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# WIDER ECONOMIC BENEFITS OF TRANSPORT SCHEMES IN REMOTE RURAL AREAS

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## ABSTRACT

Remote rural areas tend to experience slower population growth (sometimes decline), slower growth in GDP, fewer employment opportunities and lower productivity relative to the economy as a whole. Transport policy interventions are typically focussed on addressing structural economic weaknesses. Yet despite a strong general interest in wider economic benefits, their relevance to schemes in remote rural areas has received very little previous discussion. We argue that remote rural areas are likely to exhibit market distortions in the goods and labour markets, primarily arising from a lack of alternatives and choices in these areas. We also illustrate the empirical importance of the wider economic benefits, caused by these distortions, using case studies from the Highlands and Islands of Scotland to do so. We find that focusing the cost benefit analysis only on the primary transport market can significantly underestimate welfare benefits, and that the degree of underestimation varies significantly case by case. It is highest for schemes where the impacts on business and employment are large and where all of the output and employment effects occur in a remote rural area.

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## 1 INTRODUCTION

Remote rural areas are areas with low population density that are distant from urban areas. The EU and the OECD define remote rural areas as rural areas (areas with populations less than 150 inhabitants per square kilometre) more than 45 minutes from a populated centre of 50,000 or more (in Europe), and more than 60 minutes away in North America. Countries in Europe with large remote rural populations include Norway where 45% of the population live in remote rural areas, Greece (35%), Ireland (27%) and Finland and Sweden (20%), whilst in North America, 13% of Canada's population live in remote rural areas (Dijkstra and Poelman, 2008; Brezzi et al., 2011). Remote rural areas differ from other regions as they tend to experience slower population growth (sometimes population decline), slower growth in Gross Domestic Product (GDP), fewer employment opportunities and lower productivity in agriculture, industry and services.

In an economic context what makes a remote rural economy distinct is that choices of employment, opportunities to fill vacancies and choices of supplier when purchasing goods and services are limited. So market distortions are particularly likely to exist in these remote economies (Kilkenny, 2010). This is very relevant to the cost benefit analysis (CBA) of transport schemes in remote rural areas, since such schemes are often associated with broad economic development objectives, such as an expansion in output and employment. If the secondary markets in which these wider changes occur, such as the labour market, are distorted then measuring the benefits of transport investment in the primary transport market alone will not give a full measure of the welfare impacts of the investment (Jara-Diaz, 1986; Mohring, 1993). In such a situation the welfare surpluses occurring in secondary markets that are additional to user benefits, need to be accounted for in the transport cost benefit analysis.

In terms of the market distortions that can occur the highly influential report by SACTRA (1999) identified the existence of agglomeration externalities, spatial monopolies and product differentiation as reasons why wider economic benefits may be relevant in a transport cost benefit analysis even in mature economies. Other

market distortions or imperfections that may give rise to wider economic benefits identified in the literature include labour taxes, involuntary unemployment (caused by for example immobility in the housing or labour markets or distorting labour market regulations) and search costs in the labour market. To date the focus of the research effort on the incorporation of wider economic benefits into CBAs has been on urban or populated areas, but some of these market distortions also apply in remote rural economies.

The purpose of this paper is therefore to identify the importance of wider economic benefits for transport schemes in remote rural areas and to discuss how such impacts might be captured in ex ante project appraisal.

The paper is organised as follows. The next section describes how transport impacts on the remote rural economy. Section 3 introduces a typology within which wider economic impacts on remote rural economies can be considered, Section 4 presents a case study of the wider economy impacts of four transport projects in the Highlands and Islands of Scotland leading to our conclusions in Section 5.

## **2 TRANSPORT'S IMPACT ON THE REMOTE RURAL ECONOMY**

Transport improvements enhance economic competitiveness by reducing the cost of doing business at particular locations. Various channels exist linking changes in the transport system, improvements in accessibility and consequential changes in the wider economy. In discussing the channels we split the discussion into output effects and reorganisation effects and then discuss the spatial location aspects of both together.

### **2.1 The channels**

#### ***Output Effects***

Of primary interest to policymakers is that lower transport costs can stimulate increases in output. In a remote rural agricultural economy improved feeder roads both lower the cost of bringing fertiliser to the villages and lower the distribution cost of getting the product to market; prices lower and output expands. This can be a very

marked effect in developing countries because where transport infrastructure is poor, transport costs can be a high proportion of delivered prices. In contrast for city economies, the effect is likely to be less marked but should nevertheless be there. When the transport system improves, labour is enabled to access employment at lower generalised cost of travel so assuming wages held constant, wages net of transport costs rise and more people are willing to enter the labour market. Similarly, improved transport means that the cost incurred by the customer in accessing goods and services falls – output is enabled to rise. Agglomeration externalities, the productivity benefit of being located close to others, also enable output to rise – if the accessibility to a location improves and the industry, which often in remote rural areas is associated with the processing of primary products (e.g. textiles, food and drink processing, oil and gas extraction) can agglomerate.

An important caveat to the above is that in the favoured locations, land is assumed to be available. If the land market is competitive cost changes in the transport sector, possibly amplified by economies of scale, are fully passed through into the product market, labour market and land market. Surpluses in these markets mirror the transport user benefit surpluses. In the real world this may not be the case; if land or any other resource is scarce then accessibility improvements may be crowded out muting the final output effects. In this situation only the measurement of benefits in the transport market will give a full measure of the impact of the accessibility gain (Nash and Mackie, 1990).

### ***Reorganisation Effects***

In a world of all round perfect competition with constant returns to scale, there is no reason why transport improvements should lead to any commercial reorganisation. The proposition is that there are some sectors which are subject to economies of scale but which cannot be fully exploited because of transport costs. This leads to a form of imperfect competition or possibly spatial monopoly in which market areas are served from different locations. With transport improvements reducing costs, the balance between production costs and distribution costs is shifted in favour of fewer larger lower cost production locations. Mohring and Williamson (1969) use the example of steel production but the argument applies also to physical distribution

and logistics, as well as to the distribution of transport intensive products closely linked to remote rural areas including oil distribution and food and drink.

The important point about reorganisation effects is that in the pure case, economic output remains fixed but productivity increases so that output is produced at lower cost. At the aggregate level there will be economic benefits but within that aggregate there will be gainers and losers from the economic adjustments.

### ***Location Effects***

There is a spatial dimension to both the reorganisation and output effects. From the perspective of a region, there are three categories to consider:

- Relocation of activity within the region. This is likely to be the largest category. Changes in relative accessibility shift the location of production within the region.
- Relocation of activity between regions. Obviously this only applies for activities where there is competition between regions.
- Relocation of activity between countries. This can happen if resources which are fixed in location are opened up. Remote rural areas are sometimes attractive niche international tourist destinations, for example.

These categories are useful for considering the different perspectives of regional and national government. For the first and third categories the perspective is essentially the same: the first is a re-distribution within the area while the third is an unambiguous effect on national output. However the second will be viewed differently by the two tiers of government and is one reason why the regional tier can be more enthusiastic than the national tier about the case for nationally funded infrastructure investment in their areas.

Centralisation in the provision of key services in remote rural areas is often a key consequence of improvements in transport quality. Schools which operate at less than efficient scales of operation can be merged, and healthcare services can be rationalised. This can both save costs to the service provider, but also allow the delivery of a better product – e.g. more specialised healthcare facilities or more subjects being available to study in a high school. This local area spatial re-

organisation and rationalisation is a key expectation of government in remote rural areas (see Reference Economics *et al.*, 2011 for an example). Transport improvements in and to remote rural areas can also facilitate the exploitation of immobile resources not previously utilised, such as deep water harbours that can be used for the construction of oil and gas exploration platforms, wind turbines and tide and wave turbines. All of these impacts have a strong spatial impact on the economy at a local level.

With remote rural areas there is always, however, the need to consider the two-way road effect. A rural highway improves the accessibility from the region to its market, but also improves accessibility from the economic core of the country to the region. The remote region is opened up to competitive forces and some substitution of activities to the core may occur (e.g. business services). For regeneration or economic growth to occur in the remote rural region requires sectors with comparative advantage to be identified and support with strong planning policies. The way in which transport improvements act as a facilitating mechanism is therefore important.

### **3 A TYPOLOGY FOR WIDER ECONOMIC IMPACTS**

Wider economic impacts only have relevance in a transport CBA if markets are distorted – that is if price does not equal marginal social costs in the economy. By examining what sort of market distortions exist, we can develop a framework within which we can then examine the relevance of wider economic impacts to transport projects serving remote rural areas. The distortions examined are: agglomeration economies, imperfect goods market, labour taxes, involuntary unemployment and thin labour markets/search costs.

#### **3.1 Agglomeration externalities**

Agglomeration economies have been the main focus of attention in the literature on the wider economic impact of transport interventions (Venables, 2007; Graham,

2007). They arise as a consequence of the technological externalities that occur when economic agents in transport using sectors of the economy are brought closer together by a transport improvement. By bringing these agents closer together labour productivity is raised above and beyond what would be expected from the transport efficiency saving alone. The numerous micro-economic linkages between economic agents, brought closer together, generate the externalities which, collectively and at a localised level, give rise to aggregate increasing returns or agglomeration economies. Venables (2007) in his highly influential paper shows that the productivity impact caused by the agglomeration externality is additional to transport user benefits.

Remote rural areas have lower population densities than urban areas making agglomeration economies less relevant to them than to urban areas. Some remote rural areas, such as the Highlands and Islands in Scotland, have very low population densities, others however can be reasonably well populated and have higher population densities – e.g. parts of remote rural Norway, Greece or Ireland. For such well populated rural areas agglomeration economies may be relevant should a transport scheme lead to a step change in accessibility to a major centre of economic mass. Possible examples could include using fixed links to connect in-shore islands to coastal urban centres, or where a new major inter-urban high speed route passes through a remote rural area, thereby providing ‘incidental’ connectivity to major urban centres. In these situations the remote rural area suddenly gains access to a large economic mass and productivity in that area should experience a positive shock. Also relevant to the remote rural environment are localisation economies which are a particular form of agglomeration economy external to the firm but internal to an industry. They are, therefore, driven by proximity of firms to firms within the same sector or related sectors and to the size of the industry specific workforce. Primary sectors such as oil and gas extraction and manufacturing sectors found in remote rural economies such as textiles, food and drink processing could well be subject to localisation economies due to, for example, linkages in the supply chain and the sharing of knowledge between businesses.

### **3.2 Imperfect competition**

Whilst Hotelling's (1929) model of spatial competition first identified the existence of imperfect competition in spatial markets and Jara-Diaz (1986) identified the welfare impacts of transport investment in monopolistic markets, it was not until the work of Venables and Gasiorek (1999) that the empirical relevance of imperfect competition in the goods and services markets to transport CBAs was demonstrated. Imperfect competition occurs where firms hold market power by engaging in product differentiation or becoming large relative to their market. The latter is particularly the case in geographically isolated remote rural areas, where local market size is small and firms in sectors such as retail have a degree of market power.

Central to the argument of the empirical relevance of imperfect competition is evidence on price – marginal cost mark ups. There is ample evidence at international and industry level that perfect competition does not prevail with price – marginal cost ratios in the region of 1.3 being found – though there is significant variation by country and industry (e.g. Badinger, 2007; Christopoulou and Vermeulen, 2008). Unfortunately available evidence is almost exclusively focused on industry classifications and does not distinguish by area type (beyond nation states), though Richards, Acharya and Kagan (2008) found that 38% of the economic surplus of non-metropolitan banks was due to spatial market power. There remains an evidence gap on the exact degree of market power held by firms in remote rural areas, but all the theoretical models would suggest that market power will tend to be higher in remote rural areas than elsewhere..

### **3.3 Labour tax**

Venables (2007) identified the empirical relevance of labour taxes to transport cost benefit analysis. Labour taxes create a distortion in the labour market that mean workers do not receive a wage equal to their marginal product of labour, and employment levels lie below those that would occur in an undistorted labour market. He showed that if a transport scheme displaces economic activity to a more productive location, where wages are higher *ceteris paribus*, then transport user benefits do not capture the full welfare gain of the intervention because they omit the

tax wedge benefits to society of higher or more valuable employment. In a case study of the London rail proposal Crossrail (DfT 2005a), these additional surpluses due to labour tax distortions were found to be quite substantial, indeed larger in that case than the agglomeration benefits. Similar arguments can be made for additionality to transport user benefits if a transport scheme can be shown to expand employment (in terms of hours worked) at a national level – through for example lowering the cost of commuting thereby making entering the labour market more attractive to those on the margin of entering the labour market. The difficulty, for analysis of economic impacts in rural areas as elsewhere, is to distinguish between displacement effects and genuine additionality effects. In the rural case, we conjecture that one of the main sources of additionality is likely to come from unlocking schemes — those which allow significant land use change to occur through the exploitation of an immobile resource that previously was unutilised or underutilised.

### **3.4 Involuntary unemployment effects**

It has long been recognised in the CBA literature that expanding employment in areas with involuntary unemployment has a welfare value (Haveman and Farrow, 2011). Modern cost benefit analysis guides (e.g. EC, 2008 p53) explicitly recognise this through the use of shadow wages. It is therefore surprising that in a survey of transport appraisal practice in the EU Odgaard, Kelly and Laird (2005) found that, aside from Germany<sup>3</sup>, no national transport appraisal cost benefit analysis guidelines explicitly account for such welfare benefits despite pockets of high and persistent unemployment remaining at a local, and sometimes regional levels. Involuntary unemployment can be caused by workforce immobility, skill mismatches or some form of restrictive labour market regulation. If involuntary unemployment exists then transport user benefits will not capture the full social value of expanding employment – there is additionality.

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<sup>3</sup> Since the Odgaard, Kelly and Laird survey Ireland has adjusted its CBA guidelines to shadow price labour due to the presence of high levels of unemployment.

Elhorst and Oosterhaven (2008) using a Spatial Computable General Equilibrium model for the Netherlands challenge the view that involuntary unemployment is not relevant to a CBA in developed economies with mature transport networks. They found that wider economic benefits due to involuntary unemployment may change benefits as measured in a conventional transport cost benefit analysis by between -1% and +38%, and can also dominate agglomeration benefits. Whilst this example concerns the expansion of employment in remote urban centres with structural unemployment, it does illustrate the relevance of involuntary unemployment effects to a transport CBA. Remote rural areas can also experience structural unemployment. Brezzi *et al.* (2011) for Europe and North America identify that employment rates are lower in remote rural areas than elsewhere. However they also note that there is substantial variation in employment rates in remote rural areas, with some remote rural areas having very high employment rates and others quite low ones. Willingness to migrate in search of work may be a factor. Clearly therefore, involuntary unemployment effects will be relevant for some remote rural areas, but not for others.

### **3.5 Search costs and thin labour market effects**

Pilegaard and Fosgerau (2008) identified the relevance of search costs as a market distortion in the appraisal of transport infrastructure. They found additionality in the region of the 30% of commuter user benefits. This additionality arises as in job search models unemployed workers have difficulties in finding information on job vacancies (see Rogerson, Shimer and Wright, 2005 for a survey). This occurs even if there are many jobs within the workers' neighbourhood as only a small percentage of them become vacant at any one time. From the perspective of the employee, labour markets are therefore thin - even if there are many firms. This then gives firms market power over workers (Bhaskar, Manning and To, 2003; Manning, 2003a). With this market power firms are no longer price takers and instead are aware that their employment actions affect wage rates. As a consequence, firms restrict employment

levels below that would be seen under perfect competition<sup>4</sup>. An expansion of employment therefore creates a surplus additional to user benefits.

Thin labour markets are particularly relevant in remote areas as sparse populations give rise to a limited choice between employers for workers (Findeis and Jenson, 1998; Vera-Toscano, Phimister and Weersnik, 2004). Firms therefore have market power over workers in thin labour markets. There are few jobs and where they do exist vacancies are often not advertised. Successful job search is often attributed to contacts and networks (Monk and Hodge, 1995; Lindsay, Greig and McQuaid, 2005). Furthermore workers do not have ready access to job centres and information and communication technology (e.g. the internet) is not a substitute for informal networks in job search in remote rural areas (McQuaid, Lindsay and Greig, 2003).

## **4 CASE STUDIES IN THE HIGHLANDS AND ISLANDS OF SCOTLAND**

### **4.1 Introduction**

We illustrate the empirical relevance of wider economic impacts in remote rural areas with four case studies from the Highlands and Islands region of Scotland. This is predominantly a remote rural area<sup>5</sup> (as can be seen from Figure 1). The four case studies described below and whose locations are shown in Figure 1 were selected based on data availability grounds. For each of the studies there exists a standard transport cost benefit analysis based on user benefits and an economic impact study. As transport appraisal practice in Scotland primarily uses CBA, there are only a few schemes in remote rural areas for which economic impact analyses also exist. It is for this reason that the ex ante analysis upon which we draw has to date back to 1999. We need the economic impact studies to understand the scale of the wider economic impacts in terms of changes in output and employment – and it is these

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<sup>4</sup> Under monopsonistic competition the marginal cost of employing an additional worker exceeds the average cost as the wage rate experienced by firms for all workers has to increase to employ one additional worker. Firms therefore set employment levels such that the *marginal cost* of employing labour is equal to the marginal revenue product. In contrast under conditions of perfect competition employment levels would be higher as firms set employment levels such that the *wage rate* equalled the marginal revenue product of labour.

<sup>5</sup> The Scottish Government define remote rural as communities/areas with a population less than 3,000 more than 30 minutes from an urban area (defined as a community with a population greater than 10,000). Very remote rural areas are rural areas more than 60 minutes from an urban area.

projected estimates of changes in output and employment that we use to calculate the additional welfare benefits.

The economic impacts in each of the case studies have been estimated using standard cross-sectoral economic impact methods. In Scotland and the UK guidance on these methods exist (Scottish Enterprise, 2008a, 2008b; BIS, 2009; Transport Scotland, 2014 Section 9.4) and this has been followed in each of the case studies by the respective case study authors. The primary interest in these methods is to identify the local and national economic impact. Economic impact at a national level is regarded as 'additional'. In the main, public sector investment in transport and other sectors (e.g. business start-up or expansion grants) is viewed as displacing economic activity – e.g. from one region to another or one locality to another. Where additionality at the national level is anticipated this has to be demonstrated. A multi-faceted approach is usually adopted. There is a need to understand the market in which the different businesses operate (e.g. salmon farming, bio-technology, etc.) in terms of the cost base and the contribution of transport to that, where the majority of customers are and where the businesses' competitors are located. The ability of businesses to grow needs to be assessed both in terms of land/premises availability, the need for further investment and most importantly the ability to expand the workforce – are there workers with the correct skills in the locality? The economic impact analysts therefore need to draw data from both published sources, but also need to undertake primary research including interviews with producers, consumers and sometimes competitors. An understanding of the markets in which the affected businesses operate in is essential to a good quality impact analysis. Supply chain effects and the impacts of the additional wages received by increased levels of employment are often estimated using multipliers derived from input-output tables. A risk assessment on the probability of the economic impacts being realised is also made.

Analysis based on surveys with businesses expected to benefit will clearly be affected by strategic bias and hypothetical bias<sup>6</sup>. There is therefore a requirement on

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<sup>6</sup> Survey respondents may be tempted to exaggerate the level of benefit they might expect to receive to influence decision-making (strategic bias) and the requirement to image themselves in a future (hypothetical) situation can also introduce some bias, as they either may imagine a situation that is better or worse than would be realised (hypothetical bias).

the analyst to control for this through a careful analysis of the cost base of the sector and the markets of the businesses affected. Arguably a good economic impact analysis conducted using this approach is no more error prone than other methods. Lakshmanan (2011) notes for example that the literature shows that different economy models can give very different predictions of the effect on the economy of transport schemes. This can be illustrated through the comparison of two 'sophisticated' modelling approaches a production function approach used in the SASI model and a general equilibrium approach as embodied in the Spatial Computable General Equilibrium model, CGEurope. Bröcker et al. (2004 pp168-175) compare the results from these two models when applied to the same TEN-T scenarios with the same inputs. They find that whilst the models predicted the same direction and spatial location of impact, the scale of impact predicted by the different models was very different – up to a factor of 9 across the different scenarios examined in terms of the predicted increase in GDP/capita.

*<Insert Figure 1 around here>*

For the illustrative purposes of this paper we assume each of the ex ante analyses to be robust and representative of the expected impacts of the proposals – both in terms of the expected change in generalised cost and the impacts on output and employment. Clearly, as with all ex ante appraisals, optimism bias may be present.

The four case studies are described below, after which we apply the typology set out in Section 3 to identify the relevance of wider economic benefits to them. We then use a partial equilibrium approach to estimate the additional surplus associated with each distortion. In the partial equilibrium approach the additional surplus is equivalent to the difference between the marginal benefit and the marginal social cost for each additional unit of output, employment, etc. Thus for example under imperfect competition when prices are 20% above marginal social costs, the additional benefit of expanding output is 20% of the value of the expanded output. Similarly in a labour market distorted by a labour tax which leads to wages faced by the employer (the marginal product of labour) being 30% above the net wage

received by employees the additional surplus is 30% of the net wage received by the new employees (when employment expands). Local price and wage data need to be used for these estimations. We then assume the individual component surpluses are additive.

The weakness with adopting this approach is that we take the general equilibrium effects to be zero, and there exists the possibility that some double counting between the 'additional' surpluses may occur. Clearly the latter is less than ideal when we consider that, for the remote rural cases being examined, multiple market failures in both the labour and the product market can occur simultaneously. However, as a first test regarding whether wider economic benefits are of a scale to warrant further research our approach has some merits. It may not give a precise result but it is tractable and will identify whether wider economic benefits are potentially relevant. The alternative to partial equilibrium would be to undertake a general equilibrium analysis which would be very resource intensive unless such a model and database existed anyway.

## **4.2 The case studies**

### **Case Study 1: Berneray Causeway and Sound of Harris Ferry, Outer Hebrides, Scotland**

The Berneray causeway (in the Outer Hebrides) opened in April 1999 at a capital cost of £6.6 million. The Outer Hebrides are in the far north west of Scotland. The causeway is just less than 1km in length and is free to use (i.e. there is no toll). 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 two islands linked by the causeway have a total population of 1,500 people. The causeway delivered time savings, fare savings and improvements in the convenience of travel to Berneray. Using business surveys, Halcrow (1996 Section 3.1) estimate that businesses on Berneray would experience up to a 20% increase in turnover and permanent employment would increase by 38.5 full-time equivalent (FTE) jobs. This employment and output was expected to be displaced from

elsewhere in the UK. Using ex post data, user benefits in the opening year were estimated to be £272,000 (1996 resource prices and 2000 values) (Laird, 2008).

### **Case Study 2: A82 Tarbet to Fort William, Highlands, Scotland**

The A82 trunk road between Glasgow and Fort William is the principal road link between the West Highlands and the west of Scotland. The 108 kilometre section of the route between Tarbet and Fort William is single carriageway and passes through some of Scotland's most spectacular scenery. Aside from Fort William with a population of 10,000, the area served by the road is sparsely populated. The estimated cost of the route upgrade is £99.3 million (2006 prices). The direct benefits of the project are driven principally by time savings, though accident savings are also important. User and safety benefits over a 60 year project life were estimated to be £93.8 million (discounted) (2002 prices and values) giving a benefit cost ratio of 1.09 (Scott Wilson, 2006). Wider economy impacts were estimated using micro surveys of businesses. Regional output was estimated to increase by £152 million over 30 years (i.e. £5.0 million per annum) with £113 million additional at the Scotland level. About 208 permanent FTE jobs would be created in the region of which 70 are additional at the national level (Tribal, 2005 Tables 2 ,4 and 6). Additionality at the Scotland level arises as the route upgrade allows the increased exploitation of an immobile resource (the sea) for the fish farming (and salmon farming in particular) which is largely export orientated.

### **Case Study 3: A9 Perth to Inverness upgrade to dual carriageway, Highlands, Scotland**

The A9 between Perth and Inverness is the main route linking the central and north Highlands with Central Scotland (including access to ports for export, Edinburgh, Glasgow and onwards to England). The majority of the 180km route is single carriageway, which due to limited overtaking opportunities, leads to journey time and safety issues. The area it passes through is remote rural with only three significant settlements (Pitlochry, Kingussie and Aviemore) none of which has a population greater than 3,000. The A9 serves a mixture of traffic travelling to/from remote rural areas as well as interurban traffic. Scott Wilson (2008) identify that upgrading the road along its length to dual carriageway would give 60 year discounted user

benefits of almost £1.2 billion (2002 prices and values). Using business surveys in the short term it was estimated that employment in the central and north Highlands would increase by 725 jobs and in the longer term may increase by up to 4,500 jobs with a third of the jobs being in remote areas (Scott Wilson, 2007). A 30 year discounted regional Gross Value Added (GVA)<sup>7</sup> impact of £956 million was also estimated, though no attempt has been made to quantify displacement effects in the rest of Scotland, therefore for the purposes of this paper we assume that all regional output and employment gains are displaced from elsewhere in Scotland.

#### **Case Study 4: Removal of tolls from Skye Bridge, Highland, Scotland**

In 1995 the Skye Bridge was opened. The bridge connects the Isle of Skye to the Scottish Mainland. It is one of the earliest contemporary uses of private finance to fund transport infrastructure in the UK. The Isle of Skye has a population of 9,200 and has a strong dependence on tourism and agriculture and fishing. The bridge is the dominant transport link between the island and mainland Scotland. The tolling of the bridge was always controversial and on 21 December 2004 the Scottish Executive 'bought' the bridge and the tolls were removed. The removal of the tolls led to a 50% increase in the traffic using the bridge. DHC (2007) estimated user benefits of £5.9 million for a single year (2006 in 2006 prices) as a consequence of the toll removal (includes the removal of the toll and delays at the toll booth). They were not able to clearly identify any employment impacts of the toll removal due to problems in defining the counterfactual. Using output and employment multipliers from the increased income associated with the saved toll revenue McQuaid and Greig (2007), in an ex ante study, anticipated that a potential 256 FTE jobs could be created from the toll removal – of which almost 80% would arise from an increase in tourism – with an associated gain in regional GDP of £4.7 million per annum. No displacement effects to the rest of Scotland were estimated, therefore for the purposes of this paper we assume that all regional output and employment gains are displaced from elsewhere in Scotland.

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<sup>7</sup> Gross Domestic Product (GDP) = Gross Value Added (GVA) + indirect taxes - subsidies

### **4.3 Assessing the wider economic benefits of transport proposals in the Highlands and Islands of Scotland**

In this section we use the typology set out in Section 3 to identify the relevance of each market distortion to the remote rural areas of the Highlands and Islands of Scotland. Where a distortion is relevant we then set out how any additional surpluses have been estimated under partial equilibrium assumptions..

#### **Agglomeration effects**

Industry clusters occur in the remote rural areas of the Highlands and Islands particularly in the food and drink manufacturing sector. Localisation economies may therefore be relevant to these projects. However the population in the remote rural areas of the Highlands and Islands is dispersed and, as localisation economies fall away quite quickly with distance (Graham, 2009), their impact on the wider economy is expected to be small for all five schemes.

The A9 upgrade is expected to affect connectivity to the urban area of Inverness. Agglomeration economies may therefore be relevant to it. However, we again expect such economies to be small as firstly the connectivity in the immediate surrounds to Inverness will not be altered significantly by these proposals, and secondly analysis conducted by the UK DfT (2012) shows that agglomeration economies are only empirically relevant to a transport CBA near major population centres – which Inverness and Elgin are not.

We also find that none of the economic impact studies conducted considered productivity gains through increased agglomeration, from which we interpret that they are not relevant. Potentially agglomeration economies in remote rural areas could be relevant in countries where there is a much larger remote rural population (e.g. Norway, Ireland and Greece), as this may allow the transport project to change the economic mass of settlements in remote rural areas. As discussed earlier, they may also be relevant to transport schemes which provide a step change in the accessibility of the remote rural area to an urban centre. Though we do note that Bråthen (2001) found no evidence of external economies affecting the growth of four firms, located near to recently constructed fixed link island crossings, in remote areas in Norway.

## **Imperfect competition**

As discussed in Section 3, for remote rural areas there is an expectation that their remote nature would lead to higher price – marginal cost margins than in other parts of the economy, though as available evidence is almost exclusively focused on industry classifications and does not distinguish by area type (beyond nation states) we do not have direct evidence of this. For this paper therefore we turn to evidence on rural-urban price comparisons and an industry specific case study, which together demonstrate that market isolation allows higher price – marginal cost margins to occur in remote rural parts of Scotland than elsewhere.

Surveys of prices in Scotland have consistently found that prices are higher in rural areas. Sneddon Economics (2003 p.1) found that petrol prices were on average 9.7% higher than in urban areas whilst food was 11.0% higher, while more recently Hirsh et al. (2013) found that food prices in remote rural parts of Scotland were between 10 and 50% higher compared to those in an English rural town . Not all of this price difference can be attributed to differences in market power as the cost of transporting goods to the locality and differences in economies of scale in production (if goods are produced on-site) and economies in retailing account for some of the difference. Identifying the component of the price differential attributable to market power and the component attributable to differences in operating costs requires access to firm specific data. In the absence of such an analysis our best understanding of the market conditions in Scotland's remote rural areas is from industry specific studies. In this respect the UK Office of Fair Trading (OFT) has conducted three investigations into the supply of petrol (OFT, 1998; 2000; 2013). The OFT has the power to examine companies' financial transactions to identify if excessive margins are made, a power that other researchers do not have. They find that the petrol industry is competitive across the UK as a whole because of the proximity of consumers to many different suppliers. This competitive argument breaks down in remote areas where they concluded that a lack of competition in some localities gave rise to higher prices (OFT, 1998 p.73) and in some instances excessive pricing due to market power (OFT, 2000). They found that petrol retail margins across the Highlands and Islands are on average 64% higher than across

the UK. The higher 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 more accessible rural areas) to margins three times that (in the very remote parts of the region). They also considered that some of the margins were excessive and occurred due to a lack of competition.

In terms of how these findings relate to a local economy, consider a transport improvement between the central core of an economy and a remote region. Assume that the transport sector itself is competitive so that distribution cost reductions are passed on in reduced delivered costs. This has several economic effects. For exports from the remote region to the core economy (for example sheep, fish, quarry materials), the price – marginal cost mark up should be assumed no different from that for the economy as a whole and can be handled in the standard way. For imports from the core to the remote region, there is an issue about whether the transport cost reduction will be fully passed through in final prices, but even if it is, the price – marginal cost margin which applies to the increase in consumption is probably higher than for the economy as a whole. This would also be the case for goods produced and sold within the region. Moreover, transport improvements might also have pro-competitive effects either by encouraging national firms to serve market towns in remote areas and/or by encouraging residents to change their behaviour and become less captive to local shops.

The combination of these effects is difficult to predict with confidence so we assume two alternative scenarios. In the first, the average price – marginal cost margin in the remote region is assumed equal to that of the economy as a whole. In the second, the margin is taken to be double that for the economy as a whole, based on the evidence reviewed above, so that there is an additional net social benefit of displacing economic activity from the core to the periphery.

In three of the case studies all the increase in regional output is considered entirely displaced from elsewhere in Scotland, whilst for the A82 Tarbet to Fort William project only 25% of the increased regional output is considered displaced from elsewhere in Scotland. In the scenario with price – marginal cost margins the same throughout Scotland then there is no welfare gain associated with displacing output to remote rural regions – so only the A82 scheme generates an additional surplus.

For the scenario where price – marginal cost margins differ between remote rural and other areas there is a welfare gain from displacing output to remote rural areas.

### **Labour tax**

As with the rest of the UK, workers in the remote rural parts of the Highlands and Islands pay an income tax on earnings – a labour tax. This distortion means that increases in employment at a national level will create an additional welfare benefit to transport user benefits.

Whilst this market distortion effects all the projects only one of the four case studies is predicted to generate additional employment at the national level – the A82 Taret to Fort William project. These additional jobs create a surplus additional to user benefits that is not offset by a deficit created by displacing jobs from elsewhere in Scotland. This surplus, in a partial equilibrium setting, is equivalent to the income tax revenue derived by government, and is calculated using existing tax rates and local wage data.

### **Involuntary unemployment**

None of the four economic impact studies identifies alleviation of structural unemployment as one of the impacts of the projects. This is because the unemployment rate in the remote rural areas of the Highlands and Islands of Scotland is significantly lower than the Scotland and British average (HIE, 2011). The UK, as a whole, has a flexible labour market, though pockets of involuntary unemployment exist where skill mis-matches and residential immobility occur. Scottish unemployment statistics indicate such pockets are located in urban areas. This is because rural workers in the UK are very likely to migrate away from an area completely rather than remain in an area and search for a job (Monk and Hodge, 1995). This outmigration means that the remote rural economy remains at, or close to, full employment in the Highlands and Islands, even during an economic downturn. The mechanism by which the expansion in regional employment in the

case studies is therefore expected to occur is through a mixture of a reduction in 'employment related' out-migration from the region and demand side effects on output and thereby employment – the latter which brings those at the margin of the labour market into work. The latter may of course require local wage rates to increase.

In times of economic decline, remote rural areas can experience falling population levels and a tight labour market simultaneously. This is certainly the case in Scotland. Whilst out-migration by the labour force from remote rural areas is rightly a cause of policy concern, it does not constitute a market failure, and as such surpluses additional to transport user benefits associated with expanding employment in the presence of involuntary unemployment are not relevant to the remote rural areas of the Highlands and Islands.<sup>8</sup> Whilst in other countries where rural labour markets are regulated differently and the population exhibit different characteristics with respect to their propensity to migrate, market failures may occur making involuntary employment relevant to transport appraisals in those countries.

### **Search costs and thin labour market effects**

Each of the case studies identifies that an expansion of employment will occur, though not all of it occurs in remote rural areas. For the A9 case study a significant percentage occurs in Inverness.

One source of empirical evidence on the presence of thin labour markets in remote rural areas can be found in the degree of compensation that occurs for commuting costs. Theories on job search predict that workers will only receive partial compensation for commuting costs when faced with a thin labour market and evidence of such partial compensation has been found at the aggregate level in the UK (Manning, 2003b). Laird (2008 Chapter 8) finds evidence of partial compensation of commuting costs for remote rural areas in Scotland. He also finds that in Scotland, in addition to workers in remote rural areas facing thin labour markets those with low skills and women do so also. His findings on remote rural areas is consistent with

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<sup>8</sup> Where populations are very fragile further de-population may impose a negative externality on those remaining in the settlement should it become unsustainably small.

those of Lindsay, Greig and McQuaid (2005) and that of the imperfections faced by other labour market segments with for example the genre of labour market literature associated with Madden (1981). The implication of this in a transport appraisal context is that whilst additional employment in remote rural areas that is additional at a national level will always create a surplus additional to user benefits, displacement of employment to remote rural areas will create both a surplus in the remote rural area and, if the jobs or some of the displaced jobs are held by women or the low skilled, a partially offsetting deficit in the regions from which the employment is displaced.

The need to account for the displacement of employment has meant that the additional surplus associated with creating employment in thin remote rural labour markets has been estimated in two stages. Firstly the number of jobs created to which an additional surplus should be attached was estimated. To do this, employment estimates from the economic impact studies were split into employment that occurred in remote rural areas and employment that occurred elsewhere (e.g. the cities/towns of Inverness, Elgin, etc.). There is no additional welfare benefit to transport user benefits to creating employment in urban or rural areas accessible to an urban area. The remote rural employment was then further split into those jobs that were additional at the national level and those that were displaced. Only the A82 Tarbet to Fort William study identified employment additional at the national level. An additional surplus to transport user benefits is generated by all employment that is additional at the national level. For displaced employment a net additional surplus to transport user benefits is only generated for skilled male displaced employment, as there is an offsetting deficit for displacing employment from urban areas for women and low skilled workers – as those workers face thin labour markets throughout Scotland. Local proportions on skill and gender levels of the workforce were used to then identify the proportion of the displaced jobs that would be filled by skilled male workers.

In the second stage the welfare benefit per job per year is estimated and applied to each new job to which an additional welfare surplus should be attached. The additional surplus is given by the gap between the marginal product of labour and the wage received by the worker. There is no specific evidence on this gap for rural

areas of Scotland, however, Manning (2003a) argues that on balance, and for the UK as whole, the evidence indicates the wage is 17% below the marginal product of labour (i.e. the marginal product of labour is 20% higher than the wage). Local wages and this proportion are then used to identify the welfare benefit for each job created for which a surplus should be applied.

#### **4.4 Case study findings**

Table 1 presents the results of the partial equilibrium calculations of the additional surpluses associated with wider economy impacts for the five case studies. The results presented in Table 1 use a mixture of price bases and evaluation periods. This is because for each scheme we have utilised the price base and evaluation period in which the ex ante CBA and the economic impact analyses used<sup>9</sup>. The schemes also represent very different scales of investment, from approximately £7 million of the Berneray Causeway to an estimated £3 billion for the A9. It is for these reasons that in our discussion below we focus on the percentage change in the Present Value of Benefits (PVB).

Looking at Table 1 it can be seen that the additional welfare benefit due to wider economic benefits is quite large – from almost zero to 63.58% (depending on the scheme and the imperfect competition scenario examined). There is also quite a range for each of the benefit categories. Looking at thin labour markets the benefits range from 1% of the ‘narrow’ PVB (£9.46M) for the A9 to 21% (£19.21M) for the A82 Tarbet to Fort William route. The range arises as a result of how much of the employment created by the schemes occurs in remote rural areas and how much of that employment has been displaced from elsewhere. For the A9, which is an important inter-urban route, two thirds of the employment is created in urban areas or areas close to the urban areas. In contrast it is estimated that the A82 would increase net employment across the UK by benefiting an important export orientated

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<sup>9</sup> For two of the schemes Berneray Causeway and Skye Bridge toll removal only a single year analysis was available from the study reports. For the purposes of this paper we have assumed that the full economic impacts are realised in the opening year – though appreciate that because of lags in the response of the economy to the transport investment stimulus this will result in a slight overestimation in benefits. For the A9 and the A82 the economic impact analyses included a ramping up period, that reflects this lag.

sector located in the north west of Scotland – fish farming and salmon farming in particular. This gives rise to the larger additional employment welfare benefits associated with this proposed route upgrade. The additional employment at the national level created by the A82 also creates a large additional surplus due to the distorting effects of labour taxes.

With respect to imperfect competition the benefit is heavily contingent on whether price – marginal cost margins differ between remote rural areas and elsewhere. If they are the same then there are no benefits from displacing economic output to remote rural regions. If there are differences then these imperfect competition effects can be quite large approximately 39% of the ‘narrow’ PVB for the A82 (£36.47M) and the Berneray Causeway/Sound of Harris Ferry (£105,000). As we have argued earlier on the evidence available it is hard to give a definitive indication of the price – marginal cost margins in the area but it is likely that the surplus associated with this impact lies between the two. Given the potential size of this surplus, further research would be warranted on both the degree of imperfect competition within remote rural areas, but also the differences between the level of imperfect competition in remote rural areas and elsewhere.

The presence of market distortions in remote rural areas means that transport schemes that affect employment and output can give rise to welfare benefits that cannot be fully captured by looking at the transport market in isolation. At the upper end of the range these benefits are substantial. Nonetheless, the PVB does not change in order of magnitude (i.e. it does not double, nor increase fivefold or tenfold). The implication for policy therefore is that including these wider economic benefits will not transform the transport CBA from being poor to being good, as there is not a change in the order of magnitude of the PVB. However, the fact that the levels of additionality vary from case to case, and at the upper end of the range the increment in the benefit cost ratio will be sufficient to affect prioritisation/ranking of schemes (for example in the UK<sup>10</sup> these additional surpluses would be sufficient to shift schemes between different value for money categories, and therefore affect likelihood of being taken through to delivery).

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<sup>10</sup> In the UK a scheme has a low value for money (VfM) if the BCR is between 1.0 and 1.5, medium if the BCR is between 1.5 and 2.0, high if the BCR is between 2.0 and 4.0 and very high if the BCR is greater than 4.0 (DfT, 2005b)

This variation in the importance of these wider economic benefits between transport projects is interesting. It firstly shows that no rule of thumb can be adopted regarding the relationship between the benefits in the primary transport market and the additional welfare benefits that occur in the secondary markets due to the presence of market distortions. The relationship between the two is case dependent and varies with the type of route under consideration and the markets and locality served by the route. Only a small change in benefits occurs for routes through remote rural areas where the majority of the traffic is inter-urban. The additional welfare value of the wider economic benefits is much larger when the majority of the traffic using the route is directly related to remote areas and where the scheme generates employment and output that is additional at the national level.

## **5 CONCLUSION**

Most work on the wider economy impacts of transport projects has focussed on urban projects such as Crossrail in London. While there are pragmatic reasons for concentrating analytical resources on large projects, and a priori plausibility that agglomeration effects will be most marked in cities, there are other theoretical reasons why market failures in both labour and product markets may be prevalent in remote rural economies. This is because a lack of retail choices means that local imperfect markets can prevail, whilst workers can find difficulty finding employment due to immobility problems leading to involuntary unemployment or because labour markets are thin.

Using four case studies this paper has demonstrated that imperfect competition, labour taxes and thin labour markets are relevant market distortions in a remote rural Scottish context. The literature also suggests that other market failures, associated with agglomeration and involuntary unemployment, can be relevant in other regional contexts. Each of the case studies has a significant local economic impact on output and employment. This impact in combination with the identified market imperfections is empirically relevant to cost benefit analysis – increasing benefits by over 60% relative to the primary benefits alone in one case study. The degree to which the primary transport benefit understates the true welfare impact of the

proposals varies with the type of transport route under consideration and the markets and locality served by the route. A key issue is how much of the anticipated regional economic impact is displaced from elsewhere and how much is additional at the national level. The quality of the economic modelling that inputs to the cost benefit analysis is therefore fundamental to the robustness of the wider economic benefit estimates.

From a policy perspective the empirical findings assembled here are relevant in two ways. Firstly they show that measuring the primary transport benefit remains important in itself. Secondly the variation between schemes in the way wider economic benefits affect a cost benefit analysis means that their exclusion may alter scheme ranking/prioritisation in an investment programme and/or lead to a bias in the decision-making. We conclude that the wider economic benefits of transport projects in remote areas are material and relevant to transport appraisal. At the very minimum, scheme promoters should be expected to consider how a project is expected to impact on the regional and national economy and via which channels.

This paper has brought together disparate strands of research to make a case for this conclusion. There remains however the need for further research. Firstly this paper has only examined transport schemes in the Highlands and Islands of Scotland. In remote rural areas in other countries market distortions associated with agglomeration economies and involuntary unemployment may also prove to be relevant – thereby further increasing the relevance of wider economic benefits for remote rural schemes. Secondly, there is also a need to strengthen the evidence and knowledge base upon which the relevant additional surpluses are estimated. In the case of the UK there is a need for better evidence on the degree of imperfect competition in remote rural areas – as the results are quite sensitive to what is assumed here. Such evidence will of course be case dependent. This paper has also used, as a first step, a partial equilibrium approach to illustrate the scale of the wider economic benefits. The benefits have been shown to be potentially significant. It is therefore important to know how robust these partial equilibrium estimates are to general equilibrium changes and to the potential for double counting between the elements of additionality. Some testing in a general equilibrium setting is therefore required. Finally, we observe that the magnitude of the wider economic benefits

estimated relies entirely on the size of the predicted changes in economic output and employment. The robustness of these estimates is essential and further research in these predictions is important if analysts and decision makers are to have confidence in wider economic benefit measures.

## REFERENCES

- BADINGER, H. 2007. Has the EU's Single Market Programme Fostered Competition? Testing for a Decrease in Mark-up Ratios in EU Industries. *Oxford Bulletin of Economics and Statistics*, **69**(4), pp.497-519.
- BHASKAR, V., A. MANNING and T. TO. 2003. Oligopsony and monopsonistic competition in labor markets. *Journal of Economic Perspectives*, **16**(2), pp.155-174.
- BRÅTHEN, S. 2001. Do fixed links affect local industry? A Norwegian case study. *Journal of Transport Geography*, **9**(1), pp. 25-38..
- BREZZI, M., L. DIJKSTRA and V. RUIZ. 2011. "OECD Extended Regional Typology: The Economic Performance of Remote Rural Regions", *OECD Regional Development Working Papers*, 2011/06, OECD Publishing.  
<http://dx.doi.org/10.1787/5kg6z83tw7f4-en>
- BRÖCKER, J., R. MEYER, N. SCHNEEKLOTH, C. SCHÜRMAN, K. SPIEKERMANN and M. WEGENER, (2004): *Modelling the Socio-economic and Spatial Impacts of EU Transport Policy. IASON (Integrated Appraisal of Spatial economic and Network effects of transport investments and policies)* Deliverable 6. Funded by 5th Framework RTD Programme. Kiel/Dortmund: Christian-Albrechts-Universität Kiel/Institut für Raumplanung, Universität Dortmund.
- CHRISTOPOULOU, R., and P. VERMEULEN. 2008. *Markups in the Euro Area and the US Over the Period 1981-2004: A Comparison of 50 Sectors*. ECB Working Paper No. 856. Report dated January 2008.
- DEPARTMENT FOR BUSINESS, INNOVATION AND SKILLS (BIS) (2009) *RDA evaluation: Practical Guidance on Implementing the Impact Evaluation Framework*. December 2009. London: BIS.
- DEPARTMENT FOR TRANSPORT. 2005a. *Transport, Wider Economic Benefits and Impacts on GDP*. London: Department for Transport.

DEPARTMENT FOR TRANSPORT. 2005b. *Guidance on Value for Money*. London: Department for Transport.

DEPARTMENT FOR TRANSPORT. 2012. *Wider impacts sub-objective*. WebTAG Unit 3.5.14 (under consultation). London: Department for Transport.

DHC (Unpublished, 2007) Evaluation of the Economic and Social Impacts of the Skye Bridge. Report dated 22 February 2007. Available online at:

<http://www.hitrans.org.uk/Corporate/Research/Roads>

DIJKSTRA, L. and H. POELMAN. 2008. "Remote Rural Regions: How the proximity to a city influences the performances of rural regions" *Regional Focus No 1/2008*.

[http://ec.europa.eu/regional\\_policy/sources/docgener/focus/2009\\_01\\_metropolitan.pdf](http://ec.europa.eu/regional_policy/sources/docgener/focus/2009_01_metropolitan.pdf)

ELHORST, J.P. and J. OOSTERHAVEN. 2008. Integral cost-benefit analysis of Maglev projects under market imperfections. *Journal of Transport and Land Use*, **1**(1), pp. 65-87.

EUROPEAN COMMISSION. 2008. *Guide to cost-benefit analysis of investment projects. Structural Funds, Cohesion Fund and Instrument for Pre-Accession*. Brussels: Directorate General Regional Policy.

FINDEIS, J.L. and L. JENSEN. 1998. Employment opportunities in rural areas: implications for poverty in a changing policy environment. *American Journal of Agricultural Economics*, **90**(5), pp. 1000-1007.

GRAHAM, D.J. 2007. Agglomeration, productivity and transport investment. *Journal of Transport Economics and Policy*, **41**(3), pp. 317-343.

GRAHAM, D.J. 2009. Identifying urbanisation and localisation externalities in manufacturing and service industries. *Papers in Regional Science*, **88**(1), pp. 63-84.

HARRIS, R.I.D. 1999. Incidence of imperfect competition in UK sectors and regions. In: SACTRA (ed). *The welfare implications of transport improvements in the presence of market failure and the incidence of imperfect competition in UK sectors and regions*. London: Department for the Environment, Transport and the Regions, pp. 77-90.

HALCROW FOX. (Unpublished, 1996). *Berneray Causeway scheme appraisal*. Report to Outer Hebrides Council. Report dated June 1996.

HAVEMAN, R.H. and S. FARROW. 2011. Labor expenditures and benefit-cost accounting in times of unemployment. *Journal of Benefit-Cost Analysis*, **2**(2) Article 7.

HIGHLANDS AND ISLANDS ENTERPRISE (HIE). 2011. Area Profile for *Highlands and Islands*. Report dated January 2011. Inverness: Highlands and Islands Enterprise.

HOTELLING, H. 1929. Stability in competition, *Economic Journal*, **39**, pp41-57

JARA-DIAZ, S.R. 1986. On the Relation between Users' Benefits and the Economic Effects of Transportation Activities. *Journal of Regional Science*. **26**(2), pp.379-391.

KILKENNY, M. (2010) Urban/regional economics and rural development. *Journal of Regional Science*. **50**(1) pp449-470.

LAKSHMANAN, T. R. (2011). The broader economic consequences of transport infrastructure investments. *Journal of Transport Geography*, **19**(1), 1-12.

LAIRD, J.J. 2008. *Modelling the economic impact of transport projects in sparse networks and peripheral regions*. Ph.D. thesis, University of Leeds.

LINDSAY, C., GREIG, M. and R. W. MCQUAID. 2005. Alternative Job Search Strategies in Remote Rural and Peri-Urban Labour Markets: The Role of Social Networks. *Sociologia Ruralis*, **45**(1/2), pp. 53-70.

MADDEN, J.F. 1981. Why women work closer to home. *Urban Studies*, **18**, pp. 181-194.

MANNING, A. 2003a. *Monopsony in Motion: Imperfect Competition in Labor Markets*. Princeton, NJ: Princeton University Press.

MANNING, A. 2003b. The real thin theory: monopsony in modern labour markets. *Labour Economics*, **10**, pp. 105-131.

McQuaid, R., Lindsay, C., Greig, M. (2004). 'Reconnecting' the unemployed Information and communication technology and services for jobseekers in rural areas. *Information, Communication & Society*, **7**(3), pp. 364-388

MCQUAID, R.W. and M. GREIG (2007) The Bridge to Skye, Scotland. In: Baldacchino, G. (ed.) *Bridging Islands: The Impact of Fixed Links* Chapter 10, pp. 185-202. Prince Edward Island, Canada: Acorn Press.

MOHRING, H., and WILLIAMSON, H. F. (1969). Scale and "Industrial Reorganisation" Economies of Transport Improvements. *Journal of Transport Economics and Policy*, pp251-271.

MOHRING H. 1993. Maximizing, measuring and not double counting benefits: a primer on closed- and – economy cost benefit analysis. *Transportation Research* **27**(6) pp413-424.

MONK, S. and HODGE, I. 1995. Labour markets and employment opportunities in rural Britain. *Sociologia Ruralis*, **35**(2), pp. 153-172.

NASH, C.A. and P.J. MACKIE. (Unpublished, 1990) *Measuring the Benefits of Transport Access Projects*. Report to the Department of Environment. ITS, University of Leeds, UK

ODGAARD, T., KELLY, C.E. and LAIRD, J.J. (2005) Current practice in project appraisal in Europe. *European Transport Conference 3-5 October 2005, Strasbourg*. London: AET Transport

OECD. 2011. OECD Regional Typology. Report dated June 2011.  
[http://www.oecd.org/gov/regional-policy/OECD\\_regional\\_typology\\_Nov2012.pdf](http://www.oecd.org/gov/regional-policy/OECD_regional_typology_Nov2012.pdf)

OFFICE OF FAIR TRADING (OFT) (1998) *Competition in the Supply of Petrol in the UK*. OFT report 229. Report dated May 1998. London: Office of Fair Trading.

OFFICE OF FAIR TRADING (OFT) (2000) *Petrol and diesel pricing in the Highlands and Islands*. OFT report 305. Report dated July 2000. London: Office of Fair Trading.

OFFICE OF FAIR TRADING (OFT). (2013) UK Petrol and diesel sector - an OFT call for information. Report dated January 2013. London: Office of Fair Trading.

PILEGAARD, N. and M. FOSGERAU. 2008. Cost benefit analysis of a transport improvement in the case of search unemployment. *Journal of Transport Economics and Policy*, **42**(1),pp. 23-42.

REFERENCE ECONOMICS, UNIVERSITY OF LEEDS and SPYRIA PARTNERSHIP. 2011. *Shetland Fixed Links Strategy: Socio Economic Study*. Final Report to Shetland Islands Council.

RICHARDS, T., R.N ACHARYA and A. KAGAN. 2008. Spatial competition and market power in banking. *Journal of Economics and Business* **60**(5) pp436–454

ROGERSON, R., R. SHIMER and R. WRIGHT. 2005. Search-Theoretic Models of the Labor Market: A Survey. *Journal of Economic Literature*, **43**, pp.959-988.

SCOTTISH ENTERPRISE (2008a) *Economic Appraisal Guidance Note: A Summary Guide to Developing the Economic Case for a Project or Programme*. Report dated 1<sup>st</sup> November 2008. Scottish Enterprise: Glasgow.

SCOTTISH ENTERPRISE (2008a) *Additionality & Economic Impact Assessment Guidance Note A Summary Guide to Assessing the Additional Benefit, or Additionality, of an Economic Development Project or Programme*. Report dated 1<sup>st</sup> November 2008. Scottish Enterprise: Glasgow.

SCOTT WILSON. (Unpublished, 2006). *A82 Tarbet to Fort William Route Action Plan Study Executive Summary*. Report dated February 2006.

SCOTT WILSON. (Unpublished, 2007). *A9 Perth to Inverness Economic Appraisal Study Strategic Impact Assessment and EALI Analysis*. Final Report, October 2007. Available online at: <http://www.hitrans.org.uk/Corporate/Research/Roads>

SCOTT WILSON. (Unpublished, 2008). *A9 Upgrade Impacts Study, Modelling and Economic Appraisal Report*. Final Report, May 2008. Available online at: <http://www.hitrans.org.uk/Corporate/Research/Roads>

STANDING ADVISORY COMMITTEE ON TRUNK ROAD ASSESSMENT (1999) *Transport and the Economy*. Norwich:TSO.

SNEDDON ECONOMICS. (Unpublished, 2003). *Rural Scotland Price Survey*. A report for Highlands & Islands Enterprise, Scottish Enterprise and the Scottish Executive Environment and Rural Affairs Department. Report dated 12 August 2003.

TRANSPORT SCOTLAND (2014) *Scottish Transport Appraisal Guidance (STAG) Technical Database*. Glasgow: Transport Scotland.

TRIBAL (Unpublished, 2005). *A82 Tarbet to Fort William: Economic Appraisal Main Report*. Report to HITRANS. Report dated September 2005.

VENABLES, A.J. and M. GASIOREK. 1999. The Welfare Implications of Transport Improvements in the Presence of Market Failure. In: SACTRA (ed). *The welfare implications of transport improvements in the presence of market failure and the incidence of imperfect competition in UK sectors and regions*. London: Department for the Environment, Transport and the Regions, pp. 3-58.

VENABLES, A.J. 2007. Evaluating urban transport improvements: cost-benefit analysis in the presence of agglomeration and income taxation. *Journal of Transport Economics and Policy*. **41**(2), pp. 173-188.

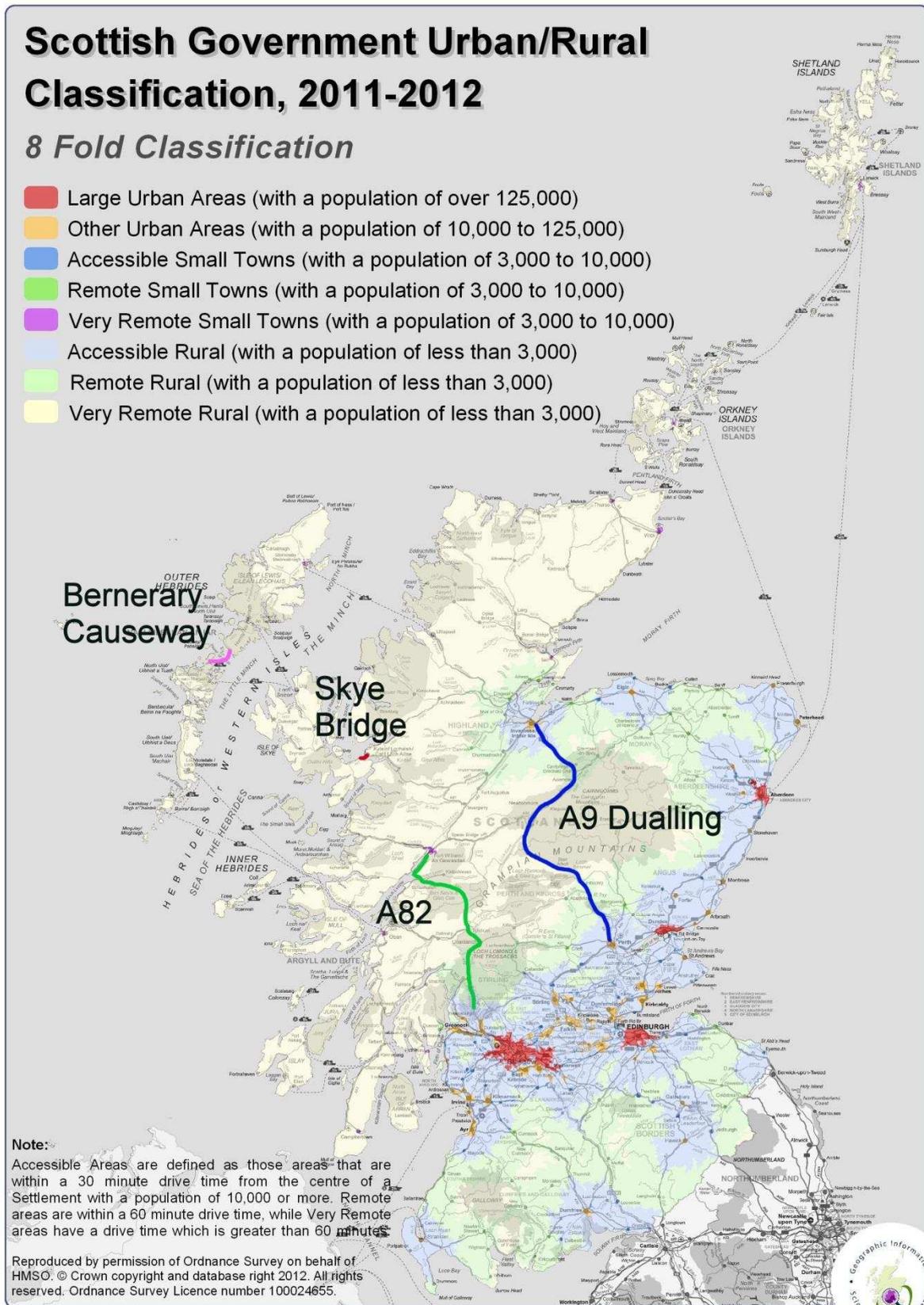
VERA-TOSCANA, E., E. PHIMISTER and A. WEERSINK. 2004. Panel estimates of the Canadian rural/urban women's wage gap. *American Journal of Agricultural Economics*. **86**(4), pp. 1138-1151.

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Figure 1: Scottish Government urban/rural classification and case study locations



**Table 1: Highlands and Islands remote rural case studies – welfare benefit measures**

		<b>Berneray Causeway and Sound of Harris ferry</b>	<b>A82 Tarbet to Fort William route upgrade</b>	<b>A9 Perth to Inverness dual carriageway upgrade</b>	<b>Skye Bridge toll removal</b>
Units of account	<i>Price base</i>	<i>1996 resource prices and 2000 values</i>	<i>2002 market prices and values</i>	<i>2002 market prices and values</i>	<i>2006 market prices and values</i>
	<i>Single year/evaluation period</i>	<i>Opening year only</i>	<i>60 years</i>	<i>60 years</i>	<i>Single year (2006)</i>
	<i>Units</i>	<i>£thousands</i>	<i>£millions</i>	<i>£millions</i>	<i>£millions</i>
Impacts in primary transport market	(A) User benefits	272.00	80.92	1,176.60	5.95
	(B) Safety benefits	--- <sup>(1)</sup>	12.86	--- <sup>(1)</sup>	--- <sup>(1)</sup>
	(C) Carbon costs	--- <sup>(1)</sup>	--- <sup>(1)</sup>	-3.29	--- <sup>(1)</sup>
	(D) 'Narrow' measure of Present Value of Benefits (=A+B+C)	272.00	93.78	1,173.31	5.95
Indirect effects on output and employment	(E) Agglomeration	0.00	0.00	0.00	0.00
	(F) Imperfect competition				
	Scenario 1 - price-marginal cost margins at 20% throughout UK	0.00	16.16	0.00	0.00
	Scenario 2 - price-marginal cost margins at 20% in urban and accessible parts and double that in remote rural areas	105.00	36.47	84.74	0.94
	(G) Labour supply	0.00	3.95	0.00	0.00
	(H) Involuntary unemployment	0.00	0.00	0.00	0.00
	(I) Thin labour markets	23.00	19.21	9.46	0.21
	(J) 'Wider' measure of Present Value of Benefits (=D+E+F+G+H+I)				
	Scenario 1	295.00	133.10	1182.77	6.16
	Scenario 2	400.00	153.41	1267.51	7.10
<b>Proportion of CBA benefits arising from market distortions (=J/D-1)</b>					
<b>Scenario 1</b>	<b>8.46%</b>	<b>41.93%</b>	<b>0.81%</b>	<b>3.53%</b>	
<b>Scenario 2</b>	<b>47.06%</b>	<b>63.58%</b>	<b>8.03%</b>	<b>19.33%</b>	

Notes: (1) Not estimated in original study. (2)