

model into a spatial computable general equilibrium (SCGE) model populated with Danish economic data. The model is then used to evaluate a transport quality improvement that increases labour supply at a national level. They report significant additional benefits of around 30% of commuter user benefits arising from the labour market (for an economy with no labour tax) as a consequence of search imperfections.

Laird (2008 Chapter 8) uses commuting and income data from the Scottish Household Survey to investigate whether a labour market failure in remote Scottish labour markets occurs as a result of job search costs. If job search costs exist then theories on job search predict that workers will only receive partial compensation for commuting costs (Manning, 2003b; van Ommeren and Rietveld, 2005; Rouwendal and van Ommeren, 2007). Laird finds that workers in remote labour markets are not compensated for their commute. Implying a market failure exists. We believe this occurs as mobility costs are high in remote areas with low workplace densities and long commuting distances. Job search costs for workers and firms are also high in remote areas, as workers do not have ready access to job centres, vacancies are often not advertised, and successful job search is often attributed to contacts and networks (Monk and Hodge, 1995; Lindsay, Greig and McQuaid, 2005). Laird (2008) also finds that women and men with low skilled jobs do not on average receive compensation for their commute. It is therefore considered a market failure in these labour market segments occurs as a result of restricted geographic job search areas, arising either due to familial constraints or a lack of mobility in housing (Madden, 1981; 1985; Zax, 1991; Ihlanfeldt, 1992; McQuaid, Greig and Adams, 2001).

The presence of higher search and mobility costs in remote areas is therefore expected to lead to a larger degree of inefficiency in remote labour markets. The result is that an increase in employment in remote labour markets will have an economic impact greater than that captured through commuter user benefits.

3 USING THE RESEARCH EVIDENCE BASE

3.1 Agglomeration

The best source of UK evidence on elasticities of productivity to effective density (both urbanisation and localisation economies) is Graham (2007a, 2007b, 2009). This data has been discussed elsewhere (e.g. DfT, 2005; 2008) and is not therefore considered further here.

3.2 Imperfect competition

There is limited evidence on price marginal cost margins as a whole let alone at a detailed geographic level. Any application of the evidence that does exist is therefore subject to a reasonable degree of uncertainty. Theory points towards higher price marginal cost margins in remote areas where competition is less intense, compared to areas where competition is more intense. Evidence from the petrol supply sector supports this position, where margins across the Highlands and Islands are 64% higher than across the UK. The higher on average margins in the region disguise wide variations in local margins: from margins that are comparable to the rest of the UK in the urban and accessible rural area of the Inner Moray Firth to high margins in the very remote parts of the region.

Taking the petrol supply sector as a barometer for price-cost margins in other sectors leads us to consider that the added value of additional output in the very remote areas of Scotland is larger than in the less remote parts of Scotland. That is the wider economic impact due to imperfect competition is larger in very remote parts of Scotland than in other parts *ceteris paribus*.

The evidence suggests there is a valid argument that the uplift to business and freight user benefits, used to capture the added value of increased output, should be higher in very remote areas than in urban areas. For transport schemes in the Central Belt where competition is intense an uplift of 10% is used in STAG. For very remote rural areas an uplift of double this, i.e. 20%, is not unreasonable, though it is based on limited evidence from only one industrial sector. The rationale for doubling the uplift in very remote areas compared to urban and accessible areas is that on average petrol and diesel margins in the Highlands and Islands are 64% higher than the UK average. This average disguises large variations between the accessible area surrounding Inverness, where margins are comparable to national averages, and the very remote parts of the region where margins can be almost 3 times larger than the UK average. An uplift of 20% means that in an appraisal increased economic output has twice the added value in very remote areas compared to other areas *ceteris paribus*. It should be noted that where a scheme impacts on businesses in very remote areas and other areas (e.g. an upgrade to the A9 Perth to Inverness) only the user benefits of business and freight traffic originating/destinating in the very remote area should have the 20% uplift applied to them.

3.3 Thin labour market effects

From the perspective of measuring thin labour market effects the key issue is the size of the wedge between the marginal product of labour and the wage. It is this that determines the additional welfare benefit associated with the creation (or loss) of employment. As discussed earlier there is a lack of evidence on the size of this wedge, though Manning argues that on balance the evidence indicates it to be 17% below the marginal product of labour on average. That is on average the marginal product of labour is 20% higher than the wage. For highly mobile labour market segments we would expect this wedge to be a lot smaller than 20%, whilst for the segments of the labour force that experience high mobility costs the wedge will be larger.

The limited evidence that is available indicates that high skilled male workers in accessible rural and urban areas experience low mobility and job search costs, whilst women, those with low skills and those in remote and very remote areas experience high search costs and high mobility costs. We suggest this evidence can be used in an appraisal by taking the added value of employment creation (displacement) over the change in transport user benefits to be:

- Zero if the job created (or displaced) is held by a male worker in a high or medium skilled occupation (manager, professional or technical occupation);
- Equal to 20% of the wage if the job created or displaced is held by a worker in a remote area, a women or someone in a low skill occupation.

To calculate the net welfare impact of displaced employment it is therefore necessary to calculate both the welfare benefits of job creation and the welfare costs of the jobs that are displaced.

4 CASE STUDY – BERNERAY CAUSEWAY AND SOUND OF HARRIS FERRY

The Berneray causeway opened in April 1999 at a capital cost of £6.6 million. It is just less than 1km in length and is free to use (i.e. there is no toll). As illustrated in Figure 3 the causeway replaced the Berneray ferry (between Berneray and North Uist) and shortened the Sound of Harris ferry crossing between Harris and North Uist. The shorter crossing for the Sound of Harris ferry was expected to lead to an increase in service frequency in the summer (to two hourly). Halcrow Fox (1996) undertook the ex-ante appraisal of the project.

The Do Something delivers the following benefits compared to the Do Minimum:

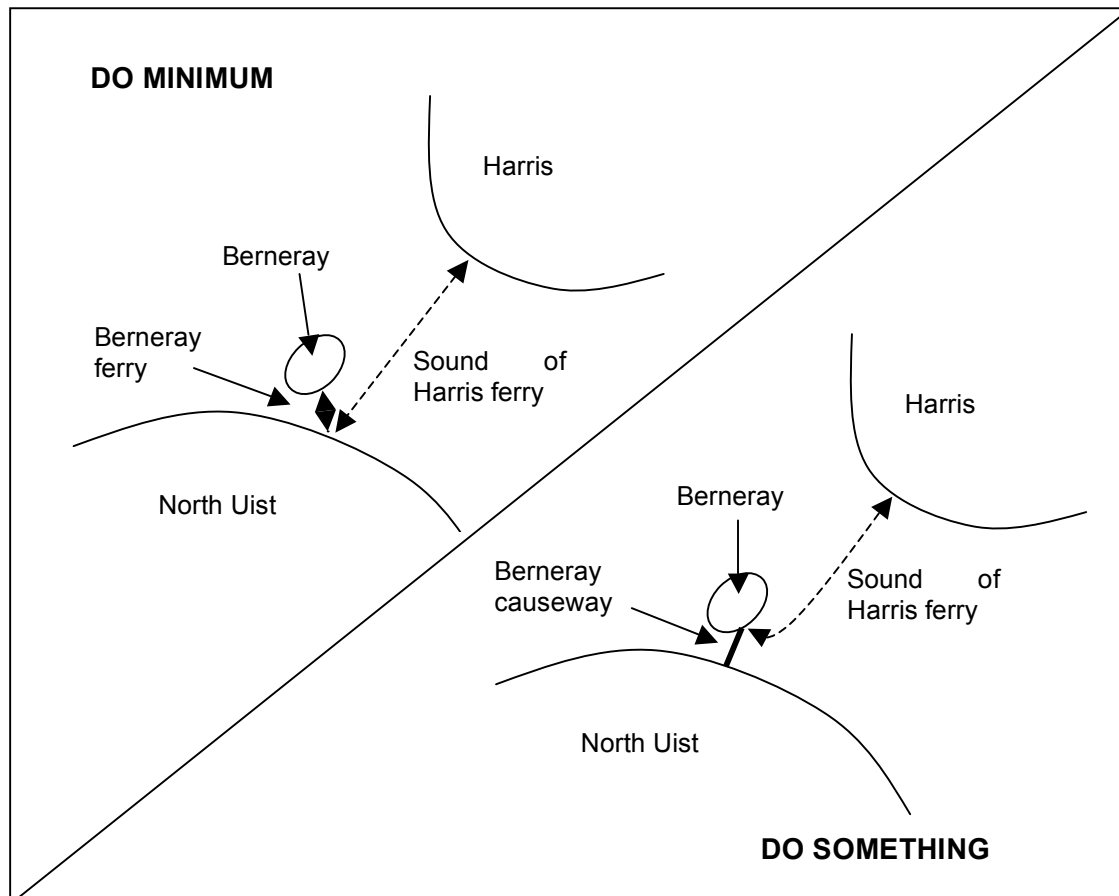
BERNERAY TRAFFIC

- a time saving of 12 minutes and the elimination of queuing time;
- a fare saving of 48p per passenger and £1.92 per car (for residents) and 75p per passenger and £2.60 per car (non-resident);
- no net vehicle operating cost saving;
- A reduction in average headway over the year from 89 minutes to an effective headway of zero with the construction of the causeway; and
- An extension of the effective operating day from an average of 12 hours to 24 hours.

SOUND OF HARRIS FERRY TRAFFIC

- a time saving of 16 minutes and no change in queuing time;
- no fare saving;
- an increase in vehicle operating costs associated with increased causeway length and access roads on North Uist (0.9km);
- a reduction in headway from an average of 3hrs 45mins to 2 hrs in May, to June, July and August. 62% of the ferry's annual demand occurs in these four months; and
- a reduction in headway from an average of 3hrs 13mins to 2 hrs in April and September. 18% of the ferry's annual demand occurs in these two months.

Figure 3: Berneray Causeway and Sound of Harris ferry: Do Minimum and Do Something



Source: Halcrow (1996, Figure 1.3)

4.1 Agglomeration

The populations on Berneray are too small and too dispersed for urbanisation economies to have an effect. Localisation economies may, however, be relevant. Graham (2004) identifies the Western Isles as an area in which the fishing sector is clustered. The proportion of the working population employed in the fishing sector on Berneray and North Uist is 21% and 10% respectively (GROS, 2008), though the absolute numbers are small – 8 people on Berneray and 38 people on North Uist. This comprises of about 7% of those working in the fishing sector in the Western Isles. The main fishing industry in the Western Isles is based in the Isles of Lewis and Harris, which between them have about 50% of those employed in the fishing sector in the Western Isles. The main deep water harbour in the island group is also located on Lewis. As the Berneray causeway does not impact on transport costs of businesses in Lewis (the location of the main cluster), and the fishing sector in Berneray and North Uist is small, the Berneray causeway is not expected to enlarge the existing cluster. This view is supported by the evidence gathered by Halcrow Fox who did not identify any employment impacts of the Berneray causeway for businesses in the agriculture or fishing sectors (Halcrow Fox, 1996 Table 3.1). Furthermore there is no evidence to date that the fishing sector experiences positive elasticities of productivity to economic mass (e.g. Graham, 2009). The Berneray

causeway is not therefore expected to generate any wider economic impacts due to localisation or urbanisation externalities.

4.2 Imperfect competition

A wider economic impact arising from imperfect competition in the product market can only occur if there is an expansion in output. There is only indirect evidence that such an expansion in output occurred as a consequence of the Berneray causeway. Halcrow Fox found evidence that businesses on and off Berneray expected turnover to increase, whilst a real cost of living reduction was also anticipated by Halcrow Fox. If households experience a cost of living reduction then the surplus can be used to purchase other goods that were not previously available (i.e. expand output). The SQW (2004) ex-post study confirms that such a cost of living reduction did occur, as it finds that households through reduced transport costs and lower prices were £407 better off per year (in 2003).

A wider economic impact of £15,000 (1996 resource prices and 2000 values) attributed to imperfect competition is estimated for the first full operating year (2000). This is 20% of the sum of time savings accruing to businesses. This is based on an assumption that 56% of time savings is attributable to business benefits (SACTRA, 1999 paragraph 3.55).

4.3 Thin labour markets

If the wage does not equal the marginal product of labour then changes in employment lead to wider economic impacts in the labour market. Once again wider economic impacts will only be felt if employment levels change. Halcrow Fox estimate that construction of the Berneray causeway leads to a net increase of 38.5 full-time equivalent (FTE) jobs. If we then assume:

- Employment does not increase at the national level as a consequence of implementing the project. That is all the jobs created by the project are re-distributed from other parts of the UK;
- The additional jobs in Berneray and North Uist are re-distributed from accessible rural and urban areas;
- 22% of the 38.5 full time equivalent jobs created by the causeway will be held by men in medium to high skilled occupations, and 78% will be held by men in low skilled occupations or by women. These proportions derive from the Scottish Household Survey dataset (2000-2004); and
- The wage of all jobs created (and destroyed) by the transport intervention is £263 (1996 prices and 2000 values). This is based on a median gross weekly wage in the Western Isles for all full time employees of £445 in July 2008 (Scottish Government, 2008b).

This gives an estimate of the wider economic impact due to efficiency gains in thin labour markets in the first full operating year of £23,000 (1996 prices and 2000 values). The calculation behind this is summarised in Table 2.

Table 2: Welfare benefits of employment creation in the Western Isles (£1996 prices and 2000 values)

Location	Occupation	FTE jobs	Wage per week	Total change in regional incomes per annum	Additional welfare benefit as proportion of wage	Welfare benefit
Jobs created in Western Isles	All occupations	+38.5	£263	£527,000	20%	£105,000
Jobs displaced from Accessible rural and urban areas	Male high and medium skilled	-8.5	£263	£116,000	0%	£0
	Low skilled and female high and medium skilled	-30.0	£263	£411,000	20%	£82,000
						£23,000

4.4 Summary

The revised economic impact of the Berneray causeway and re-cast of the Sound of Harris ferry is summarised in Table 3. As can be seen from this table, the inclusion wider economic impacts increases the overall benefit of the project by 19% (from £200,000 in 2000 to £238,000).

Table 3 Benefits of the Berneray causeway and Sound of Harris ferry service enhancement in first full operating year (2000)

	Economic impact (£)	
	Existing approach	Extended scope
User Benefits	200,000	200,000
Agglomeration effects	N/A	0
Imperfect competition	N/A	15,000
Labour supply		
Thin labour markets	N/A	23,000
Single year benefits	200,000	238,000

Note: 1996 resource prices and 2000 values

5 CONCLUSION

There is limited evidence on the added value of wider economic impacts to transport user benefits in a transport cost benefit analysis. This is in direct contrast to say travel time savings, where there is an extensive evidence base collected over many years. Clearly the wider economic impact evidence base becomes smaller as one tries to disaggregate evidence between remote and accessible or urban areas. Theory and what evidence is available point towards a larger degree of imperfect competition in very remote areas than in the urban or accessible areas (Scottish Government definitions) and to the existence of thin labour markets in remote areas. From a practical perspective the case study presented demonstrates that market

failures in remote areas can lead to significant economic benefits additional to transport user benefits. The assertion that wider economic impacts are only relevant to large urban areas is therefore refuted.

Given this and on the basis that the wider economic impact analysis in transport appraisal guidance is currently only a sensitivity test to the main cost benefit analysis the following recommendations seem defensible:

- Imperfect competition: a higher mark-up to business user benefits than the 10% should be used for very remote areas. A mark-up of 20% has been suggested, albeit this is based on evidence from only one industrial sector; and
- Thin labour markets: the creation of employment in remote areas has an additional welfare impact to that captured through commuter user benefits. The limited evidence that is available suggests that this impact is equivalent to 20% of the gross wage. When incorporating these benefits into an appraisal it is also necessary to take into account the welfare costs of displaced jobs.

The inclusion of thin labour market effects in an appraisal makes it necessary to estimate employment impacts as part of an appraisal. It is also necessary to estimate the number of jobs that are displaced from other regions, the skill set of those jobs and the regions from which the jobs will be displaced. This increases the modelling burden placed on the analyst and would imply that thin labour market effects will only be calculated when significant employment impacts are anticipated.

The limited evidence base on wider economic impacts means that almost any new research has value. The nature of the subject means that the research will be complex and that for some issues there is a risk the results may be inconclusive. Three research areas, from a remote area perspective, stand out as being worth pursuing. Firstly, there is a need to disaggregate the existing elasticities of productivity to economic mass to distinguish between the industry clusters evident in remote areas. Secondly, there is a need to build up the evidence base on the level of imperfect competition. Ex-post studies on areas which experience a large change in access costs could be informative (e.g. the impact of the ferry Road Equivalent Tariffs pilot to the Western Isles) as could recent advances in economic research which has attempted to back out price-marginal cost mark-ups from regional input-output tables. Finally, job search costs are a cause of the market failure in remote labour markets. The development of specific job-search models for these areas would add to the literature. If the models could be embedded into either a partial or general equilibrium model that included the transport sector this would have added value for transport appraisal.

NOTES

¹An assessment of imperfect competition should be based on price-marginal cost margins as the market failure occurs when prices do not equal marginal costs. Price-cost margins and price marginal cost margins are only equivalent when industries exhibit constant returns to scale.

²It should be noted that this calculation rests on the assumption that the monopolist does not price differentiate. If a monopolist is able to discriminate between consumers they will expand output towards the socially optimum level and convert some of the surplus under the demand curve to producer surplus. In this scenario there will be a lower, and at the limit zero, additional welfare impact in the product market. With a price differentiating monopolist average price-cost margins will not be a good indicator of market power. To date this issue has not been explored in the literature, and we will not return to it, but we note that such an argument undermines the general case for wider economic benefits in the product market.

³The population of the Western Isles (Eilean Siar) dropped by 10% between 1991 and 2001

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