different from the U.S. carriers outside EAS. This picture is however diverse, because there are other factors that can affect the efficiency of the operators. If e.g. aircraft with pressurized cabins are used for comfort and not because of market size requirements, this may in turn affect the aircraft operating costs. Lian (2010) mention better adaptation of aircraft types as one way of improving the internal efficiency of the PSO program in Norway.

Merkert and Williams (2010) has applied a two-stage bootstrapped DEA approach in a first attempt to evaluate the efficiency of PSO carriers by studying technical and scale efficiency for 18 PSO air transport operators over two financial years 2007/08 and 2008/09. Their results show that measured against the best performer in the sample, the efficiency of the average operator is a bit higher than the authors' *a priori* expectations, with an efficiency score of between 80 and 90%. Interestingly, operators in the early stage of the PSO contract seem to perform better than those that are close to retendering. Operators with a high number of PSO contracts seem to perform better than those with fewer contracts. However, the authors state that further research is needed before robust conclusions can be drawn.

2. Such clauses are an indirect measure to stimulate competition among carriers on the EAS services.

The authors point out that some of the operators also serve non-PSO routes, and those operations are included in the analysis. It is also worth noting that the comparison is made against the best PSO performer. At this stage of the work, it is not possible to address differences in performance compared with non-PSO operators on comparable operations. In this author's view, further research on comparisons of airline efficiency is needed, also because a dominant share of the air transport subsidies is used for covering the costs of airline operations.

6.2 Airport operating costs

Airports in remote areas are normally characterized by low utilization of runway capacity. The marginal cost of a single aircraft movement is low, and within the capacity constraints of the airports, the operations are characterized as having increasing returns to scale (IRS). Therefore, the perhaps most important challenge is to look for opportunities to reduce the fixed costs of airport operations. Some actions that can be taken to reduce such cost could perhaps be:

- Cooperation with local authorities on sharing of fixed costs, like fire & rescue equipment.
- Coordination of opening hours with the needs of the airlines.
- Implementing Remote Tower Operations to reduce manning needs. Gustavsson (2011) describes some work done by LFV, Sweden to save airport operating costs while maintaining the necessary safety level.
- Reduce the need for expensive ground-based navigation systems by implementing systems like Space-based Augmentation systems to support existing GNSS signals. Such systems are called WAAS in North America and EGNOS in Europe. Schaad (2011) describes briefly a case study on this topic.
- Sharing of marketing costs with local stakeholder groups from e.g. the tourist industry and local Chambers of Commerce. If marketing efforts increases traffic, then the cost coverage needed per passenger will be reduced. Halpern (2010) presents a survey focusing on the most commonly used marketing sources for airports in remote regions. One intuitively reasonable finding is that independent airports have a more innovative approach to marketing than airports being a part of a regional or national system.

International bench-marking of airport operations in remote regions are scarce and hence this seems to be an important area for future research. Two exceptions are worth mentioning; Transport Canada (2007), and Ulvin Olsen (2011).

7. AIR TRANSPORT AND EMPLOYMENT IN REMOTE REGIONS

7.1 The problem

Intuitively, air transport is important for both industry and residents of a country. That is especially true if the alternatives are weak, due to long distances or lack of alternative modes of transport. The importance of air transport becomes particularly evident when the air transport system fails for a period of time due for instance to union strikes or natural disasters. However, it

is not straightforward to measure the importance for the society of a well functioning air transport system, and it is almost impossible to imagine a contra-factual situation without air transport. The rapid growth in air transport in many economies may be seen as an indicator of the importance of air transport to economic growth but conversely, rapid growth may reflect increasing travel opportunities as economic prosperity take place. Bråthen, Johansen and Lian (2006) focused on air transport as a contributor to economic activity in general. The authors grouped the contribution into four main categories (Table 2).

Table 2. **Main employment categories**

Type of impact	Description
1 Direct	Operation of airlines and airports (technical support and handling, catering, fuel, security, cleaning), commercial activities (shopping, restaurants, car rental, parking), land transport and air cargo.
2 Indirect	Sub supplies (goods and services) to direct activities (covered in the region)
3 Induced	Spending by employees in activity 1 and 2
4 Catalytic	a- Location impacts (firms and labour) b- Tourism and trade (demand side) c- Productivity and investment (supply side)

Source: Bråthen, Johansen and Lian 2006.

7.2 Direct effects

Direct effects are defined as the activities required for producing air transport services. The distinction between direct activities and indirect activities may be difficult. Usually, airport activities are described as direct activities even if they are non-airside activities like shops, car rental etc. This principle has its flaws, especially if indirect activity is calculated by use of multipliers. At some airports services are located at the airport while at other airports the same services can well be located outside the airport area, thus providing a smaller base for multiplier calculations. This choice should of course be presented and discussed.

The next question is what to measure and how to measure the extent of activity. Turnover figures are difficult to acquire and the firm structure and the quality and comparability of the accounting figures may vary. Some experience indicates that employment figures are much easier to acquire (Bråthen, Johansen and Lian 2006). Estimates on turnover and wages may later be acquired from structural business statistics from e.g the National Central Bureau of Statistics. Employment data can be collected from each airport's registers over tenants and service providers.

7.3 Indirect effects

Indirect effects are defined as sub supplies (goods and services) to direct activities provided from the surrounding region. A relevant airport region must therefore be defined. Direct measurements of indirect effects by asking respondents is usually too demanding.

7.4 Induced effects

Induced effects are defined as impacts of income generated in particular by activity 1 and 2 (Table 2) via private consumption (spending by employees in direct and indirect activities).

7.5 Indirect and induced effects – Norwegian cases

Bråthen, Johansen and Lian (2006) used a Keynesian I-O model to calculate what indirect and induced impacts the air transport sector activities have in the hinterland of four airports in Norway (Table 3). These airports includes one of Norway's larger regional airports for short take-off and landing aircraft (Leknes, 75 000 pax), one medium-sized airport for mainly domestic traffic (Molde, 350 000 pax) and two larger international airports (Bergen, 3.5 mill pax) and Oslo (16 mill pax).

Table 3. **Multipliers M = (direct + indirect + induced effects)/direct effects**

	Leknes	Molde	Bergen	Oslo main airport
Multiplier employment (no of employees)	1,37	1,26	1,61	1,91
Multiplier man-years	1,33	1,34	1,54	1,96
Multiplier regional production	1,54	1,49	1,71	1,99
Multiplier regional income	1,39	1,36	1,77	1,95

Source: Lian et al 2005

The table illustrates that the impacts of air transport activities are more significant in larger than in smaller regions. This can be explained partly by the fact that a larger region can absorb more of the impacts within the region itself, partly that the industrial structure in larger regions contains more varied services production. Generally, the industrial structure is more varied in the larger Oslo/Akershus and Hordaland than in the other two smaller regions of Leknes and Molde. At the same time, the indirect air transport activities are relatively more important in Oslo/Akershus and Hordaland than in the two other regions. This can partly be explained by the fact that these airports are larger, and provide services for larger regions and are hubs in the national air transport network with international connections. Larger airport at the same time have a more varied production structure, since they provide more diversified non-airside services.

The Norwegian multipliers given in Table 3 are much smaller than can be found in most of international studies. The international multipliers vary from around 1.3 to 8.5, with an average of around 2.6 (Bråthen et al 2006). There are no evident correlation between annual traffic and the size of the multiplier. If we study airports at the size of Oslo main airport, the multiplier spans from 1.5 (Brussels) to 4.1 (Milano). Evidently, some of the variations have to do with how the direct employment effects are defined, as pointed out above. Lian (2010) discusses multipliers in air transport in some detail.

7.6 Catalytic effects

When we initially state that air transport is vital for industry and consumers, we are really talking about catalytic effects. These are a kind of effects that capture how the growth in air transport boosts the performance of other industries (through tourism, trade, investments and productivity in general). Such effects may also include consumer welfare impacts as individuals

benefit from better accessibility. Thus, we distinguish between three kinds of catalytic effects. They are not fully commensurable, as some of them may be regarded as measures (like location and trade) to achieve increased productivity.

a. Location impacts (firms and labour).
b. Tourism and trade (demand side).
c. Productivity and investment (supply side).

Furthermore, when it comes to tourism and trade there is a question whether air transport entails positive or negative effects. The trade and tourism balance may very well turn out to be negatively affected on a regional level. E.g. if air transport activities increase, the net outbound flow of tourists may increase. Besides, location effects may occur to the benefit of some regions but at the expense of other regions. Correspondingly, positive cumulative growth effects in some regions may lead to negative backwash effects in others. Thus, one should avoid adding regional location impacts to a national aggregate. However, positive airport impacts in remote regions may support national policies of developing such regions.

Eurocontrol (2005) have estimated that EU residents travelling by air spend more as tourist outside EU than visitors arriving into EU do (around 0.3% of GDP in 2003). However, the net impact was positive for the 10 new members of the EU with spending by inbound tourism and business travels that were higher than spending by own residents abroad (net GDP effect of 0.4%). They have also estimated effects on investments and overall productivity by controlling for other drivers of economic growth. The analysis reveals a clear relation between air transport and investment development and the underlying productivity. The combined long-run effect of growth in air transport is estimated to increase the level of GDP by 4% each year. Effects are greater in less developed countries than in developed economies. The main objection against such econometric analysis is the direction of causation.

ATAG (2005) has done similar calculations for world regions. Total employment (including catalytic employment) is seen in relation to the sum of direct, indirect and induced employment. The “catalytic multiplier” varies from 1.15 in North America, via 1.8 in Europe to 3.90 in Latin-America. Hence, less developed regions seem to benefit most from air transport. Transferred to a national perspective one could argue that remote regions, many of whom are export oriented, would experience the largest catalytic effects.

There are reasons to believe that the airport affects the economic activity level in general, and also the industry structure. There are examples of multi-national companies and network industries that have located themselves in remote areas, and they are clearly dependent on reliable air services. Another issue is related to the fact that some important sectors (like oil and gas, fisheries and industry clusters) are less footloose because they are dependent on natural resources, local skills and local industrial networks. If this kind of resource base becomes less productive without an airport in the vicinity, then there are productive catalytic effects present, and not only relocation effects that are often zero-sum games. A third issue is related to how economic players in remote areas interact with their markets in buyer-supplier relationships. *A priori,* the probability of finding markets and collaborators are significantly higher for businesses in central areas.

7.7 A case study on catalytic impacts

The air transport system may play an important role in exploiting the scale effects in both human capital and natural resources in remote areas. However, there will certainly be large variations among regions depending on their existing resource base. Halpern and Bråthen

(2010 and 2011) did a case study on two airports in remote regions in Norway, Ålesund and Brønnøysund, where Brønnøysund is by far the most remote area[3]. As a result of having a local airport, 87% of respondents from both regions combined strongly agree that their region is better connected nationally and 58% internationally. The lower figure for international connectivity is likely to be a consequence of the range of air services that are available at the airports, which are largely domestic versus international. As a result of having a local airport, 67% of respondents strongly agree that they have better opportunities for holidays, 54% that they have better access to health services, 50% that they have better contact with friends or relatives, and 41% that they are able to do their job better. In this study, the presence of the local airport seemed to be important for the retention of residents in both regions. 70% of respondents strongly agree that they are more likely to continue living in the region as a result of having a local airport. This varies from 75% for residents around Brønnøysund to 63% around Ålesund, and the difference in average response for the two regions is significant. This suggests that while local airports are important for the retention of residents in both regions, the level of importance is significantly greater for residents in the most remote region.

According to Halpern and Bråthen (2010), the main impacts that the local airports have on businesses are that they enable them to serve a larger market (15% of respondents rated this factor to a very great extent), promote exports (10%), and enhance competitiveness (8%). However, the local airport is also rated highly as having a subsequent impact on the economic performance of businesses; increasing turnover (12%) and strengthening profitability (8%). The influence of the local airport on investment decisions is generally positive; influencing inward investment. 66% of respondents in both regions combined stated that they invested more in their region than they would otherwise have done, and the share was larger in the most remote region.

It is difficult to quantify the importance of local airports to businesses. Halpern and Bråthen (op cit) asked respondents to estimate what proportion of their turnover is dependent on air services at their local airport. The largest proportion of respondents (39%) reported no connection between turnover and air services. However, 61% of respondents estimate that at least 1% of their turnover is dependent on air services at their local airport. Almost a quarter of respondents (23%) estimate over 20% and 7% estimate over 60%.

Respondents were asked to rate the importance of a number of key location factors for their business. Contact with customers is ranked first according to the proportion of respondents that consider the factor to be very important (44%). Proximity of an airport and general quality of life are ranked joint second (36%). This means that over a third of the respondents consider proximity of an airport to be a very important key location factor for their business. Access to a local market is ranked fourth (34%). Access to a qualified workforce is ranked fifth (25%).

Proximity to an airport is more important to businesses in sectors that are often referred to in literature as being air-intensive such as hospitality and services, finance and insurance, energy, real estate and business, and transport and warehousing. Proximity to an airport is also found to be more important for businesses with offices, departments or sister companies in other regions or abroad compared to businesses that have offices, departments or sister companies in the same region. Catalytic effects may be quite significant in certain areas, and this issue should be pursued in future research.

3. This section is mainly citations from this work.

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