Estimating the Costs and Benefits of Regional Airport Subsidies: A Computable

General Equilibrium Approach

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Abstract

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Subsidies to airports have become a controversial issue, especially in Europe since liberalisation of air transport. Regions seek to increase economic activity by subsidising local airports, enabling them to win more traffic, especially from low cost carriers. These subsidies do have an efficiency cost, in that they induce airlines and passengers to use less preferred airports. However they can lead to an increase in economic activity within a region, for example from tourism, and the region can gain from this. The most commonly used method of estimating regional impacts is Input-Output analysis- this tends to produce estimates of large impacts on economic activity. Very often the assumptions underlying Input-Output models are not met however. In this paper, a regional and national computable general equilibrium (CGE) model is used to estimate both the regional and national impacts on economic activity of airport subsidies. The model also enables the net benefit from this change in economic activity, at the regional and national level, to be estimated. The research indicates that it is possible for a region to enjoy economic gains as a result of an airport

subsidy, even though the nation as a whole is likely to lose, though not in all cases, since economic activity is shifted, and not necessarily increased overall. This poses a difficult problem for governments in developing policies towards subsidies offered to regional airports.

1 Introduction[1]

Subsidies to regional airports are controversial, especially in Europe. Many regions subsidise their airports, and this helps them win traffic, especially from Low Cost Carriers. These subsidies have been opposed by legacy carriers and by major city airports, and in Europe, the European Commission has intervened. However, many issues concerning the overall costs and benefits of these subsidy policies are yet to be resolved.

Subsidies reduce efficiency by distorting choices, and they artificially assist one competitor over another. Regional governments, however, have seen airports as a means of stimulating economic activity within the region, and they have been willing to subsidise them. If those who pay for the subsidies, the regions, are willing to do so, should they be stopped from doing so? The issue is not so simple, since, to an extent, subsidies may shift, rather than stimulate overall economic activity. Other regions may suffer as a result of a region's subsidy, and the nation as a whole need not enjoy an overall increase in activity.

This paper focuses on measuring the changes in economic activity that might come about, in the region and nation, as a result of airport subsidies. It also discusses how the benefits and costs of these changes in economic activity might be measured. Once this is done, the benefits and costs of changes in economic activity can be compared to the costs of the subsidies, and tis enables an overall cost benefit assessment to be made of the subsidies, for the regional and national perspectives. The approach enables answers to questions such as:

- Can a region gain from offering a subsidy to an airport?

- Do other regions lose?

- Does the nation as a whole gain or lose?

- Are there cases in which the nation as a whole gains?

This paper seeks to contribute in several ways:

- Firstly, it illustrates a method of evaluating airport subsidies- this method is quite general, and can be applied where the data are available and the relevant models are available. In particular it used a computable general equilibrium model to estimate changes in economic activity, and adapts this model to determine welfare costs and benefits;

- Secondly, illustrates how a region can gain from offering airport subsidies, and how the nation as a whole may gain or lose;

- Thirdly, it shows how results vary with assumptions about how key markets, such as the labour market, work and with different assumptions about what impacts the subsidies have on flows of tourism expenditure; and

- Fourthly, it discusses how rules of thumb might be developed for making assessments of airport subsidy proposals when full data sets are not readily available, and when the ideal models are not available.

Thus, this paper, at one level, presents a way of thinking about evaluation regional airport subsidies. At another level, it outlines a means of making rigorous assessments of the costs and benefits of such subsidies. Finally, it also indicates the sorts of results that might come about, in fairly typical situations, when such cost benefit studies are done.

It suggests that it may make very good sense for a region to subsidise its airport to attract tourism expenditure. However, it also suggests that it will usually be the case that subsidies which benefit the region offering them will impose costs on other regions of the economy. Furthermore, in a wide range of situations, it will be the case that while the region gains, the nation as a whole will lose. This poses a difficult problem in competitive federalism- should the region be allowed to make its own choices, if it funds subsidies itself, or should the federal government override the region when its actions lower the welfare of the nation as a whole?

Section 2 provides a brief background to the airport subsidy issue. Section 3 discusses how impacts on economic activity and welfare or benefits can be measured. The model used and the simulations employed are outlined in Section 4, and results of the simulations are presented in Section 5. Implications of these results are discussed in the concluding section.

2 Background: the Airport Subsidy Issue

There is growing attention being given to the way some regional governments are subsidising their local airports as a means of attracting economic activity. With the development of low

cost carriers (LCCs) a group of airport users which are very price sensitive has emerged. Competition is developing between secondary and major city airports (Forsyth, 2006b). Until recently, most of the traffic bound for a major destination, or emanating from a major origin, would use airports at that destination or origin. However airlines, and especially the LCCs, are willing to use secondary airports, which are moderately close to the destination or origin, though less convenient than the major city airports, if it is cheaper to do so. Thus Ryanair has been willing to fly to Charleroi to access Brussels, Lubeck to access Hamburg and Bratislava, to access Vienna, because these airports are cheaper to use than the city airports (Barrett, 2004). These airports are cheaper partly because regional governments have been willing to subsidise them.

These airport subsidies have become very controversial. There was a major case involving Charleroi Airport, a Ryanair destination (see Barbot, 2006; European Commission, 2004). In the Charleroi case, Ryanair was required to pay back several million Euro in "illegal" subsidies which it had received. Part of the dispute has revolved whether subsidies are equally available to all users of an airport, not just favoured customers. The EC had been attempting to grapple with the problem. Currently it is prepared to permit subsidies as long as they are offered on a non discriminatory basis.

This said, the issue of airport subsidies has not been resolved. Many bodies, such as city airports and legacy airlines oppose the use of public funds to support one section of the air transport infrastructure used predominantly by LCCs. Arguments are put forward for and against regional airport subsidies- typically these arguments reflect one or another aspect of the issue. There is little by way of systematic evaluation of the case for regional airport subsidies.

Many are critical of subsidies on general grounds. Subsidies normally distort choice, and cause inefficiencies. Thus subsidies to regional airports will distort the airport choices of airlines, through inducing some to use airports they would not be willing to pay the full cost of using. Subsidies are also expensive in that they need to be funded from taxation, which is itself distortionary- the cost of raising one Euro through taxation exceeds one Euro.

As against this, it can be argued that if a regional government wishes to use its own (taxpayers') funds in subsidising an airport, it should be allowed to do so. It may see benefits in attracting more economic activity into the region. In particular, more traffic through local airports leads to more tourism expenditure, which stimulates economic activity. Additional tourism expenditure is seen by governments around the world as desirable for the extra activity it stimulates- hence governments spend substantial sums on tourism promotion. This gain in economic activity, however, may come at a cost, since tourism may be shifted, not increased. Thus the tourists bound for the main destination may simply be shifted away from the city airport and via the regional airport, increasing economic activity in the region at the expense of the main destination.

The costs of these subsidies should be, in principle, fairly easy to calculate, but the benefits are difficult to assess. Is €1m in extra subsidies worth an additional €5m in economic activity? Firstly the impact on economic activity has to be determined. This is sometimes done using Input-Output techniques, but these are partial techniques and fail to capture important effects. Hence impacts as estimated cannot be relied upon. Even where the change in economic activity stimulated by the subsidy policy is reliably estimated, it is difficult to determine whether it is worthwhile, since it not a matter of comparing like with like. To make a rigorous

assessment of a subsidy, it is necessary to determine how large the impact on economic activity is, both in the region and in other regions which are affected by it (normally negatively), and to determine how large the benefit from this activity is. The gain to a region of an additional €5m in output will be much less than €5m if additional resources must be used to create this output, as will normally be the case. There needs to be a way of measuring the benefits from extra activity in terms comparable to those used for measuring the cost of the subsidy. Only when can the balance of costs and benefits of the subsidy be determined, for the region offering the subsidy, and for the nation as a whole, taking into account effects in other regions.

Thus far, discussion of the costs and benefits of regional airport subsidies has been couched in very general terms. It is however, quite feasible to analyse the issue in much more rigorous terms. Computable general equilibrium (CGE) models are now widely used in many countries to assess how changes in policies or external events impact on economic activity, as measured by key variables such as GDP and employment. Unlike I-O models, these models are complete models of the economy, and incorporate goods and factor markets as well as resource constraints. They take account of the negative as well as positive effects of changes, such as the fact that booms in some parts of an economy can crowd out other parts, moderating the overall impacts. Multi regional CGE models are being used to explore how all regions in an economy are affected by changes which impact directly on one region. Many CGE models only measure impacts on macro variables and industry outputs and inputs. However they can be adapted to provide measures of changes in welfare, by deducting the cost of additional inputs used from measures of the value of additional output.

In this way they can be used in cost benefit analyses of policy problems, such as tourism promotion or tax changes. The benefits of additional tourism, resulting from promotion, to an economy can be estimated (see Forsyth, 2006a), and these benefits can be compared to the costs of promotion (see Dwyer and Forsyth, 1994). In much the same way, the costs and benefits of regional airport subsidies, designed to attract tourism or other forms of economic activity, can be evaluated both for the region providing the subsidy, other regions which are affected by it, and the national economy as a whole.

This paper analyses how this can be done. It discusses and illustrates how CGE models can be used to make estimates of changes in the value of output in a region which subsidises its airport. It takes a further step by showing how this information can be used to develop a measure of change in welfare, which can be compared to costs such as the cost of the subsidy. In short, it is about how a cost benefit study of airport subsidies can be done.

It uses a multi regional CGE model of a real economy, namely that of Australia and the regional (state) economies of Australia. It uses a hypothetical example of a subsidy and its effects on tourism expenditure. While reliable and extensive data on real life examples are difficult to come by, it would be feasible to substitute these should they be available.

3 Measuring Impacts on Economic Activity and Benefits

When a regional airport is subsidised, there is a range of possible sources of benefit or cost to the region or the national economy. The subsidy has a cost, and it must be financed- this

financing will have implications for economic activity in the region. The subsidy will lead to the region becoming more competitive, and attracting more visitors- this leads to additional economic activity. Some or perhaps all of this change in economic activity will be at the expense of economic activity in other parts of the national economy. Some expenditure will come from outside the national economy, such as that associated with international visitors. Additional economic activity is not the same as economic benefits- typically, the change in output will be greater than the change in welfare of the region or nation- it is necessary to determine how changes in activity affect economic benefits.

The Welfare Cost of Subsidies

When a region subsidises an airport, it will normally be the case that the gain to consumers is less than the cost of the subsidy. Hence subsidies, ceteris paribus, reduce welfare overall. This is shown in Fig 1. The demand curve for the airport is shown as D, and the initial average and marginal cost curve is shown as AC=MC. Initially the price for use is set at P1 and after the subsidy of s per unit is granted, it falls to P2. The gain to the initial consumers is shown as s per unit, at P1P2AD, and the gain to new consumers averages ABD. The total gain is P2 ABDP1, but the cost of the subsidy is P2BCP1.

This is not the end of the matter, because subsidies must be financed. The regional government will have to finance the subsidy from additional tax or reduced expenditure. The cost of the subsidy will only be its face value in the unlikely event that lump sum taxes are feasible. In the normal situation, it will be necessary to rely on distortionary taxation, which implies that the cost of raising a €1 in revenue will exceed €1. Thus the cost of the subsidy will be greater than its face value to the extent that the marginal cost of raising €1 exceeds €1.

In addition to this, increased taxation in the region will discourage economic activity. If subsidies attract activity, taxes will repel activity, though not necessarily to the same extent. In evaluating the subsidy, it will be essential to assess the negative as well as the positive impacts on economic activity in the region, and the loss in benefits which it engenders.

A further complexity concerns who enjoys the benefits of the subsidy- these typically will accrue to other regions or nations. If the subsidy results in lower air fares paid by tourists from other regions of the nation, the benefits of the subsidy will accrue to the nation. If the lower fares are paid by foreign tourists, the nation will not gain.

Additional Expenditure in the Regional and National Economy

The objective of the subsidy is to increase economic activity in the region. It can do this in several ways. Firstly, it results in more economic activity at the airport, with more passengers and flights to service, more maintenance activity and other aviation related activity. Secondly, there may be additional freight throughput, which also generates additional economic activity. Many secondary airports cater for low cost carriers, which typically do not carry much freight, but some secondary airports are positioning themselves as freight hubs. Thirdly, there will be more tourism through the region.

It is tourism which is likely to be the largest source of additional expenditure and economic activity (the simulations reported on in later sections focus on tourism expenditure, though the model used is capable of handling other forms of expenditure). An additional tourist's expenditure at the airport, both direct and indirect through the airline will normally be only a

small proportion of the total trip cost. Even though the expenditure by the tourist is not incurred solely within the region which is subsidising the airport, only a small proportion need be for this source of stimulus to be the largest.

It will be an empirical matter how large the spending boost within a region will be. In some cases, most passengers arrive at the secondary airport and immediately travel to their main destination outside the region. In such situations, the subsidy is clearly futile. In other cases, the tourists may spend a significant proportion of their trip within the region, and sometimes, the tourists may spend their entire trip within it, having substituted this region for a trip to a competitor destination. The typical pattern of subsidised secondary airports is that tourists spend a proportion, though not the majority, of their time and trip budget in the region.

There can be several sources of tourists. They may be from other regions of the home national economy. They may be international tourists who a shifted from visits to other regions of the national economy- the tourist who uses a secondary airport to access their main destination but who spends some time in the airport region would be an example of this. Finally, the new services being operated to the secondary airport may generate additional international tourism to the national economy- for example when new flights stimulate British tourists visit Lubeck and Hamburg rather than visit a destination in France or stay at home and spend their income in other ways. In the first two of these cases, there is a reduction in tourism expenditure in other regions- in the third case, there is no reduction.

Impacts on Economic Activity

These changes in expenditure will give rise to changes in economic activity, in the region and in other regions, and thus the broader national economy. Economic activity in the region will be stimulated. However the gain in output need not be the same as the increase in expenditure, since other activities can be affected negatively. The tourism boom may increase land prices, discouraging other industries. In the short term, capital stocks are fixed, and this limits changes in output. More international tourism will put pressure on tourist facilities, and discourage domestic tourism to the region, at least in the short term. With some regions, especially the larger ones, there may be a relatively fixed labour supply and only little unemployment. Additional demand would then put pressure on wages, lessening output in non tourism industries. Where there is unemployment, tourism expenditure may lead to a larger increase in output as unemployed workers are absorbed into the workforce. Finally, in some cases, the region may expand output by relying on an influx of workers from other regions.

The impact on economic activity in other regions will normally be negative, though not always. Where there is a shift of domestic tourism to the subsidising region, other regions will lose economic activity. The same will be true when international tourists switch from other regions towards the region offering the subsidy. The situation is more complex when the subsidy stimulates additional international tourism. It might appear that other regions will not lose out. However this is not so, since other mechanisms such as the exchange rate will come into play. More international tourism expenditure amounts to an increase in exports, and this will push up the exchange rate. This in turn lessens other exports and increases imports. Overall, with the current account balance remaining the same, the gain to the subsidising region will be matched by a fall in expenditure to the other regions. This is a classic "Dutch Disease" situation, whereby a boom in one sector of an integrated economy leads to pressure

on other export or import competing industries. Thus, in each of the cases considered, while the subsidising region will gain economic activity, other regions will lose economic activity.

These gains and losses will tend to cancel one another out, and the net impact on output in the national economy will be small. It could be positive or negative. If the subsidising region has extensive unemployment, the positive impact on output could be large, while if other regions have tight labour markets, the negative impact will be small- on balance, there will be a positive effect on output in the economy as a whole, which comes about through shifting activity towards the labour surplus region. The reverse would be the case if the subsidising region was one with a labour shortage. Because of the Dutch Disease effect, it need not follow that additional international tourism to the region and nation will lead to a net increase in economic activity in the nation (on the "Dutch Disease" see Neary and van Wijnbergen, 1986). In addition to these effects, the effects of the tax increase, needed to finance the subsidy, must be taken into account. This will discourage economic activity in the subsidising region, though it may have some positive effect on economic activity elsewhere, by making the subsidising region less competitive. Overall, any net impact of the tax increase on national economic activity is likely to be negative.

Measuring the Benefits to the Region and Nation

The value of the changes in regional or national output will be typically measured by changes in Gross Regional Product and Regional Value Added or Gross Domestic Output. As these terms indicate, they are measures of the gross value of the additional output. They are not a measure of the welfare gain to the region or nation, or the net economic benefit which they enjoy. To measure the net gain, it is necessary to subtract off any additional costs incurred in

producing this output. Except in the situation where all factor inputs are held constant, there will be the cost of additional factors used to be subtracted from the change in value of gross output. Where additional capital and labour are used in producing the additional output, the costs of these neeed to be deducted.

The cost of additional capital used can be measured by the rental value of that capital. The cost of additional labour is more difficult to measure. If additional labour comes from workers who are already working but who now undertake overtime, the additional costs can be measured by the after tax wage rate. If there is unemployment and more workers gain jobs, the cost of this labour is their reservation wage, or wage that they insist on receiving if they are to be willing to work. Since work involves effort, loss of leisure and travel, most unemployed workers have a reservation wage above zero- in many cases, no doubt well above zero. Finally, where the additional labour comes from workers who migrate to the region to take up the jobs which become available, the gain to the original regional community will be the value of the extra output they create, less the after tax wage they are paid. In addition, if the immigrant workers make more use of community facilities, the net cost of supplying these to them should also be deducted.

There are essentially two sources of potential economic gain to the region or nation which these measurements will pick up:

- Firstly, the macro stimulation effect- additional expenditure can lead to additional economic activity which can be valued at more than the factor costs of producing it, and

- Secondly, the compositional effect-there will be an impact on the efficiency with which resources are used, and this can be positive or negative.

The first effect is relatively straightforward. The second effect is less well known. It comes about from the region or nation producing a more profitable mix of output from a regional or national point of view. If there is a boom in tourism expenditure, stimulated by additional international tourism, the costs of providing for this may be less than the additional revenue from it. Tourists may pay the economy more for the goods and services they require than it costs the economy to produce them. This would be so if, for example, tourists purchased relatively more highly taxed goods and services. This tends to be the case- tourism exports are taxed more heavily that competing exports. Most exports are exempt from most taxes, such as GST/VAT, but only some tourist expenditure is (GST rebates are only very partial). In addition, tourists purchase taxed items such as alcohol, which do not attract rebates. Even when a tourism boom leads to no addition to economic activity or output, the compositional effect can be positive (Forsyth, 2006a).

Thus, a region which gains more tourism expenditure can gain from both these sources-additional economic activity, and a positive compositional effect on its output. The nation as a whole is much less likely to experience a positive impact on output- the effect could well be negative. However, in spite of this, it could gain from a positive compositional effect. This could come about if the regional airport subsidies had a strongly positive impact on international tourism into the country.

Welfare and Jurisdictions

There are at last three, and possibly four, levels of jurisdictions from whose perspective welfare is to be evaluated. One level is the region imposing the subsidy, another level is the nation of which it is part. Thirdly, there is the world as a whole, including the nation and other nations. In addition, the welfare of groups of nations, such as those in the Euro Zone or in the European Union, can be identified. The impacts and balance of net welfare gain or loss at each of these levels can differ- one level may gain but another level will lose.

At the regional level, the subsidy will lead to increased economic activity, from which there will be a gain. Against this must be set the cost of the subsidy. The region may gain or lose.

At the national level, which consists of the region plus other regions, there will be the cost of the subsidy. While the subsidising region will gain economic activity, other regions will lose. If regions are similar, there will be a net loss from subsidising, since economic activity will be shifted around, not substantially increased. If the subsidising region is a depressed region, relative to other regions, there could be a gain from shifting economic activity while not increasing the overall total. Further, if there is unemployment in the nation as a whole, there may be a gain from increased overall economic activity, though the size of this gain will be moderated by increases in the exchange rate induced by the inflow of tourism expenditure.

At the world level, foreign tourists will gain from the subsidy, though nations other than the nation imposing the subsidy will lose economic activity. On balance, the subsidy is likely to lead to reduced overall welfare, unless there is a shift in economic activity from a congested to a depressed nation, or it induces a strongly positive compositional effect. This would be similar to the case in which the subsidy leads to more domestic, intra-regional tourism,

towards a region which is relatively depressed, though foreign tourism to the country does not increase.

The European situation gives rise to a further complication. Countries such as Germany and France do not have separate exchange rates, since they are part of the Euro Zone. This means that when there is a change, such as additional tourism to Germany from a country outside the zone, such as the UK, the impact on the exchange rate affects not just Germany, but also other countries in the zone, such as France. If Germany has tourism boom, France loses as a result of the higher value of the Euro. Thus, to analyse how a region (Schleswig Holstein) and a country (Germany) are affected by an airport subsidy in the region, it would be necessary to have a model of economic activity in the region, the nation, and the group of nations within the Euro Zone. Whilst this is recognised in this paper, it is not specifically modelled.

Assessing Impacts on and Benefits from Economic Activity

Since the primary motivation of the subsidy is to increase economic activity in the region, the method of assessment of changes in economic activity and the benefits from this will form a central core of any evaluation of subsidies. In this study, a CGE approach is used.

Regional economic analysis often employs input-output (I-O) approaches, especially for estimating economic impacts of airports and tourism. However the use of I-O techniques has been increasingly challenged of late (see Niemeier, 2001, on airports, and Dwyer, Forsyth and Spurr, on events and tourism, 2004). The criticism focuses on whether the assumptions needed for this approach to provide an accurate measure of the change in economic activity at the regional level (or the national level) are met.

Such an approach essentially measures the economic activity directly and indirectly associated with a change, such as an increase in tourism expenditure in a region. If this approach is to be used as a means of estimating *the change* in economic activity as a result of a stimulus, it relies on very restrictive assumptions. Essentially there must be a free supply of all resources, land, labour and capital, to the region- no resources associated with the economic activity can be drawn from any other economic activity in the region. If resources are drawn from other activities, their output will fall, and the net change in economic activity in the region will be less that that estimated by the I-O approach. Thus, the I-O approach might be useful where expansion if economic activity in a remote region is achieved by drawing more resources in. However, for many or most regions, which constitute integrated local economies, the assumptions of the I-O approach are not met. Thus they cannot be used to estimate the change in economic activity as a result of a stimulus, such as a tourism boom. A model which more accurately reflects resource constraints and markets in the economy must be used.

Thus, while there are strong qualifications to the use of I-O techniques as means of measuring economic impacts at the regional level, there are even stronger reasons for rejecting the technique as a means of measuring the change in economic activity at the national level. Resources used in one region come partly, at least, from other regions, lowering economic activity. Market prices change to facilitate resource and goods and services flows. Changes in exports of services such as tourism impact on exchange rates and thus on other imports and exports.

The appropriate technique for estimating regional and national economic impacts is a multi regional CGE model. Such a model is a complete representation of the regional and national economies, along with the links between them and the links with the rest of the world. A typical CGE model will have a range of industries and markets, will model industry and consumer behaviour, and will ensure consistency, e.g. that supply equals demand. Assumptions will also need to be made about government behaviour (e.g. whether it keeps the deficit constant when a change is made) and about the exchange rate (e.g., whether it is flexible). CGE models typically allow for different assumptions to be made about key aspects concerning the way the economy works (e.g. whether there is a fixed or variable real wage) or about government policy. In this way, the sensitivity to different assumptions can be tested (for a review of CGE models, see Dixon and Parmenter, 1996).

For most national economies, large and small, a number of CGE models exist. For many countries now, multi regional models are available. These incorporate the detail of individual regions, and model them as distinct, integrated economies, with their own factor and goods markets, and links to other regions. One significant difference between regional and national models is that there is no exchange rate between regions- if there is an export boom in one region, it will not be choked off by a rise in the exchange rate. However the national exchange rate will rise and this will lead to a decline in economic activity in other regions. Thus a typical impact from a stimulus in one region will be reduced economic activity in other regions, caused by the exchange rate rise and the movement of goods and resources from other regions to the booming region, and thus the net change in economic activity in the region will exceed the change in the national economy as a whole.

CGE models in common use usually report impacts on macro magnitudes (GDP, Gross Regional Product, employment) and impacts on industry outputs ((eg changes in output of the accommodation industry, coal industry etc). While there is no reason why they cannot, most do not report any welfare measure, or assessment of the extent to which the region or nation is better off. Changes in GDP (which measures the value of output) and similar macro aggregates are a poor measure of welfare change except in certain circumstances (fixed factor inputs), because if additional output is created using additional factors, these factors are rarely costless. However it is a straightforward matter to add a simple net benefit or welfare change module to a CGE model. Thus, a measure of welfare change, consisting of the change in the value of net output less the cost of additional resources (labour, capital) used in producing that output, can be used. One issue which needs to be resolved is that of the appropriate shadow prices of factors such as labour. If there is full employment, the cost of labour is accurately measured by the after tax real wage rate. However, if there is unemployment, and workers are willing to work for less than this, a lower shadow wage is warranted.

With a multi regional CGE model, it is possible to estimate the change in economic activity, eg gross product, which comes about in the region and in the national economy as a whole as a result of additional tourism flows stimulated by the airport subsidy. With information abut the value of additional production, along with information about the additional use of factors and the costs of these factors, the net benefit or welfare change in the region and nation can be estimated. These benefits and costs can then be compared to the cost of the subsidy, and the net gain or loss from the subsidy policy, to the region and the nation, can be calculated.

4 The Model and Simulations

The model used in this study is a multi regional CGE model of the Australian economy developed by the Sustainable Tourism Cooperative Research Centre, Centre for Tourism Economics and Policy Research (see Dwyer, Forsyth, Spurr and Ho, 2003). It is a model with two regions, New South Wales and the Rest of Australia, which sum to form the Australian economy. This is a model with extensive detail on the tourism sector, which has been developed from a general model, the MMRF model, developed by the Monash University Centre of Policy Studies. The MMRF model is widely used in policy analysis in Australia. The STCRC model consists of about fifty industrial sectors, as well as number of more detailed tourism industries. Impacts of changes in tourism, such as an increase in foreign tourism expenditure, or additional interstate tourism expenditure, can be readily evaluated.

The model is a flexible one which allows for different assumptions about key relationships and markets. Thus it can allow for full employment, or unemployment and a fixed real wage. Alternative assumptions about the exchange rate mechanism, and government budgetary policy, can be allowed for.

This is a model of a real economy, and it presents measures of which might happen if there are various changes which impinge on this economy. Clearly, the results for similar changes which affect other economies will differ, however, the pattern of impacts (e.g. increased activity in the host region, reduced activity in other regions) are likely to be repeated in other economies, unless their structure is very different.

The region in focus, the state of New South Wales, is the largest state in Australia, accounting for about 40% of economic activity. It is an integrated economy, with manufacturing,

agricultural resource and tourism sectors. There is a state government which levies taxes and incurs expenditure. It exports to and imports from other regions. It has a local labour market which is imperfectly integrated with labour markets in the rest of Australia. If there is a stimulus, such as a tourism boom, this will increase economic activity, though this will draw on factors within the region, thus having a negative impact on other economic activity in the region.

One complexity, which is taken account of in this model, is that taxes generated in one region need not flow back to the region-some, or even all, taxes may accrue to the national government. In the case of the model being used, there are state taxes and national taxes, as well as a tax which is levied nationally (the GST) but redistributed to the states. Thus it is possible to work out how much better off a region/state is as a result of additional economic activity and increased tax revenues generated from this. In general, some of the benefits from additional economic activity in one region will be shared with other regions through the tax system, and it is even possible, in some cases, that the main benefits of such extra activity may accrue outside the region. It is important that the model used be able to pick up this effect, since the tax effects of additional tourism may be the single largest source of welfare gain to the region and nation, especially when there is full employment.

Simulations of Airport Subsidy Impacts

A range of different scenarios resulting from a region subsidising an airport are considered.

The regional government subsidises the local airport to the extent of $1.5m. To fund this, it raises local taxes, which has a negative impact on economic activity within the region. The

subsidy is passed on to airlines which use the airport, and they in turn lower ticket prices. Thus the travellers are the ultimate recipients of the subsidy (this is not an essential assumption- it could be assumed that the subsidy stays with the airlines, which may be foreign or home country owned). The subsidies to the airport are sufficient to attract LCCs to switch operations from major airports which are located in other regions. The subsidies are assumed to work, in that they are successful in attracting additional traffic through the region. Major airports may or may not respond, lowering charges to LCCs, but it is assumed that the subsidy has the effect of increasing traffic through the region. (A further complexity which could be analysed, but which is not examined here, is that the evaluation of the subsidy will depend on how effective the response of the major airports is in diluting the loss of traffic to the regional airport. For a discussion of this, see Forsyth, 2006c). FSCs serving the major destinations may also respond, which further complicates the issue (see Barbot, 2006).

LCCs are assumed to be quite responsive to the lower charges offered by the regional airport. A subsidy of $1.5m gives rise to additional tourism expenditure in the region of $7.5m. The total expenditure of the tourists who now fly through the regional airport may be much larger than this, but the region's share of this is much less than 100%-some tourists may pass through the region and spend little in it.

Five scenarios are considered

1. The subsidies lead to an additional $7.5m of additional international tourism expenditure to the region, and all of this extra tourism is diverted from other regions in the nation.

2. The subsidies lead to an additional $7.5m of additional tourism expenditure in the region, of which $6.5m represents reduced tourism to other regions, and $1.0m represents additional foreign tourism expenditure into the nation.

3. The subsidies lead to additional intrastate tourism expenditure of $7.5m into the region, and a reduction in intra regional tourism in the rest of the nation of the same amount.

4. The subsidies lead to additional intrastate tourism expenditure of $7.5m, met from reduced intra regional tourism in the rest of the nation of $6.5m, and a reduction in outbound international tourism from the rest of the nation of $1.0m.

5. The subsidies lead to an additional $7.5m of additional international tourism expenditure to the region, with no impact on tourism to other regions.

For all of these simulations, it is assumed that the regional government keeps its budget deficit constant- ie it funds the subsidy from taxation (as ultimately, it will have to in the long run). Five different labour market scenarios are considered.

1. Case A

   Flexible employment in both regions (host region and rest of economy)

   Fixed national real wage (Also fixed real wage in both regions)

2. Case B

Fixed national employment and flexible employment in regions

(Also flexible real wage in all regions)

3. Case C

Fixed employment in all regions (i.e., fixed national employment)

(Flexible national real wage and also flexible real wage in all regions)

4. Case D

Fixed employment in host region and flexible employment in rest of economy

(Flexible real wage in host region and fixed real wage elsewhere)

5. Case E

Flexible employment in host region and fixed employment elsewhere

(Fixed real wage in host region and flexible real wage in other regions)

The simulations using the CGE model do not allow for the costs or benefits of the subsidy. They report the effect on output that the imposition of the subsidy will have, for example the depressing effect the subsidy has in an economy with unemployment. Output, as measured by the change in GDP, measures the product which is available for spending on investment or consumption. When this product is used partly to provide a subsidy which is enjoyed by foreign tourists, there is a loss of welfare to the home economy. Thus, in addition to the welfare measures as estimated in the simulations, it is necessary to deduct the cost of the subsidy to obtain a measure of the net change in welfare as a result of the policy. Where the subsidy is used to attract additional domestic tourists, these tourists are the beneficiaries of the

subsidy. Their gain is less than the cost of the subsidy, because of the deadweight loss of the subsidy. Thus, in the simulations in which subsidies are directed towards domestic tourists, a gain equal to the amount of the subsidy, less the deadweight loss, must be added to the welfare change experienced by regions other than the region offering the subsidy.

5 Results

The results of the simulations are summarised in Tables 1 to 4. More detail is provided in Tables A1 and A2 in the Appendix. The impacts, on output, and on real welfare (value of extra output less cost of additional factors) are reported, for the region offering the subsidy, other regions in the nation, and for the nation as a whole. In these simulations, the shadow price of labour is taken as the after tax real wage rate. This is at the upper end of the likely range for the shadow price- it would be the appropriate shadow price if there were full employment, and there were no involuntary unemployment. If there is unemployment, the shadow price would be less, since workers would be willing to work for less than the after tax wage. Given the high shadow price of labour used, the real welfare gain when there is increased employment will be a minimum estimate.

In Table 1, the effects are broken up into the tax effect, the tourism stimulation effect, and the total effect. The simulation for is Case 1A, with flexible employment, and additional foreign tourism entirely at the expense of foreign tourism to other regions. When the host region imposes a tax to provide for the subsidy, it has a depressing effect on the region, as measured by Gross Regional Product. Thus the tax effect is negative. There is a slight positive effect on other regions- the host region makes itself a little less competitive as a place to do business as

a result of its extra taxes. The tourism effect is positive, and in this case, it is very large- this is an economy with unemployment and the stimulatory effect is big. The depressing effect in other regions as a result of the loss of tourism expenditure is also large.

The effects on real welfare have a similar pattern to the effects on GDP or Gross Regional Product. The host region makes a net gain of $1.41- not quite as large, in this situation, as the cost of the subsidy. Other regions unambiguously lose as a result of the subsidy, mainly because of the loss of benefits from tourism.

In Table 2, the sensitivity of results to alternative labour market assumptions is illustrated for scenario 1. As mentioned, Case 1A embodies a very flexible labour supply. In Case 1B, employment in the nation as a whole is fixed, but employment in the regions is flexible. Regional output and welfare in the host region rise substantially, though the changes are more or less matched by opposite effects in the other regions. From the perspective of the host region, the welfare gain exceeds the cost of providing the subsidy. From the national perspective, the subsidy is not worthwhile. In the third of these cases, 1C, employment is fixed in both region and nation- thus the changes in output are not large. There are positive changes in welfare for the host region, and negative changes for other regions however. This is because the compositional effect of a tourism boom/slump are being captured, and there is no effect through stimulation of economic activity. The host region enjoys additional $7.5m additional tourist expenditure, and its welfare gain is $0.59. This is a plausible figure granted that tourism is highly taxed relative to other exports. This is saying that an additional $1 of tourism expenditure into a fully employed economy brings a net benefit to that economy of about $0.08- this is to be expected granted that the costs of providing goods and services to the tourists is close to the revenues they bring. Case 1D is something of a disaster scenario- it

involves little gain to the regional economy, a big loss in output and welfare to other regions, and a loss to the national economy. This is to be expected- it is a case where the busy region attracts more economic activity away from regions with unemployment. The final case 1E is quite a positive case, and it is the reverse of the previous case. The subsidy shifts economic activity to the host region, which is relatively depressed, and away from the regions with full employment. Aside for the cost of the subsidy, there is a positive impact on the national economy.

In Table 3, the alternative scenarios involving impacts on tourism flows are considered. Case 1A involves a direct substitution of foreign tourism away from other regions to the host region. Case 2A allows for some additional foreign tourism to the nation as a whole. The host region is affected much as in Case 1A, but other regions are less negatively affected, as is the nation as a whole. In case 3A, there is a switch of domestic tourism to the host region. The positive impact on the host region is smaller than the negative impact on the other regions- this could be a reflection of different industrial structures in the regions. Case 4A allows for some reduction in outbound tourism as a result of the subsidy by the host region, and it has a smaller negative impact on the nation as a whole.

In Case 5A, the airport subsidy generates new tourism expenditure to the region and the nation- there is no direct negative impact of expenditure on other regions. However, while the host region gains, other regions lose, and the nation as a whole is relatively unaffected in welfare terms.

In each of these cases, there is a positive welfare effect on the host region. This effect is slightly smaller than the subsidy, however, indicating that the case for a subsidy is fairly marginal.

To assess whether the subsidy is worthwhile, from the perspective of the region offering it or the nation as a whole, it is necessary to factor in the costs and benefits of the subsidy. In scenarios 1 to 5, it is necessary to deduct the cost of the subsidy from the welfare gains experienced by the host region. In scenarios 3 and 4, it is also necessary to add in the gain from the subsidy enjoyed by other regions' domestic travellers. It is assumed that the deadweight loss from the subsidy is a quarter of the cost of the subsidy, and that the gain to other region's domestic travellers who benefit from the subsidy is $1.12m.

A number of selected cases are considered in Table 4. In case 1B, the host region gains more in welfare than it loses from funding the subsidy- thus it gains from offering the subsidy. However, other regions lose considerably (the subsidy shifts economic activity towards the host region), and from the perspective of the nation as a whole, the subsidy reduces welfare. Case 1C is similar, though there is no shift in economic activity, since both regions have full employment. There is a welfare gin to the host region from attracting more tourism expenditure, but this is matched by a similarly sized loss to other regions- on balance, the nation loses by about the cost of the subsidy.

In case 1E, (which involves shifting economic activity towards the relatively depressed region) the host region gains from attracting the tourists, but after deducting the cost of the subsidy, the subsidy is marginal. Other regions lose, though not by much, and the nation as a

whole loses. With slightly different numbers, this case could be positive for the region, and conceivably, for the nation as a whole.

The final case considered here, 3E is an interesting one, because the subsidy is positive for the nation (slightly) though not for the region offering it. Shifting economic activity towards the region is positive for welfare, and the subsidy cost is partly offset by the gain made by the domestic recipients of the subsidy. Interestingly, however, the subsidy is not positive for the region- which it stimulates economic activity, the gains from this are less than the cost of the subsidy. Comparing cases 1E and 3E, this region would prefer to attract foreign tourists, but it is in the national interest for it to target domestic tourists.

6 Conclusions

This paper illustrates how the costs and benefits of airport subsidies can be estimated, and the overall cost/benefit balance for a specific case can be calculated. A specific example has been taken, and the quantitative results cannot be generalised. However it is possible to generalise about the broad nature of the possible results. In particular, it is the case that;

- It is possible for it to be in the economic interest of a region to offer airport subsidies to attract economic activity;

- It is quite likely that the economic impacts in regions other than the host region will be negative, even when they are not directly affected by the subsidies;

- The balance for the nation as a whole can be either positive or negative; and

- The impacts on the regions and nation depend on their circumstances. In particular, regional airport subsidies could be positive for the nation as a whole if the region offering the subsidies is relatively depressed and other regions are not.

This paper illustrates, for a specific case, how the costs and benefits arising from airport subsidies can be estimated. It is necessary first to make an estimate of the changes in economic activity, and then it is necessary to translate these into measures of cost and benefit, for the region and nation. These costs and benefits can then be set against the costs of the subsidy so that an overall balance can be calculated.

The approach outlined involved several steps:

1. Projecting the effects of the subsidy, on airport traffic, visitor flows and changes in expenditure, in the region, in competitor regions and the national economy;

2. Using these expenditure changes to estimate impacts on economic activity by making use of a multi regional CGE model. Such a model can embody alternative assumptions about the ways key markets, such as the labour market works, along with assumptions about the policy stances of governments;

3. Determining what contributions these changes in the value of aggregate output make to economic welfare in the region and nation. This involves putting a cost on any additional factors used, such as the shadow price or opportunity cost of labour.

Steps 1 and 3 need to be carried out, explicitly or implicitly, whatever approach to evaluation of the subsidy is taken. Clearly, the effects of the subsidy on variables such as expenditure in the region need to be projected. This can be difffiuclt, involving, as it does, some assumptions of what the counterfactual would be. Any evaluation needs to put a price on all of the effects, including make some assessment of what changes in economic activity are worth, in welfare terms.

Step 2 is the most demanding in terms of analytical resources. As outlined, it involves the use of a multi regional CGE model. These do exist for many countries, and they are being used increasingly to explore tourism and aviation issues, as well as general economic policy issues. However, for a particular region or nation, in which a regional airport subsidy is to be assessed, there may be no such model available.

Rather than use a simplified model such as an Input-Output model, with known deficiencies, it would be preferable to have recourse to the results of simulations of models for similar economies. These can give some indication of how large the broad magnitude of changes to economic activity at the regional and national level would be under assumptions about policy stances and key market workings which reflect how the economies in question are working. Thus, if there is high unemployment in a region, substantial stimulation to output can be expected if the airport subsidy has a large effect on tourist expenditure into the region. Alternatively, if employment is tight, smaller effects on output can be expected. The relationship of changes in economic activity to welfare changes will be similar for two economies which have a similar structure, with a similar pattern of distortions and taxes. Where no models for a region and nation are available, it is possible to develop rules of

thumb, based on results for similar economies, which give an indication of magnitudes and patterns of change. While imperfect, it will be better to use these rather than simply use guesswork to assess whether subsidies are worthwhile.

The nature of the results reported here indicates that there are difficult policy problems which arise with regional airport subsidies. While they can be in the interest of the region offering them, they can also be against the interest of other regions and the nation or a whole. If the nation is part of a currency zone, such as the Euro Zone, or an economic community, such as the EU, such regional subsidies can be also against the interest of the broader community or Zone. The European Commission is right to be concerned about them, since they do pose an awkward problem for a federal system. Granted this, it is important to develop more rigorous approaches to measuring the welfare effects on regions, nations and broader communities of regional airport subsidies to replace the casual reasoning which has been used in the past.

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Table 1

Tax, Tourism and Total Effects on Product and Welfare

$m

GDP/Gross Regional Product	Region	Other Regions	Nation
Tax Effect	-3.27	+0.24	-3.03
Tourism Effect	+6.35	-6.58	-0.23
Total Effect	+3.08	-6.34	-3.26
Real Welfare			
Tax Effect	-1.07	+0.07	-1.00
Tourism Effect	+2.47	-2.57	-0.09
Total Effect	+1.41	-2.50	-1.09

Table 2

Impacts of Different labour Market Assumptions on Product and Welfare

$m

Case	Region	Other Regions	Nation
GDP/Gross Regional Product			
1A	+3.08	-6.34	-3.26
1B	+4.41	-4.36	+0.05
1C	+0.59	-0.53	+0.06
1D	+0.57	-6.31	-5.74
1E	+3.27	-.0.52	+2.76
Real Welfare			
1A	+1.41	-2.50	-1.09
1B	+1.85	-1.82	+0.04
1C	+0.59	-0.53	+0.06
1D	+0.57	-2.50	-1.93
1E	+1.48	-0.52	+0.97

Table 3

Impacts of Different Scenarios on Product and Welfare

$m

Case	Region	Other Regions	Nation
GDP/Gross Regional Product			
1A	+3.08	-6.34	-3.26
2A	+2.86	-5.86	-3.01
3A	+2.32	-5.81	-3.49
4A	+2.25	-5.56	-3.31
5A	+1.42	-2.77	-1.35
Real Welfare			
1A	+1.41	-2.50	-1.09
2A	+1.34	-2.29	-0.95
3A	+1.33	-2.56	-1.22
4A	+1.31	-2.43	-1.13
5A	+0.86	-0.94	-0.07

Table 4

Overall Welfare Balance: Selected Cases

$m

Case	Benefit/Cost	Region	Other Regions	Nation
1B	Welfare	+1.85	-1.82	+0.04
	Subsidy	-1.50	0	-1.50
	Balance	+0.35	-1.82	-1.46
1C	Welfare	+0.59	-0.53	+0.06
	Subsidy	-1.50	0	-1.50
	Balance	-0.91	-0.53	-1.56
1E	Welfare	+1.48	-0.52	0.97
	Subsidy	-1.50	0	-1.50
	Balance	-0.02	-0.52	-0.53
3E	Welfare	+1.32	-0.90	+0.43
	Subsidy	-1.50	+1.12	-0.38
	Balance	-0.18	+0.22	+0.05

Figure 1.

Price

P$_1$ .... D C

P$_2$ .... A .... B

0   X$_1$ X$_2$ Airport Traffic

Demand
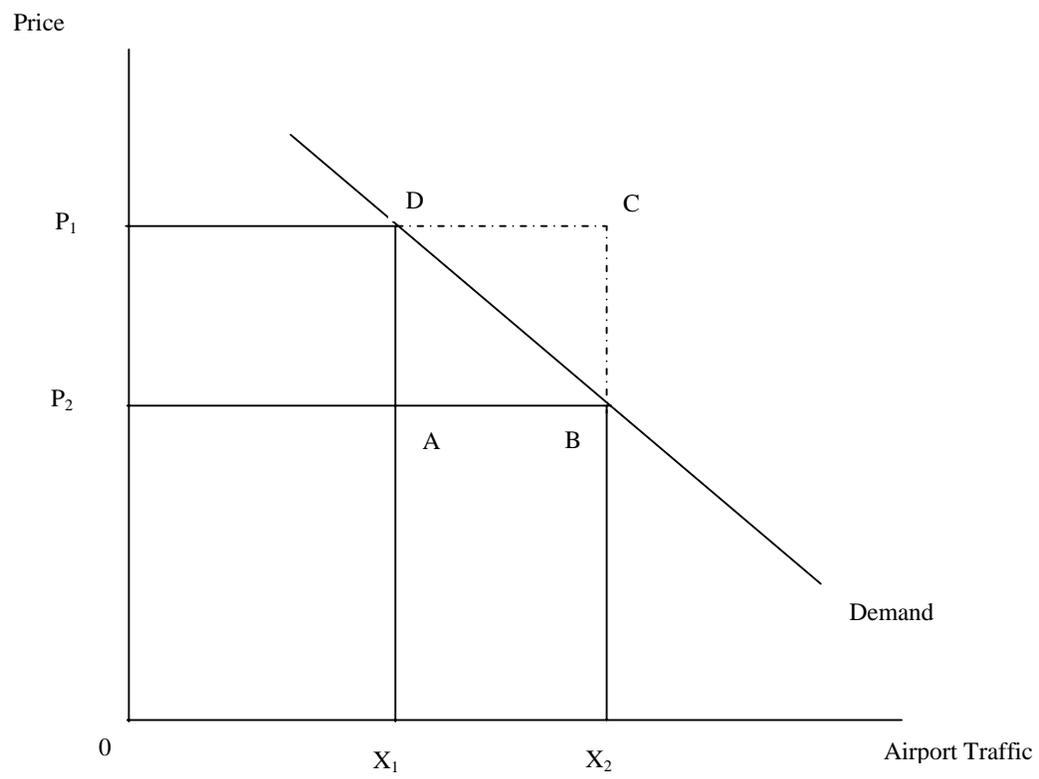
Appendix

Table A1

Impacts on GDP / Gross Regional Product of Airport Subsidy in $ Million

Scenario 1	Region	Other Regions	Nation
1 A	3.079	-6.339	-3.260
1 B	4.405	-4.357	0.048
1 C	0.588	-0.531	0.056
1 D	0.572	-6.312	-5.739
1 E	3.272	-0.515	2.758

Scenario 2	Region	Other Regions	Nation
2 A	2.858	-5.863	-3.005
2 B	4.110	-3.990	0.120
2 C	0.588	-0.460	0.128
2 D	0.574	-5.838	-5.264
2 E	3.037	-0.445	2.593

Scenario 3	Region	Other Regions	Nation
3 A	2.315	-5.808	-3.493
3 B	3.685	-3.737	-0.052
3 C	0.828	-0.904	-0.076
3 D	0.832	-5.781	-4.950
3 E	2.311	-0.896	1.415

Scenario 4	Region	Other Regions	Nation
4 A	2.252	-5.561	-3.309
4 B	3.563	-3.573	-0.010
4 C	0.830	-0.864	-0.034
4 D	0.834	-5.535	-4.701
4 E	2.234	-0.856	1.378

Scenario 5	Region	Other Regions	Nation
5 A	1.419	-2.765	-1.346
5 B	2.195	-1.604	0.591
5 C	0.591	0.003	0.594
5 D	0.584	-2.756	-2.172
5 E	1.511	0.009	1.520

Table A2:

Impacts on Real Welfare of Airport Subsidy in $ Million

Scenario 1	Region	Other Regions	Nation
1 A	1.407	-2.496	-1.089
1 B	1.852	-1.817	0.035
1 C	0.588	-0.531	0.056
1 D	0.572	-2.497	-1.925
1 E	1.482	-0.515	0.967

Scenario 2	Region	Other Regions	Nation
2 A	1.335	-2.288	-0.954
2 B	1.755	-1.646	0.109
2 C	0.588	-0.460	0.128
2 D	0.574	-2.289	-1.715
2 E	1.404	-0.445	0.959

Scenario 3	Region	Other Regions	Nation
3 A	1.327	-2.545	-1.219
3 B	1.783	-1.845	-0.062
3 C	0.828	-0.904	-0.076
3 D	0.832	-2.542	-1.710
3 E	1.323	-0.896	0.427

Scenario 4	Region	Other Regions	Nation
4 A	1.307	-2.434	-1.127
4 B	1.743	-1.762	-0.019
4 C	0.830	-0.864	-0.034
4 D	0.834	-2.431	-1.597
4 E	1.298	-0.856	0.442

Scenario 5	Region	Other Regions	Nation
5 A	0.862	-0.935	-0.073
5 B	1.123	-0.537	0.586
5 C	0.591	0.003	0.594
5 D	0.584	-0.935	-0.351
5 E	0.898	0.009	0.906