Buses and the Economy II

Task 1 Report

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0 INTRODUCTION

Buses and the Economy II is the follow up to 'Buses and Economic Growth' undertaken by ITS in 2011-12 (Mackie et al 2012). This project identified and, where possible, quantified the contribution the bus service makes to the wider economy through facilitating access to jobs, shops and recreational activities.

In summary the aim of this follow up study is to:

- **Quantify** the relationship between improved accessibility, employment and GVA
- **Understand** the role bus plays in helping unemployed
- **Understand** the role buses play in helping re-vitalise town centres
- **Examine** the role of bus services in market towns.

To pursue these different strands of work we have split the work-schedule into different tasks through which the relationship can be illustrated and understood.

1. A literature review considering the methodological approaches and empirical evidence on the link between labour market outcomes, regeneration and public transport accessibility.
2. Using/developing a model which determines the level of first order effects, ie translates transport quality changes into changes in accessibility
3. Panel data analysis to examine the impact of changes in service level on the labour market using actual market data
4. An additional survey to identify the impacts that bus service accessibility has on employment outcomes
5. A survey of expenditure of visitors to city and town centres.
6. A case study, based on user and household surveys, on the value of bus networks to market towns.
7. Final reporting

The remainder of this report focuses on the first of these tasks. Each of the other tasks are presented in self-contained Task Reports.

1   LITERATURE REVIEW

1.1 Introduction

This review is targeted towards the policy question posed in this study –how, and how much, does bus service contribute to economic performance? In the next section, we review various Government documents giving guidance on the assessment of policy interventions to promote economic performance.

The purpose of Section 1.2 is to demonstrate that we appreciate current appraisal guidance, develop a clear interpretation of it in relation to our study and show how we intend to develop application methods within the appraisal framework. It is therefore a selective review of relevant work to fit our purpose and not a general or comprehensive review. Section 1.3 covers the literature on previous work quantifying the link between Public Transport and Employment

1.2 Assessing the benefits of better buses

All public expenditure programmes need to be assessed in terms of value for money. The overarching guidance is provided in the Treasury Green Book currently under revision. However, underneath that umbrella, different Departments have worked out their own more detailed guidance for application in the sectors for which they have responsibility. The DfT's appraisal guidance is contained in the Web document WebTAG (DfT 2014a). A natural starting point therefore is to consider whether there are any special appraisal issues raised in the consideration of the impact of better bus services on the labour market and jobs and how to interpret the guidance particularly on Wider Impacts (DfT, 2014b) and Regeneration (DfT, 2014c).

It may be argued that some types of initiative might be more akin to regeneration or skills development programmes. For example, this might be the case for targeted initiatives aimed at helping to get NEETs[1] into jobs or training. In the following section, we therefore review briefly the appraisal guidance issued by or on behalf of departments such as BIS (2009), DWP (Fujiwara, 2010) and CLG. There is a commonality of approach in these documents which facilitates discussion. This is of course interesting in the context of the City Deal where Local Enterprise Partnerships and Combined Authorities are being encouraged to think strategically about improvements in transport, land development, skills, flood protection etc as engines for delivering improved performance of the city region economy. The logical end point to this approach is a consistent approach across programmes and across revenue and capital.

1.2.1   The Department for Transport's Appraisal Guidance and Employment Effects

Most of WebTAG is about transport impacts such as travel time, reliability, safety and environmental impacts. None of that is discussed here. Clearly the effects of better buses will come about through changes in travel times, reliability, comfort or fares; those are the mechanisms by which improved accessibility is created. But the appraisal treatment of such impacts is well documented in WebTAG and there is no special reason to depart from it in

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[1] Not in Employment, Education or Training

the case of bus scheme or bus policy analysis. It is when we come to the wider impacts on the economy that the application of the guidance to the local bus sector needs to be considered carefully.

Four sources of additional wider impact on economic efficiency are acknowledged in the guidance:- agglomeration impacts; output changes in imperfectly competitive markets; labour supply impacts; move to more or less productive jobs. Of these, the labour market effects are of most interest in our context. Agglomeration effects might apply to clustering of retail and entertainment in town and city centres. We show elsewhere in the report that bus service makes a significant contribution to town centre accessibility, but have not studied the agglomeration economies or density economies associated with that. Imperfectly competitive market effects are generic rather than specific and there seems no reason to treat them differently in this context.

Labour supply wider impacts estimate the value generated from the change in travel cost affecting the numbers of people attracted into work.

Currently the guidance document TAG Unit A2.1 DfT (2014b) suggests Labour Supply Impacts should be relevant to most schemes. In the context of bus service improvements, there are reasonable arguments that it should apply to schemes involving recurrent costs.

The following text is taken from TAG Unit A2.1 (DfT, 2014b)

Labour supply impacts*: "A change in transport costs alters the net financial return to individuals from employment. This is likely to affect the incentives of individuals to work, and therefore the numbers choosing to work and the overall amount of labour supplied in the economy. "*

The labour market effects are valued in terms of the additional tax revenues generated by the change in labour supply. The labour market is assumed to clear but with a tax wedge separating the gross of tax wage (representing the value of marginal product of labour) and the net wage (on which the employee balances their labour/leisure choices). When something happens in the economy to stimulate an extra unit of employment, the tax wedge measures the marginal net social benefit of creating that extra unit of employment. This is based on the assumption of competitive markets but with labour taxes. In passing it should be noted that this is not quite the same as the assumption in the next section.

The labour supply impact is estimated in several parts (DfT, 2014b):

"i)calculating how commuting costs for round trips change as a result of the scheme and how this will affect the benefit an individual obtains from working;

ii) calculating how the change in the benefit from working will impact on the overall amount of labour supplied; and

iii)calculating the additional national output produced by the new labour supplied. "

The first step requires estimation of impact of commuting costs on generalised cost for workers (per zone pair and year). The change in commuting costs are divided by earnings of

workers to give relative change in earnings to be compatible with the use of labour supply elasticity.

In step 2 the labour supply elasticity is used to convert the change in net earnings to a change in labour supply by zone pair. The relative change in participation is weighted by workers and multiplied by median wage of the worker.

The change in labour supply is denoted (DfT, 2005 p 51) as

$$\frac{dEt}{Et} = -\frac{dGt}{Wt} * El$$

where:

- Et=employment (or labour supply) at time t
- W=average gross wage/earnings
- G=average generalised cost of commuting
- El=elasticity of labour supply with respect to returns to work
- d is a change in a variable

Each worker will contribute to GDP at time t through their productivity, so the total effect on GDP (GP1t) is

$$GP1t = dEt * GDPt$$

Or, by substitution from above:

$$GP1t = -\frac{dTt}{Wt} * El * Et * GDPt$$

The national output change (step 3) is the total productivity change over all zones[2].

$$GP1^f = -El * \frac{\eta}{(1-\tau_1)} \sum_i \left(\sum_j W_{i,j}^{A,f} \left(G_{i,j}^{A,c,f} - G_{i,j}^{B,c,f} \right) \right)$$

where:

- GP1[f] is impact on GDP from more/less people working in forecast year f
- $W_{i,j}^{A,f}$ is number of workers living in zone i and working in zone j for scenario A

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[2] Annex 2 of the discussion paper (DfT, 2005), provides a more detailed exposition of how such welfare effects would be estimated in a zonal model, requiring details on commuters living in area i and working in area j, and the underlying changes in generalised costs for these pairs, the average wage and GDP per worker in each area. TAG unit A2.1 (DfT, 2014a) provides more detail on how the GDP impact would be calculated based on zonal pairings.

- $G_{i,j}^{A,c,f}, G_{i,j}^{B,c,f}$ are the modal trip weighted commuting average generalised costs between zone i and j in the base case B and the alternative case A
- y_j^f is gross earnings in zone j at time f
- η is the parameter capturing lower the average productivity of workers at the margin of the labour force (recommended to be 0.69).
- τ_1 is average tax rate on earnings

The elasticity of labour supply is clearly key here – this measures the extent to which labour supply responds to a change in the wage rate in a given time period.

Currently, WebTAG recommends an elasticity around labour supply with respect to wages of 0.1 (according to TAG Unit A2.1 (DfT, 2014b), this value is estimated *'from DWP calculations and wider literature review'*). The discussion paper (DfT, 2005) states (p52) that using literature sources and '*data from ONS (Nomis), we have calculated an overall elasticity of 0.1 for men and 0.4 for women. Weighting these according to the national claimant count leads to an overall estimate of 0.15…..Labour model runs by DWP…suggest a somewhat lower elasticity of about 0.05. Considering the above evidence we recommend using a range for the labour supply elasticity of 0.05 to 0.15, with a best estimate of 0.1.'*
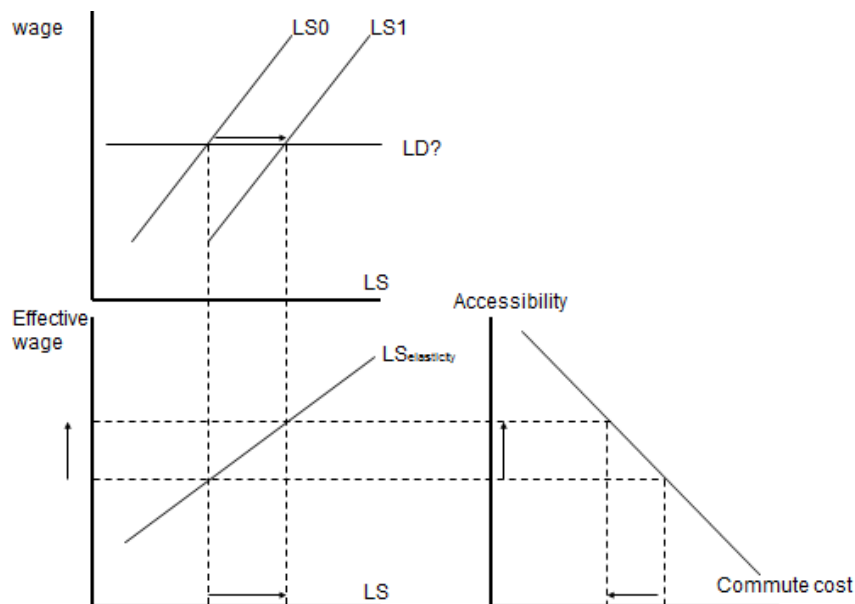
We have held discussions with the TASM Division of DfT about the interpretation of these statements and with their help have identified a number of possible economic cases. The one which we favour for its tractability and consistency with general Green Book principles, specifically the full employment assumption[3], is the following:

- The demand for labour is elastic at the going wage rate, gross of commuting costs, for the relevant class of labour. A reduction in commuting costs flows through to labour, increasing the wage net of commuting costs and stimulating an increase in labour supply[4] as shown in Figure 1-1 below.

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[3] See next section for relaxation of the full employment assumption.

[4] Thanks to Adam Spencer of TASM Division, DfT ; responsibility for interpretation is ours.

Figure 1-1 Impact of Change in Commute Cost on Labour Supply

For general purpose appraisal such as roads or railways, this is a fair approach since it is not feasible to estimate bespoke tax wedge calculations for (say) the A14 road scheme. It is a judgement call as to when market specific calculations might be called for, but clearly in contexts such as employment creation for NEETs, the relevant marginal tax wedge and labour supply elasticity is likely to be very different from the economy-wide average above.

In that context a study reported in the 3Rs Guidance (ODPM 2004 page 102) is of interest. This concerns the appraisal of an initiative by the previous Government , ' the New Deal for Young People'. This was a programme for getting young people into employment. 339,000 young people were assessed to have been moved into employment at a gross cost of £1.3bn.

'*This gross cost, however, needs to be adjusted to allow for the effects of …….*

- *The reduction in expenditure on Jobseeker's Allowance and other welfare benefits due to the reduction in unemployment ; and*
- *The rise in tax revenue due to an increase in employment and national income*

……………..NIESR………estimated that:

- *For the £1.3 billion spent on the scheme government borrowing would only need to increase by £0.5 billion after the full effects are taken into account*
- *Typically the gross spending on NDYP was ca £334m per annum. Offsets (per annum) to this included increases in indirect taxes of £58 million and direct taxes of £64 million and expenditure on social benefits would fall by £135 million'*

Obviously there are numerous assumptions in the calculations, but, taken at face value, this suggests that in 2002, an effective marginal tax rate for this cohort was around 60-75%, so

the tax wedge was significantly higher than the average for the population as a whole. For targeted interventions, it would not be inconsistent with WebTAG principles to allow an appropriately documented cohort-specific value. However it would also need to be recognised that the average wage of NEETs on the margin of entering the labour market would be lower than the average wage in the economy, possibly not far above the National Minimum Wage.

1.2.2 Regeneration Wider Impacts

Regeneration areas are often parts of large cities, eg East Manchester, West Leeds, Selly Oak, or can be towns, eg Corby, Ipswich or wider rural areas.

There are further market failures to those described above, which are associated with the excess supply of labour at a regional/sub regional level.

A transport project that lowers both commuting costs and business/freight costs results in an increase in labour supply and an increase in labour demand. In a perfectly competitive market, such shifts in the labour and supply curves will yield a higher market clearing wage. Any regeneration benefits are fully captured by transport user benefits.

In a local economy with employment below full employment levels, ie involuntary unemployment, the creation of additional employment can have an economic benefit greater than that captured through changes in the cost of travelling to work. Because there is a failure in the labour market, wages may not fall, even though employment levels expand. A series of welfare impacts occur as a result of the transport improvement, as discussed in Laird and Mackie (2009).

- There is a benefit felt by existing workers who travel to work more easily. This can be correctly measured in the transport market, ie the reduction in commuting costs.

- There is a welfare gain felt by workers, no longer involuntarily unemployed, in the form of wages paid over and above the reservation wage.

- Finally, a welfare gain is felt by employers, as they enjoy an increase in producer surplus – their willingness-to-pay for the additional labour exceeds the wage they pay.

Therefore transport schemes that increase employment in areas of high unemployment will have positive economic impacts that are not encapsulated in transport user benefits.

This is highly relevant to regeneration areas as immobility in residential location (e.g. through the prevalence of social housing) and skill mis-matches (including the de-skilling of unemployed workers) are market failures that can lead to excess supply of labour (i.e. structural or involuntary unemployment). In such conditions an additional economic impact to transport user benefits will occur if employment increases in the region experiencing the excess supply of labour (i.e. the regeneration area).

Boardman et al (2011) describe unemployment rates of 5% or below as frictional, any such areas can reasonably be considered to be at full employment. A simplifying and reasonable assumption (that is typically used in CBA) is that there is full employment in the regions from which the labour is displaced, so the loss of welfare associated with reduced employment in these areas is fully captured through the change in commuter user benefits in these regions.

Rates above 10% represent structural unemployment, so reductions in unemployment around this rate represent net increases in employment. (Between 5-10% this effect is partial). In this way, there is a net economic impact from a redistribution of employment to the regeneration area.

The existing DfT guidance on regeneration is contained in Regeneration Impacts (TAG Unit A2.2) (DfT, 2014c). This TAG unit is concerned with the estimation of the final economic impacts of a transport project in terms of employment and GDP. The Department for Transport state "*There is no single definition of regeneration areas, but these areas will have been designated for specific policy purposes related to economic development under one of the UK government's or European Union's regeneration programmes "*. The current WebTAG guidance on Regeneration is not as detailed as it is for labour market impacts.

Many DCLG commissioned studies are concerned with value for money against the programmes aims and objectives looking at cost-effectiveness through an assessment of cost per job (Tyler et al, 2010). We see this as a sensible approach – the challenge is not the appraisal but to model and establish whether such linkages exist, ie do transport measures create local employment? As such, measures of employment are important, but also GVA per employee are used widely as indicators of economic contribution of an intervention.

There are only a few examples in the international literature where these effects have been examined, of most relevance is probably that described by Elhorst and Oosterhaven (2008).

1.2.3   Regeneration Social Benefits
Regeneration social benefits are the social benefits that society places on having a fairer spatial distribution of income and opportunities. The important distinction between them and regeneration wider impacts is that the regeneration wider impacts only occur if market failures exist, whilst regeneration social benefits purely reflect the preference of society of a more equitable distribution of income. Regeneration wider impacts also reflect an increase in economic efficiency, whilst regeneration social benefits arise from a redistribution of economic activity.

Regeneration wider impacts and regeneration social benefits are not included in the cost benefit analysis of transport projects in the UK. For schemes that impact on the economic activity of a 'Regeneration Area' employment and GDP impacts are reported in a Regeneration Report (RR) and included in a scheme's Appraisal Summary Table (AST). Guidance on the estimation and monetisation of such wider impacts is yet to be incorporated into WebTAG.

We are unaware of existing formal processes by which social benefits of regeneration are monetised and included in CBA. There are however existing frameworks (eg English Partnerships, 2003) by which such effects can be be monetised through applying a unit value to each net job created, based on a value of government willingness to pay for job creation, (likely to vary by area, type of job, underlying employment) illustrated through a spreadsheet based approach.

1.2.4   Other Departments' approaches
In contrast to the DfT WebTAG approach, other Departments tend to focus on trying to measure the Gross Value Added associated with some policy initiative. For example suppose an additional new job is created with a wage of £10k per annum and no offsetting or additional costs then the GVA is £10k per annum and it is worth spending something less

than that to create the job. So, if we were comparing policies across sectors to promote job creation and take up---skills, childcare, ease of travel to work etc--- it would make sense to look at all policy initiatives on a common basis.

The example above is the simplest possible case and in practice the methods incorporate various complexities which have been given attention to varying degrees. For example, the BIS RDA Evaluation Guide (2009) contains the following set of key questions for an informed additionality judgement :

Deadweight: in the context of before and after or with and without, there is a need to assess what would have happened anyway in the base or reference case.

Leakage: Who were the target groups and to what extent did the impact leak to non-target groups. For example, if the target area was an area of multiple deprivation but improved bus services ran through other areas on their way to the town centre, a proportion of the gross impact might accrue outside the target area or group

Displacement: Does the initiative partly displace existing output? For example, would an initiative to reduce the costs of accessing employment by bus have a gross effect which was partially offset by reduced employment/activity from people who walked or cycled to work?

Substitution: On the supply side would a company , say a bus company employing additional labour from a target group do so at the expense of other labour leaving net output unchanged or changed less than gross output?

Multiplier Effects: How much additional economic activity is generated downstream from the primary impact?

In the context of bus travel, the most important of these is probably Displacement. From the perspective of the economy as a whole we would like to know the impact on jobs and GVA net of any displacement effects. Another issue is that the GVA approach assumes the costs of entering the labour market are zero but in practice the treatment of childcare and other direct costs of entering the labour market would require careful consideration. Finally, whereas the CBA approach assumes that the wage represents the opportunity value of labour in terms of leisure forgone, the GVA approach assumes the opportunity value of labour to be zero. This is one reason why GVA impacts of job creation will tend to be larger than CBA benefit measures. However, for policy analysis the prime requirement is for consistency of approach across programmes, since relative performance of competing policy instruments is important.

1.3 Public Transport and Employment

1.3.1 Spatial Mismatch Hypothesis

The spatial mismatch hypothesis (Kain, 1968; Brueckner and Martin, 1997; Ihlanfeldt and Sjoquist 1990) (SMH) argues that the movement of jobs away from central city areas, combined with constraints on geographic mobility imposed by continued residential segregation, limits the employment prospects of inner-city minorities. The application is analogous to low-income groups also. Public transport represents an option for improving this mismatch between job and worker locations. However, as noted by Ihlanfeldt and Sqoquist (1998), other factors such as lack of information on job availability and

discrimination and lack of skills are at least as important in affecting employment levels for inner city, low income groups. Much of the subsequent literature refers back to the SMH.

1.3.2   Impacts of transport accessibility on search intensity

McQuaid et al (2001) surveyed unemployed in Edinburgh to see how far they were willing to travel to potential new job. The premise of their work is that "the effectiveness of intra-regional job search is influenced by how far people are willing to travel to new employment". They regressed potential travel to work times on covariates including socio-demographics and individual and family characteristics, car ownership and Public Transport (PT) accessibility. Whilst they used postcode area to generate a PT accessibility measure, they accept that "there may be multiple job locations which may not be on a travel route to a CBD[5]".

The results of their analysis revealed intra-area spatial mismatch with certain groups willing to travel less distance than others. They found that areas of high unemployment were typified by lower willingness to travel to work times, which they cite as evidence of a disincentive effect. They go further and say that improving access to job opportunities may be important in these areas. They found that longer periods of unemployment did not decrease the willingness of unemployed people to travel to a new job.

Patachini and Zenou (2005) discuss the SMH but also consider transport mode as another explanation for differing employment outcomes between blacks and whites. Access to private transport facilitates job search across a wider area. They develop a theoretical model in which whites mainly use private vehicles to commute whereas non-whites use public transportation.

Patachini and Zenou test this model using English Labour Force Survey and British Household Panel data. Search intensity is modelled as a function of local labour market characteristics captured by sub-regional (NUTS3) data. They find living in areas where (time) distance to jobs is higher yields the unemployed to search less than in areas with better job access. They also find that having access to a car increases search intensity.

Their empirical analysis uses Cross-sectional and Panel data techniques based on LFS data– at aggregate, regional level rather than individual level. These aggregate indices do not truly reflect impact of public transport accessibility. Also, their search intensity variable (ideally number of hours spent looking for work) is crudely approximated as the ratio of non-employed actively searching for jobs and the sum of all non-employed.

1.3.3   Public Transport and Employment levels

There is little evidence of the degree to which public transport affects employment. Whilst the spatial mismatch hypothesis focuses on the spatial separation of jobs and houses, there is less work on the impact of commuting times or distances.

Sanchez (1998) uses a cross section of block[6] group census data and GIS to analyze the location and employment characteristics of workers with varying levels of accessibility to

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[5] Central Business District

[6] Blocks are statistical divisions of census tracts, generally defined to contain between 600 and 3,000 people

transit. Accessibility is measured by straight line distances to nearest bus and rail stops/stations as well as frequency at nearest bus stop. Utilizing a variety of spatial measures, a two-stage least squares regression is used to estimate the relationship of transit accessibility with labour participation levels for the cities of Portland, Oregon and Atlanta, Georgia. To avoid the bias arising from endogeneity between employment and car ownership, car ownership is estimated as a function of local household sizes, incomes and weeks worked as well as distance from the urban centre. Controlling for race, skill levels, employment accessibility and household characteristics, he compares labour market participation rates for workers within walking distance of transit routes to participation rates of workers not within walking distance. Transit access measures are based on distances to the nearest station and service frequency. He finds that transit access, but not always frequency, is a significant factor in determining average rates of labour participation of areas within these two cities. The first-stage within regression results (ie the estimation of car ownership) are not reported, and the inclusion of the second stage dependent variable is not standard procedure, so the results appear questionable.

Ozbay et al (2006) look at the issue of accessibility measures using 18 county level data from New York/New Jersey for the year 2000. They estimate a model of employment using two stage and three stage least squares. Accessibility between each combination of residential and employment locations is estimated, as a function of modal travel times adjusted and socioeconomic and travel characteristics in the residential region. An employment function explains the number of employees in a particular job type who reside in one location and work in another by accessibility, wage rate, and average numbers of level of education and children in each residential location.

They find accessibility (measured in units of weighted travel time) is positively affected by public transit and car travel times. Accessibility emerges as a significant determinant of employment for all job types. Specifically they find the number of new employments induced by a 10% accessibility improvement to be 0.46%. They also examine the issue of causality by estimating accessibility as a function of employment, which suggests that employment growth does influence accessibility.

A similar earlier analysis (Berechman and Paaswell, 2001) focuses on the impact of changes in accessibility on employment in specific job areas in the low income South Bronx area of New York. Accessibility between residential and employment locations is measured as a function of weighted modal times and costs, car ownership and household income. Using census block group data on 13 job types in 17 employment sectors, based on any locations where residents of the Bronx work, yields 56,000 observations. This work has similar findings to above, that a 10% improvement in accessibility improves employment by 0.44%.

Neither of these studies has a temporal dimension so time varying, unobserved differences between areas cannot be controlled for. High R^2 values for the accessibility measures are probably due to the similarity between the dependent (weighted travel times) and some independent variables (modal travel times)., which is questionable.

Work by Buchanan (GLA Economics 2009), forecasted the distribution of employment growth in Greater London for various future scenarios up to 2031, specifically focusing on the relationship between employment and public transport and highway accessibility.

Accessibility indices were calculated using a gravity model applied to zonal population measures and zone to zone generalised time measures from the TfL's London Transportation Studies (LTS) model. Using the PT based indices they examined the relationship between employment density and PT accessibility. They found that accessibility explained around 85% of employment density and conclude that employment clustering in Central London is almost entirely dependent on public transport access. This is questionable on two counts. Firstly, it takes no account of the direction of causation in this relationship, ie is PT accessibility higher to serve the higher density areas, rather than driving density itself? Secondly, no other localised covariates are examined, implicitly assuming all other missing variables (eg population characteristics) are not correlated to the accessibility measures.

Although focusing on road network accessibility, the work by Gibbons et al (2012) is very interesting econometric estimation of linkage between accessibility and employment. They construct a panel (1998-2007) database of employment at the ward level married to measures of road construction schemes. They deal with the issue of endogeneity by looking at the impact of these schemes in areas close to (10-30km), but not directly on top of these schemes, the implication being that these are true wider economic benefits that are incidental to the main target area of these schemes. Their measure of accessibility is an index capturing the amount of employment reachable per unit of travel time along the major road network in a given location, based on ward to ward travel times. They use a fixed effects approach to avoid any bias arising from the correlation of unobserved time invariant area level effects with accessibility. They allow for intra and inter ward correlations but they do not include additional controls for any changes in aspects such as the labour market characteristics of wards. They find a 10% improvement in accessibility leads to around a 3% increase in the number of businesses and employment up to 30km from the site, although the estimates range between zero and 10% depending on sector and specification. Employment varies due to entry and exit of firms in an area, not due to a response from existing firms.

1.3.4 Public Transport and Individual Labour Market Outcomes

There is a considerable amount of literature on estimating employment status for individuals (ie unemployed or not) as a function of personal and regional characteristics eg Gunderson (1980). Logit and probit applications are standard tools in examining probabilities of employment and labour force participation. These models are analogous to regression models but estimate the probabilities of a discrete outcome for an individual (in this case unemployment) as a function of explanatory variables (see Scott-Long (1997) ch.3 for discussion).

Rice (2001) looks at 62 US cities (and a larger but more aggregated set of data on 76 cities) and uses individual level probit analysis to examine the impact of public transit route density on individual's probability of employment whilst controlling for other city characteristics as well as individual characteristics..At the city level she measures public transport by miles of route per city, normalised by city size. City level control variables are taken from processed census data. For some citiies this represents a considerable aggregation, eg New York will encompass many different local transit and housing quality environments. Iindividual level data on wages, employment status, hours of work and personal characteristics are taken directly from the Census Bureau. Rice finds density of public transit routes has a positive effect on the probability of employment for the low education population, which is significant

at the 5% level. There was however no significant effect for the overall population. A 10% increase in public transport density is associated with an increase in 0.6% in the probability of employment – roughly half the size of effect of a comparable increase in car ownership. The results do not control for the endogeneity of car ownership, and she suggests this could be done following the same procedure as Raphael and Rice (1999) who instrumented for car ownership using state gasoline taxes and average insurance premiums.

Matty (2013) details recent work on developing a profiling tool to predict the likelihood of a new claimant reaching long-term unemployment (LTU) and other unemployment milestones (measured as periods of continuous Jobseeker's Allowance claiming).

Individual's background and attitudinal response variables were collected by telephone interview and combined with administrative data to develop a number of predictive models using a binary logistic regression (logit) approach. These models estimated individual's probabilities of reaching differing lengths of time unemployed (eg 3 months, 6 months and 12 months continuous JSA claiming) as the dependent variables.

Follow up analysis confirmed which individuals reached these differing milestones allowing the predictive power of the model to be assessed.

Whilst the analysis included a public transport variable, it was a simple binary classification - only whether it is available or not for commuting to work.The model results suggest the following factors as key drivers of unemployment duration:

- Living alone or with a dependent under 18 as opposed to living with a partner or spouse.
- If individual's parents were not in regular paid work during childhood
- If not worked at all in the last two years
- Men more likely than women
- Not having English as a first language
- Not having access to public transport

1.4 Rural Transport Networks
Where step-changes in bus service level provision are advocated (e.g. service withdrawal or contrastingly new dedicated public transport infrastructure) option and non-use values may potentially be relevant – see Laird et al., 2009, for an example of relevance to rail policy. These benefits reflect the values that people who are not actually using a bus service attribute to that service. A barrier to their inclusion however remains a lack of evidence on their size and how they may vary with differing qualities of bus service.

The initial ideas of option and non-use values were introduced in the 1960s by Weisbrod (1964) and Krutilla (1967) respectively. The focus was on environmental economics and in the following years, the 1970s and 1980s, the concern was to strength the theoretical framework of both concepts. It is in the last two decades when the first quantitative studies focused in the transport sector have appeared: Bristow et al. (1991); Crockett (1992); Humphreys and Fowkes (2006); Jackson (20109) and Laird et al (2013) made studies in the British context whilst Painter et al. (2002); Geurs et al. (2006); Chang et al (2012) and Wallis and Wignal (2012) did the same in other countries.

Bristow et al. (1991) were the first in developing a methodology in order to obtain option and non-use values. The authors analysed the impact of the withdrawal of bus services in two areas of Leeds. Crocket (1992) investigated the case of the withdrawal of a Settle-Carlisle rail service. Humphreys and Fowkes (2006) were the first in disaggregating and estimating empirically the components of the total economic value in the Edinburgh-North Berwick rail line. The novelty was the use of a choice experiment in addition to the already used contingent valuation method. Geurs et al. (2006) used choice experiments only in their analysis of two rail services in low and high density areas in Netherlands with the context of changes in frequency and withdrawal of the service.

Jackson (2009) also estimated option and non-use values in three rail lines in the north of England presenting a different approach to disaggregate the total economic value. In addition, the author demonstrated that self-completion surveys can be useful in certain contexts. Chang et al. (2012) focused their analysis in bus services to and from Seoul metropolitan area with the context of change in level of service and withdrawal of it. Wallis and Wignal (2012) investigated option and non-use values in bus and rail services in four semi-rural/peri-urban communities in New Zealand. The context of their analysis was the withdrawal of the existing service or the introduction of a new one.

Despite these studies, the evidence on option and non-use values is still limited for transport appraisal applications. Aside from service withdrawal it is uncertain what values are relevant for other contexts of transport service provision, and for differing degrees of accessibility to opportunities of employment or services. Other evidence gaps relate to catchment areas of stations, the impact of a combined use of modes (i.e. bus and train), new railway links (i.e. high speed rail) and how much of the non-use value double counts use benefits (Laird et al, 2009). In addition to these evidence gaps the only evidence related to UK bus services is more than 20 years old and derives from a small exploratory study (Bristow et al., 1991).

2 REFERENCES

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