



Department  
for Transport

# TAG UNIT A2.3

## Appraisal of Employment Effects

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This TAG Unit is guidance for the **APPRAISAL PRACTITIONER**

This TAG Unit is part of the family **A2 – ECONOMIC IMPACTS**

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# 1 Overview

## 1.1 Introduction

- 1.1.1 The unit provides guidance on how to quantify and value the employment effects of transport investment and their inclusion within transport appraisal as part of the value for money assessment and also for use in other parts of the Transport Business Case in terms of numbers of jobs and GDP. The particular employment effects captured in this unit include labour supply impacts – the movement of individuals between the labour market and economic inactivity; and the move to more/less productive jobs – a change in the spatial distribution of employment.
- 1.1.2 Transport investments can have a broad spectrum of impacts and it is by no means certain that employment will increase at either the local or national level; any employment changes will be context specific. For this reason prior to analysing employment effects, scheme promoters should develop an Economic Narrative, which articulates and justifies the scope of the analysis; this will inform the Appraisal Specification Report (ASR) (see TAG Unit A2.1). The Economic Narrative should contain information on the following: (1) a summary of the expected employment effects and justification of their occurrence on the basis of economic theory and context specific evidence; (2) the associated welfare change (including the identification of any relevant market failures); and (3) the methods to quantify and value the impacts.
- 1.1.3 In line with the principles of HMT Green Book guidance, the Department's appraisal process uses welfare analysis to determine value for money. Under a well-defined set of circumstances user-benefits will capture the entire welfare effects of a transport investment, including employment effects. However, if there are (1) significant feedback effects into the transport market as a result of land use change or (2) 'distortions' or market failures that mean the economy is not functioning efficiently, additional benefits (or disbenefits) will arise as the impact of transport improvements is transmitted into the wider economy.
- 1.1.4 The value for money assessment is based on national welfare impacts. Key to any assessment of employment effects is **displacement** – the extent to which employment effects at the local level represent a movement of jobs from other locations. Changes in jobs at a local level may not represent benefits at a national level.
- 1.1.5 In specific circumstances employment effects may also be valued in terms of changes in Gross Domestic Product (GDP). However, only welfare measures of employment effects, which account for all associated impacts, can be reported in the Economic Case: GDP measures can be reported in the Strategic Case, if they help inform the extent to which a transport scheme will achieve an economic objectives, such as to rebalance the economy or regenerate a specific area.
- 1.1.6 The analysis, which informs the GDP reported in the Strategic Case, should be presented in an Economic Impacts Report alongside the welfare analysis. This is to ensure transparency so that the analysis can be objectively scrutinised.
- 1.1.7 This unit is structured as follows:
- Section 2 "Understanding Employment Effects" explains the mechanisms by which transport schemes can impact on employment and the circumstances in which these impacts may increase welfare over-and-above user benefits;
  - Section 3 "Quantifying and Valuing Employment Effects" provides guidance to value the welfare and GDP effects associated with labour supply impacts and the move to more/less productive jobs; and

- Section 4 “Reporting Employment Effects” provides guidance for reporting the GDP and welfare impacts associated with labour supply impacts in the Strategic and Economic Cases respectively, as well as the information to be included in the Economics Impact Report.

## 2 Understanding Employment Effects

2.1.1 This section outlines the transmission mechanisms through which transport investment can affect employment and how the impacts can be included in a Transport Business Case. The section is structured as follows:

- Section 2.1 explains the transmission mechanisms through which transport investments can affect employment and the concept of displacement;
- Section 2.2 explains how employment effects can be measured in terms of GDP and welfare analysis and where these should be reported in the Transport Business Case; and
- Section 2.3 provides a check list of the types of information which should be presented in the Economic Narrative to justify the analysis of employment effects.

### 2.2 Transmission Mechanisms and Displacement

2.2.1 Employment effects refer to changes in the level and location of employment as a result of a transport investment. Through improving accessibility, as measured by reductions in generalised travel costs, transport investment may induce behavioural changes in terms of firms’ demand for and households’ supply of labour.

2.2.2 An accessibility improvement, as measured by a reduction in generalised travel costs, is equivalent to an increase in the effective return to labour and capital. In the case of changes to the effective return to labour, this may change the supply-side outcomes:

- Better job matching (agglomeration impact) as travel to work areas expand;
- Change to the number of working hours; or
- Reduction in inactivity as people enter the labour market.

2.2.3 In the case of changes to the effective return to capital (profits), this may change firms’ demand for labour:

- Increased demand for labour as firms seek to expand production; or
- Reduced demand for labour as firms strive to achieve cost efficiencies.

2.2.4 There is a broad spectrum of possible demand and supply responses and the precise outcome will be context specific. Understanding these impacts is important – not least – because any changes in the level and location of employment will change the demand for travel. These feedback effects have the potential to change accessibility, as measured by generalised travel costs, and lead to further changes in behaviour and economic activity. An important role of the Economic Narrative is to understand the potential significance of these feedback effects and to consider how these can be represented in the modelling approach – see TAG Unit A2.1 for more details.

#### Displacement

2.2.5 Key to any assessment of employment effects is **displacement**; in other words the extent to which local or sectoral employment changes are additional at the national level, gross and net impacts respectively.

- 2.2.6 In keeping with the HM Treasury Green Book guidance, the economy is assumed to operate at full employment in the long run, such that only transport investments which increase the supply of labour can increase the number of jobs at the national level. In the absence of labour supply impacts, changes in the demand for labour will lead to 100% displacement of employment at the national level; employment would be displaced from other industries or locations. The implications for transport appraisal are as follows:
1. Transport investments which induce changes to the national supply of labour have employment effects at both the local and national levels.
- The extent of the increase in net employment will depend upon the demand response to the increase in the supply of labour.
2. Transport investments which affect the distribution of labour demand, in terms of industry or location, but which do not lead to a change in the national supply of labour can have employment effects in terms of number of jobs at the local but not the national level.
- 2.2.7 Therefore, in order for employment to increase there needs to be a supply response accompanied by a change in demand. If there is no supply response, a change in demand will lead to a full displacement of economic activity.
- 2.2.8 In exceptional circumstances, the local economy may temporarily operate below full employment, which a transport investment could potentially help to relieve. If this is considered to be the case, the scheme promoter needs to provide the following information in the Economic Narrative: (1) present context specific evidence which demonstrates the local economy is operating below full employment; (2) determine the length of time before the economy would be expected to return naturally to full employment; (3) justify why the particular transport investment is expected to reduce unemployment; (4) determine the persistence of the new jobs; (5) explain how these impacts are to be quantified and valued.
- 2.2.9 The construction and operation of transport investments and any associated multiplier effects are assumed to have no net national employment impact, as the opportunity cost of public investment in one scheme is foregone investment in another; this is akin to the 'crowding out' argument.
- 2.2.10 In practice a transport investment is likely to affect the local demand for and supply of labour simultaneously, such that careful analysis is required to disentangle the two effects and determine the net employment impact.
- 2.2.11 The extent to which displacement may occur and not be captured in the analysis of the labour market impacts is likely to be greater, the smaller the study area considered. This is because the analysis will fail to capture the impacts on firms outside of the study area. Thus, the study area should be sufficiently large that it captures behavioural responses – for further information see Variable Demanding Modelling M2.

#### **Productivity improvements from changes in spatial distribution of employment**

- 2.2.12 Even if national employment remains unchanged, changes in the geographical distribution of employment may be associated with other types of national economic impacts, such as productivity changes.
- 2.2.13 Place based effects refers to the productivity impacts, which arise as a result of a location's specific characteristics, such as natural resource endowments and agglomerations. Such effects are external to the firm or individual, in other words they only act upon firms and

individuals in the specific location. Thus, if there is an expansion of employment in areas subject to place based effects and a relocation of jobs towards these areas, there would be an accompanying change in productivity – in other words there would be a move to more/less productive jobs.

- 2.2.14 It is important to note that productivity may not change in response to a relocation of economic activity and in those cases where it does, place based effects may not necessarily be the cause. For example, firms may be subject to people based effects, in which employee characteristics, such as skills, affect productivity. In addition, firms may relocate in order to expand, which may have associated productivity impacts.
- 2.2.15 The guidance on the move to more/less productive jobs tries to isolate place based effects. However, the methodology uses data on local average productivity differentials and does not control for non-placed based effects, such as people based effects and firm level characteristics. For this reason the methodology could lead to misleading results, with the magnitude or direction of the productivity impact erroneous.
- 2.2.16 If the move to more/less productive jobs is considered a significant scheme impact, the expected impact should be identified and justified in the Economic Narrative. Furthermore, if the use of the valuation methodology from this guidance is considered to produce misleading results, this should be explained in the Economic Narrative and an alternative method proposed and justified – see M5.3 for the principles which should be adopted when using Supplementary Economy Models. If a supplementary method is used, the results should be reported alongside those derived using the valuation methodology in this guidance.
- 2.2.17 For the purposes of the Economic Case only the net national employment and productivity impacts should be determined and presented. Whilst changes in the level of local employment may be of interest to inform an economic objective in the Strategic Case, such as the regeneration of a city centre, the value for money assessment in the Economic Case is based on national impacts.

## **2.3 Measuring Employment Effects**

- 2.3.1 The Department's appraisal process is based on the principles of the HMT Green Book guidance, which advocates the use of cost-benefit (welfare) analysis to determine the value for money of investment spend. Welfare analysis captures a broad range of impacts, such as economic, environmental and social. The results of welfare analysis are reported in the Economic Case and inform the value for money assessment.
- 2.3.2 In most cases all of the welfare impacts will be captured by the estimation of user-benefits – see User and Provider Impacts (A1.3). However, if there are (a) significant feedback effects into the transport market as a result of land use change or (b) distortions and market failures that mean the economy is not functioning efficiently, additional benefits may arise when the impact of transport improvements is transmitted into the wider economy. This unit focuses on capturing the additional benefits which arise due to distortions and failures in the labour market – Box 1 sets out some of the key market failures which are relevant to the measurement of Employment effects.

<b>Box 1: Market Failures Affecting the Labour Market</b>
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<b>Taxation:</b> Taxation acts to distort the functioning of the labour market, as it drives a wedge between the value of the output and the remuneration received by employees and
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businesses.

Individuals and businesses make decisions about how much labour to supply and demand on the basis of the private gain, in the form of wages and profits respectively. However, the imposition of taxation distorts actual demand and supply of labour, thereby affecting the labour market equilibrium. As the tax revenue, associated with changes in the labour market, is external to employees' and businesses' decision-making process, it represents a source of welfare, additional to that captured by user-benefits.

**Frictional Unemployment:** One of the imperfections in the operation of the labour market is related to time; individuals do not instantaneously find jobs upon entering the labour market or leaving previous employers, such that there is a time search element to unemployment. The length of time required to find a job is likely to be lower in thicker labour markets. This type of market failure can be associated with agglomeration impacts; agglomeration impacts capture the effect of thick labour market – see TAG Unit A2.4.

**Wage Rigidities:** Markets are often characterised by sticky prices, in which the market price does not equate supply and demand in the short term, such that there is excess demand or supply for labour. In the case of excess supply of labour, this is referred to as structural unemployment. Transport investment could potentially help the labour market achieve a more efficient outcome, if it enables labour to commute to other locations, in which there is a relative shortage of supply, or induce firms to hire more labour.

**Monopsony Buyers:** The local labour market is dominated by a single employer, who, because of his dominant position, can artificially hold the wage rate below the market clearing price, such that employment is below the competitive market outcome. A transport investment could potentially help the labour market achieve a more efficient outcome, by increasing competition in the labour market, either by enabling labour to commute to other locations or attracting firms to the local area. This type of market failure is likely to be most relevant for low skilled employment and remote areas and less so for mobile workers.

- 2.3.3 Section 3 of this unit outlines methods to estimate the welfare effects associated with a particular type of distortion in the labour market – taxation. Where other market failures are relevant to a particular transport improvement, these should be justified in the Economic Narrative. See M5.3 Supplementary Economy Models for guidance on the analytical principles for assessing market failures.
- 2.3.4 In certain circumstances GDP analysis may be used to supplement the cost benefit analysis, such as scheme prioritisation or understanding market failures not captured in the Wider Economic Impacts guidance. For full details on assessing the costs and benefits of economic impacts and the circumstances in which GDP analysis may be warranted see TAG Unit A2.1.
- 2.3.5 Gross Domestic Product measures the value of marketable output produced by the factors of production and not the change in welfare. For this reason it should **not** be reported in the Economic Case. GDP estimates should be reported in the Strategic Case, if they inform specific economic objectives, such as to rebalance the economy or regenerate a local area.
- 2.3.6 In many instances the economic objectives of the Strategic Case will be locally focussed, such as to increase employment and GDP in a regeneration area. In such circumstances displacement may not be a primary concern of the scheme objectives. However, the net national employment and GDP impacts should also be presented. This ensures there is a direct read across from the national welfare measure in the Economic Case to the employment effects and GDP measure reported in the Strategic Case.

## 2.4 Economic Narrative

- 2.4.1 Any analysis of employment effects should be justified in an Economic Narrative, as set out in section 3 of TAG Unit A2.1. Within the Economic Narrative, the scheme promoter should describe what, if any, employment effects are expected to occur and justify these. Furthermore, the scheme promoter should identify the welfare impacts associated with any employment effects, whether these impacts are captured fully by user-benefits or whether there are market failures, which provide additional sources of benefits or disbenefits. Finally, the Economic Narrative should outline the methodologies which will be utilised to quantify and value the employment impacts. Box 2 provides a checklist of the types of information, which should be provided in the Economic Narrative, when assessing employment effects.

### Box 2: Example Information required in Economic Narrative for Employment Effects

Below is a checklist of the types of information that should be presented in the Economic Narrative, if employment effects are to be analysed. **This list is not exhaustive** and additional information may be required to set the context of the transport investment, justify the impacts and explain the appraisal approach.

#### 1. Expected Employment effects

- Is the transport investment expected to have employment effects?
- If so, what effects are expected to occur?
  - Are these expected to be additional at the national level?

#### 2. Justify expected employment effects

- What is the transmission mechanism through which transport investment is expected to have employment effects?
  - What evidence is there that transport acts as a barrier to employment?
- What evidence is there that firms will hire additional labour as a result of the transport investment?
- What evidence is there that those expected to enter employment have the skills required by firms?
- If jobs are expected to be relocated, what evidence is there that there could be a productivity impact?

#### 3. Social Value of employment

- Are the expected employment effects fully captured by user-benefits?
- Are there any market failures present, such that there may be sources of social value additional to user-benefits?
  - If so, what market failures are present?
  - What evidence can be brought to bear to demonstrate the presence of market failures?

#### 4. Quantifying and Valuing Employment Effects

- How are the employment effects to be quantified and valued?

- 2.4.2 The next section of this unit provides guidance to estimate two potential employment effects: labour supply impacts – where individuals enter employment from economic inactivity; and the move to more/less productive jobs – the impacts of employment relocation on productivity. In addition, it provides guidance to measure the change in Gross Domestic Product and the associated welfare impacts arising from tax externalities.

- 2.4.3 If alternative transmission mechanisms or market failures have been identified, or it is decided to utilise more context specific parameters in the analysis than those presented in this unit, these should be justified in the Economic Narrative – see TAG Unit M5.3 for guidance on the use of Supplementary Economic Modelling (SEM). Note the results of SEM can only be reported as sensitivity tests to the WebTAG methodologies – see TAG Unit A2.1 for more information.

### **3 Quantifying and Valuing Employment Effects**

- 3.1.1 This section provides guidance for valuing the benefits associated with labour supply impacts and the movement to more productive jobs over-and-above user benefits.
- 3.1.2 The term ‘labour supply impacts’ describes the mechanisms by which the level of national employment is affected by a transport scheme; transport investment may induce individuals who are economically inactive to enter the labour market by affecting the effective return to labour. This impact may be relevant for all transport schemes, not just the very largest projects. Any assessment of this should be justified in the Economic Narrative, through the presentation of evidence which demonstrates local transport acts as a barrier to employment.
- 3.1.3 The term ‘move to more/less productive jobs’ describes the mechanism by which the location of employment and hence productivity is affected by a transport scheme; transport investment may induce a relocation of employment by affecting the effective returns to labour and firms. Any assessment of this should be justified in the Economic Narrative.
- 3.1.4 The methodologies to quantify and value employment effects utilise several simplifying assumptions (these are outlined in sections 3.2 and 3.3), such as perfectly elastic demand for labour. Within the Economic Narrative, scheme promoters should assess the appropriateness of these assumptions. If more context specific assumptions are deemed desirable, the reason for this should be explained and an alternative method proposed and justified – see TAG unit M5.3 for the principles which should be adopted when using supplementary economy models. The results of the supplementary method should be presented alongside those derived using the valuation methodology in this guidance.
- 3.1.5 Employment effects should be interpolated between modelled years in the same ways as other benefits. After the final modelled year, the tax wedges on labour supply impacts and the move to more/less productive jobs impacts should be grown by the non-work value of time.
- 3.1.6 Both the move to more/less productive jobs and labour supply impacts are associated with dynamic clustering, as they directly affect the physical density of clusters via changes in the location and level of economic activity respectively. Only labour supply impacts have an unambiguous positive relationship with dynamic clustering; an increase in jobs at the national level will raise productivity and vice versa. In the case of the move to more/less productive jobs, where economic activity and employment are displaced, the relationship with dynamic clustering will be context specific; it could be positive or negative. See TAG Unit A2.4 for further information on dynamic clustering.
- 3.1.7 This section demonstrates how changes in employment resulting from transport investment may be forecast and the impact of this change on economic activity, measured as the change in GDP. The welfare associated with this change in output, which is additional to user benefits, may then be estimated. This section is structured as follows:
- Section 3.2 sets out the methodology and key assumptions to quantify and value the labour supply Impacts in terms of changes in employment, GDP and welfare.

- Section 3.3 sets out the methodology and key assumptions to quantify and value the move to more/less productive jobs in terms of changes in employment location, GDP and welfare.

## 3.2 Quantifying and Valuing Labour Supply Impacts

- 3.2.1 Increases in the supply of labour arise from individuals moving into the labour market from economic inactivity. This sub-section provides guidance to forecast employment changes and estimate the associated welfare and GDP impacts.
- 3.2.2 Labour supply impacts imply land use change and for most schemes it would be disproportionate to quantify the land use change, as the labour supply impacts will be small relative to the overall benefits of the transport investment. For this reason the methodology outlined below focusses on how labour supply impacts should be quantified and valued, without explicitly quantifying land use change.
- 3.2.3 However, if the labour supply impacts are significant, the associated land use change and feedback effects into the transport market should be reflected in the analysis; this moves the analysis to Level 3 – sensitivity test with explicit land use change. TAG Unit A2.1 provides guidance on constructing sensitivity tests and the impacts which should be quantified and valued, such as Transport External Costs (TECs). For guidance on quantifying land use change see TAG Unit M5.3.

### Quantify jobs

- 3.2.4 As stated in section 2, it should be assumed as a starting point that transport schemes are not able to increase net national employment. As a consequence, to demonstrate labour supply effects are significant it's necessary to provide context-specific evidence that insufficient transport accessibility is a local barrier to people entering the labour market and hence employment. If this can be demonstrated, the equations below can be used to estimate the costs associated with commuting in areas where travel costs are anticipated to be affected by the transport scheme.
- 3.2.5 Equations 1 and 2 estimate generalised travel costs and commuting costs for journeys between the relevant areas for different modes. Equation 3 estimates the total labour supply impact across the areas where costs of travel are expected to change as a result of the transport scheme. The estimation of a positive labour supply impact anticipates the expected increase in jobs from people entering work who would otherwise be inactive due to high commuting costs.
- 3.2.6 There are a number of assumptions underlying the methodology for estimating labour supply impacts:
- First, it is assumed that demand for labour is perfectly elastic across the area under consideration when estimating labour supply impacts; in other words employers are willing and able to absorb an increase in the supply of labour at the prevailing wage rate. This simplifying assumption is utilised due to a lack of evidence on the reaction of firms and wages to changes in labour supply.
  - Second, it is assumed people make decisions about whether to work on the basis of their net wages; the net wage accounts for employment taxes, such as income tax and national insurance contributions. The elasticity of labour supply with respect to net wages, utilised in equation 3, is an estimate of the strength of this response and is equal to 0.1.<sup>1</sup>
  - Third, it is assumed reductions in the generalised cost of commuting increase the effective net wage and vice versa.

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<sup>1</sup> Estimate based on DWP calculations and wider literature review.

**Equation 1 Average Round-trip Commuting Cost**

$$G_{i,j}^{S,f} = \frac{\sum_m (g_{i,j}^{S,m,f} + g_{j,i}^{S,m,c,f}) T_{i,j}^{S,m,f}}{\sum_m T_{i,j}^{S,m,f}}$$

**Equation 2 Labour Supply/Employment Impact**

$$E^f = \sum_i \sum_j \left[ -\varepsilon^{LS} \left( \frac{(G_{i,j}^{A,f} - G_{i,j}^{B,f}) \Omega_j^{S,f}}{(1 - \tau_1) y_j^f} \right) W_{i,j}^{S,f} \right]$$

$g_{i,j}^{S,m,f}$	is the generalised cost of commuting from area $i$ and area $j$ , under scenario $S$ , by mode $m$ , and for forecast year $f$ .
$T_{i,j}^{S,m,f}$	is the annualised number of commuting trips from area $i$ to area $j$ , under scenario $S$ , by mode $m$ . This will vary depending on the forecast year $f$ , to the extent that it varies in the modelling of transport (TEE) user impacts.
$G_{i,j}^{S,f}$	is the average round-trip generalised cost of commuting from area $i$ to area $j$ , under scenario $S$ , for purpose of commuting $c$ . These costs will vary depending on the forecast year $f$ .
$E^f$	is the labour supply impact, and assuming demand for labour is perfectly elastic, this will be equal to the employment impact of the transport scheme. This impact may vary depending on the forecast year $f$ .
$\varepsilon^{LS}$	is the elasticity of labour supply with respect to effective wages (net of taxes and other transport costs) and is equal to 0.1. This will not vary depending on the forecast year.
$G_{i,j}^{A,f}$	is the average round-trip generalised cost of commuting from area $i$ to area $j$ , under the alternative scenario $A$ . $G_{i,j}^{A,B,f}$ is the cost of commuting under base scenario $B$ .
$\Omega_j^{S,f}$	is the average annual number of round-trip commuting journeys per worker employed in area $j$ in a year, which may vary by forecast year.
$\tau_1$	is the average tax take required to convert gross earnings $y_j^f$ into net earnings, with which the change in commuting costs can be appropriately compared. It is estimated to be equal to 30%. <sup>2</sup> This will not vary depending on the forecast year.
$y_j^f$	is the average annual gross income/pay for workers in area $j$ , for forecast year $f$ .
$W_{i,j}^{S,f}$	is the number of workers living in area $i$ and employed in area $j$ , under scenario $S$ , for forecast year $f$ .

**Valuing Jobs**

- 3.2.7 The valuation of the labour supply impacts resulting from a scheme can be calculated in terms of GDP impacts from equation 4 below. The welfare impacts over and above user benefits are equivalent to the benefits to the exchequer. These are the tax revenues resulting from labour supply impacts and can be estimated as 40% of the resultant change in GDP. This tax revenue impact is calculated below in equation 5. This reflects both the

<sup>2</sup> Based on average tax revenue from income tax, NICs, corporation tax and mixed income. For converting gross to net wages, only the tax on existing jobs is taken into account.

increase in tax revenue (income tax, national insurance contributions and corporation tax) and the reduction in out of work subsidies.

- 3.2.8 The tax revenue is associated with a welfare change because the presence of taxation distorts the labour and capital markets – see Box 1 for more information.<sup>3</sup>
- 3.2.9 There are a number of assumptions underlying the methodology for valuing labour supply impacts:

- First, the output change associated with employment impact is valued by GDP per worker.

When quantifying employment changes, neither the extent of the labour demand change nor the transmission mechanism are modelled. However, in reality firms' labour demand will be a function of the return to capital. Thus employment changes will be associated with wage and profit changes. For this reason the labour supply impacts are valued using GDP per worker.

- Second, the productivity of workers on the margin of the labour force is lower than that of the average worker. This is reflected in equation 4 by parameter  $\eta$ , which is a fraction of the average GDP per worker.
- Third, we do not value the private benefits of those entering employment and their employers, in other words the associated user-benefits equal zero.

Using this method, the number of people entering the labour market are not, by default, represented in the transport model. Those entering employment, and their employers, are implicitly assigned no private benefits. In other words, their associated user benefits are equal to zero. This assumption also implies that the impacts of these new transport users do not significantly impact existing transport users, non transport markets and the environment. This method is appropriate where it can be demonstrated that associated land use change is not significant.

Where significant numbers of people are likely to be entering employment and there is an associated land use change, this should be identified in the Economic Narrative and the an appropriate method should be identified to understand and value these impacts (see overview).

- Fourth, the welfare change associated with labour supply impacts is equal to the change in tax revenue.

### Equation 3 GDP Impact

$$GDP^f = \sum_i \sum_j \left[ -\varepsilon^{LS} \left( \frac{(G_{i,j}^{A,f} - G_{i,j}^{B,f}) \Omega_j^{S,f}}{(1 - \tau_1) y_j^f} \right) W_{i,j}^{S,f} \eta GDP W_j^{S,f} \right]$$

$GDP^f$

is the market value of output associated with the change in the level of employment for the forecast year.

<sup>3</sup> OECD Tax Policy Studies (2010), 'Tax Policy Reform and Economic Growth'  
[http://www.oecd-ilibrary.org/taxation/tax-policy-reform-and-economic-growth\\_9789264091085-en](http://www.oecd-ilibrary.org/taxation/tax-policy-reform-and-economic-growth_9789264091085-en)

$\varepsilon^{LS}$	is the elasticity of labour supply with respect to effective wages (net of taxes and other transport costs). This will not vary depending on the forecast year.
$G_{i,j}^{A,f}$	is the average round-trip generalised cost of commuting from area $i$ to area $j$ , under the alternative scenario $A$ , for purpose of commuting $c$ .
$\Omega_j^{S,f}$	is the average annual number of round-trip commuting journeys per worker employed in area $j$ in a year, which may vary by forecast year.
$\tau_1$	is the average tax take required to convert gross earnings $y_j^f$ into net earnings, with which the change in commuting costs can be appropriately compared. It is estimated to be equal to 30%. <sup>4</sup> This will not vary depending on the forecast year.
$y_j^f$	is the average annual gross income/pay for workers in area $j$ , for forecast year $f$ .
$W_{i,j}^{S,f}$	is the number of workers living in area $i$ and employed in area $j$ , under scenario $S$ , for forecast year $f$ .
$\eta$	is the parameter capturing the lower productivity of the marginal worker. Currently it is calculated as the fraction of 0.69 of the average GDP per worker. <sup>5</sup>
$GDPW_j^{S,f}$	is the GDP per worker of the average worker in employment in area $j$ , under scenario $S$ , for forecast year $f$ .
<b>Equation 4 Wider Impacts – Tax Wedge</b>	
$WI1^f = \tau_2 GDP^f$	
$WI1^f$	is the welfare associated with labour supply impacts and will vary depending on the forecast year.
$\tau_2$	is the tax wedge on the labour supply impact, currently estimated to be equal to 40%. <sup>6</sup> The tax take will not vary depending on forecast year.

### Checklist for appraising labour supply impacts

3.2.10 The table below provides a checklist of the key evidence requirements when appraising labour supply impacts.

<b>Table 1 Checklist for appraising labour supply impacts</b>	
<b>Issues</b>	<b>Check</b>
Provide context-specific evidence that insufficient transport accessibility is a barrier to people entering employment	
Estimate change in GTC resulting from transport scheme	
Estimate change in jobs and GDP resulting from transport scheme	
Estimate tax wedge associated with increased GDP	

3.2.11 Having quantified and valued the labour supply impacts resulting from a transport investment these impacts should be reported appropriately – see section 4 for information on documenting analysis and reporting results within the Transport Business Case.

<sup>4</sup> Based on average tax revenue from income tax, NICs, corporation tax and mixed income. For converting gross to net wages, only the tax on existing jobs is taken into account.

<sup>5</sup> Based on evidence from Table 3.6 in Gregg, P., Johnson, P. and Reed, H. (1999) Entering Work and the British Tax System, Institute for Fiscal Studies, London

<sup>6</sup> Estimated tax take of GDP changes from increase land market participation. This incorporates average income effects of new workers, operating surplus and lost unemployment benefits.

### 3.3 Quantifying and Valuing the Move to More/Less Productive Jobs

- 3.3.1 The move to more/less productive jobs arises from the relocation of employment and the spatial inequality of productivity (*place-based effects*). This sub-section provides guidance to forecast employment changes and estimate the GDP and welfare associated with any productivity changes.
- 3.3.2 As noted in paragraph 2.2.12 even in instances of 100% displacement, in which economic activity relocates, such that one area gains at another's expense, there may still be a net national productivity impact and change in welfare, as a result of place based effects. The methodology presented in this sub-section explicitly takes account of displacement in the estimation of the productivity impact and welfare change:
- Quantification – there is no employment increase, the increase in jobs in any one area must be matched by an equivalent reduction in other areas; and
  - Valuation – only the output change as a result of productivity impacts is estimated. This is done through the application of productivity differentials (equation 5).
- 3.3.3 Care should be taken when valuing the productivity impacts, as the productivity differentials could potentially lead to misleading results (see paragraphs 2.2.15 for more details). If the use of the valuation methodology from this guidance is considered to produce misleading results, this should be explained in the Economic Narrative and an alternative method proposed and justified – see M5.3 for the principles which should be adopted when using Supplementary Economy Models. If a supplementary method is used, the results should be reported as a sensitivity test to those derived using the valuation methodology in this guidance.
- 3.3.4 Dynamic Clustering (TAG Unit 2.4) is related to the move to more/less productive Jobs, as the relocation of employment can affect the physical density of clusters. However, for both impacts to be included in the analysis they should be individually identified and justified in the Economic Narrative.

#### Quantifying the Move to More/Less Productive Jobs

- 3.3.5 The relocation of employment can be quantified either (a) using scenarios about how firms and households are likely to respond to the transport improvement or (b) using a land-use model to forecast how the transport scheme would impact firms and households. Any scenarios should be evidence based with the treatment of displacement made clear and consistent with the appraisal of dynamic clustering impacts.
- 3.3.6 To ensure consistency between the forecast generalised travel costs and the location of employment, there should be an interaction between the methodology to forecast land use change and the transport model. In other words the outputs from the transport model should be used to forecast the land use change, and the subsequent land use forecast should serve as a further input to the transport model. In this manner employment locations are informed by generalised travel costs and the generalised travel costs by employment locations.
- 3.3.7 If dynamic clustering has also been identified as a potential impact of the transport investment in the Economic Narrative, this should be estimated using the same forecast of employment relocation as for the move to more/less productive jobs.

#### Valuing the Move to More/Less Productive Jobs

- 3.3.8 The valuation of the move to more/less productive jobs resulting from a scheme can be calculated in terms of GDP impacts from equations 5 below. The associated welfare

change, which is additional to user benefits, is equivalent to the benefits to the exchequer. These are the tax revenues resulting from changes in productivity and can be estimated as 30% of the resultant change in GDP. This tax revenue impact is calculated below in equation 6. This reflects the increase in tax revenue (income tax, national insurance contributions and corporation tax).

3.3.9 There are a number of assumptions underlying the methodology for valuing the move to more/less productive jobs:

- First, the productivity change is a function of the average productivity differential of each area, gaining and shedding employment, from the national average.
- Second, the output change associated with changes in productivity is valued by GDP per worker, which implies a change in the return to labour and capital.

The geographical distribution of demand and supply of labour will be a function of profits and wages respectively. Thus productivity changes, which result from the relocation of employment, will be associated with wage and profit changes. For this reason the move to more/less productive jobs are valued using GDP per worker.

- Third, private benefits to employees and employers who are relocating to more productive jobs are captured by change transport user benefits. However the method for valuing move to more/less productive jobs implies land use change. Where there are significant feedback effects from land use change the methodology to value user-benefits, rule of a half, breaks down. While the evidence base needs to be developed further, the estimation of user-benefits with fixed land use may provide a reasonable proxy for user-benefits with variable land use, capturing the welfare effects of most changes in the transport market.
- Fourth, the welfare change associated with the move to more/less productive jobs is equal to the change in tax revenue.

Equation 5 GDP Impact	
$GDP^{A,f} = GDPW^{B,f} \sum (E_i^{A,f} - E_i^{B,f})PI_i$	
$E_i^S$	is the total employment for each area $i$ in the base $B$ and alternative $A$ case.
$PI_i$	is the zonal productivity differential per worker in each area $i$ . Technological progress is assumed constant so this will not vary by forecast year.
$GDP^{A,f}$	Is the movement to more/less productive jobs impact of the alternative case (A) compared with the base (B), to be calculated. This will vary depending on the forecast year $f$ .
$GDPW^{B,f}$	is the national average GDP per worker in the base case $B$ . This will vary depending on the forecast year $f$ , is taken from the <a href="#">Wider Impacts Dataset</a> .
Equation 6 Wider Impacts – Tax Revenue	

$WI2^f = \tau_1 GDP^{A,f}$	
$WI2^f$	is the welfare associated with the move to more/less productive jobs and will vary depending on the forecast year $f$ .
$\tau_1$	Is the tax take on the move to more/less productive jobs, currently estimated to be equal to 30%. <sup>7</sup> The tax take will not vary depending on forecast year.

### Checklist for appraising the Move to More/Less Productive Jobs

3.3.10 The table below provides a checklist of the key evidence requirements when appraising the move to more/less productive jobs.

Table 1 Checklist for appraising the move to more/less productive jobs	
Issues	Check
Provide context-specific evidence that a change in transport accessibility will lead to a relocation of economic activity	
Estimate change in GTC resulting from transport scheme	
Estimate relocation of jobs and change in productivity resulting from transport scheme	
Estimate tax wedge associated with increased GDP	

3.3.11 Having quantified and valued the move to more/less productive jobs resulting from a transport investment these impacts should be reported appropriately – see section 4 for information on documenting analysis and reporting results within the Transport Business Case.

## 4 Reporting Employment Effects

- 4.1.1 This section provides guidance on how employment effects should be reported in both the Economic and Strategic Cases of the Transport Business Case.
- 4.1.2 The purpose of the Transport Business Case is to aid the decision making process by presenting the robust evidence of the potential impacts of a transport scheme. Thus where the expectation of employment effects can be justified and credible analysis brought, these should be reported.
- 4.1.3 Where precisely the employment effects are reported in the Transport Business Case depends on the measurement approach. Only welfare analysis can be reported in the Economic Case, whilst GDP can be reported in the Strategic Case.
- 4.1.4 Note: whilst GDP and welfare analysis are reported in different parts of the business case, they both measure a common economic impact. As such there should be a common forecast of national employment effects underpinning the welfare and GDP analysis.

<sup>7</sup> Estimated tax take of GDP changes from existing workers becoming more/less productive and hence attracting a marginal income tax as well as an increased operating surplus.

## 4.2 Economic Case

- 4.2.1 The Economic Case sets out evidence to inform whether a scheme offers value for money to the taxpayer. This includes setting out quantitative and qualitative evidence for a scheme's impact on social welfare (including impacts on the economy, environment and society) and the cost of the scheme to the broad transport budget. All the costs and benefits of a scheme should be assessed at the national level, which for DfT-funded investments means the United Kingdom.

### Labour Supply Impacts

- 4.2.2 The welfare associated with labour supply impacts, the methodology set out in section 3.2, should be reported in the adjusted BCR and not the initial BCR. This is because the evidence base is less widely-accepted than other parts of the appraisal. Note if there are significant labour supply impacts and the land use change has been quantified, the welfare effects should be reported as a sensitivity test.
- 4.2.3 In considering the use of the methodology it is important to consider how well the following assumptions fit with the evidence presented in the Economic Narrative: (a) the relationship between changes in generalised travel costs and national employment, specifically the response of economically inactive individuals and firms; and (b) the productivity of the entrant workers.
- 4.2.4 In addition, the number of individuals forecast to enter employment from economic inactivity, as a result of the transport scheme, should be reported in the Economic Case alongside the associated welfare effect.

### Move to More/Less Productive Jobs

- 4.2.5 The welfare associated with the move to more/less productive jobs, the methodology set out in section 3.3, should only be reported as a sensitivity test in the value for money assessment and not in the adjusted or initial BCR.
- 4.2.6 In deciding what weight to place on estimates associated with the move to more/less productive jobs it will be important to consider whether: (1) the methodologies to forecast land use change are subject to high levels of uncertainty (e.g. land use models tend not to be validated against outturn data), such that their accuracy is typically unknown; and (2) the valuation methodology, which estimates the productivity change, is sufficiently context specific.

## 4.3 Strategic Case

- 4.3.1 The purpose of the Strategic Case is to determine whether a proposed transport scheme achieves Government objectives, such as to regenerate a local area or reduce noise pollution. It is here that non-welfare measures of economic impacts, such as GDP, can be reported, if they inform the extent to which the proposed transport scheme achieves the Government's objectives; in the case of labour supply impacts and the move to more/less productive jobs, the methodologies contained in the guidance can be used to estimate GDP. In the case of labour supply impacts and the move to more/less productive jobs the welfare estimate is equivalent to 40% and 30% of GDP change, and the latter may be reported here.
- 4.3.2 If reporting economic impacts in the Strategic Case, the following principles should be adopted:

- 1. Use appropriate metric to inform Strategic Case. This may differ from Economic Case, which must be welfare based.**

Within the Economic Case welfare is the metric used to value economic impacts. This serves a specific purpose to inform the value for money assessment. In the Strategic Case, however, an economic objective may be better informed by other metrics, such as change in GDP. For example, an economic objective to boost economic activity in a regeneration area may be best informed by the change in GDP and growth of employment. Any reported GDP figure should be a net present value and in the same price base as the welfare estimate.

- 2. Analysis should be consistent with that in the Economic Case.**

The Strategic Case scenarios should be the same as those in the Economic Case in terms of the magnitude, nature and location of economic impacts and the assumptions underpinning the analysis, such as population, employment and workforce skills.

- 3. The core scenario of economic impacts should use the WebTAG methodologies.**

The core estimate of economic impacts in the Strategic and Economic Cases should use the WebTAG methodologies set out in User and Provider Benefits (A1.3) and Wider Economic Impacts (A2). TAG Unit A2.1 outlines how the GDP change can be derived from the welfare estimates.

- 4. Sensitivity tests of economic impacts should only be reported in the Strategic Case if the associated welfare effects have been reported in the Economic Case.**

Under no circumstances should sensitivity tests be reported in the Strategic Case, if there is no corresponding welfare estimate in the Economic Case; there should be an analytical “bridge” between the Strategic and Economic Cases, which explains the relationship between the welfare and alternative metrics to value the economic impacts.

- 5. Local economic impacts should only be reported alongside the corresponding national impact.**

The economic objective may be locally focussed, such as the regeneration of a local area. In this instance, it would be appropriate to report local impacts. Nevertheless, the corresponding national impacts should be reported alongside to aid transparency: reporting the national and local economic impacts together clarifies the extent of the assumed relocation (displacement) of economic activity.

## **4.4 Economic Impacts Report**

4.4.1 All of the analysis and evidence base underpinning the forecast of employment effects and the estimation of GDP and welfare analysis should be reported in an Economic Impacts Report – see TAG Unit A2.1 for information on producing an Economic Impacts Report.

4.4.2 The Economic Impacts Report is designed to improve the transparency of analysis, in order that it can be objectively scrutinised. To this end, the analysis should be set out in a clear manner such that someone could replicate the results reported in the Strategic and

Economic Cases. This includes setting out the evidence base, including any assumptions, together with the analytical approach.

- 4.4.3 It is recommended that results are reported in tables and differences should be explained:
- (a) If local GDP has been estimated it should be reported alongside national GDP
  - (b) National GDP estimates should be reported alongside the corresponding WebTAG welfare estimates
  - (c) Where sensitivity tests have been conducted, welfare estimates should be reported alongside the welfare estimates in the core scenario welfare estimate.
  - (d) Where SEM models have been used, national GDP and corresponding welfare estimates derived from the same model should be reported
- 4.4.4 If the methodologies contained within this unit have been employed, the EIR should be light touch. However, any departures from these, such as the use of alternative assumptions or analytical approaches, will be more information intensive and require a full account and justification.
- 4.4.5 In the case of the move to more/less productive jobs, land use change must be forecast. The methodology together with the key parameters and the underlying evidence base should be reported – see TAG Unit M5.3 for guidance on the information to be reported.
- 4.4.6 Any departures from the methodologies in this unit, such as the use of alternative assumptions or analytical approaches, will be more information intensive and require a full account and justification – see TAG Unit M5.3 for guidance on the information to be reported.

## 5 References

Gregg, P., Johnson, P. and Reed, H. (1999) *Entering Work and the British Tax System*, Institute for Fiscal Studies, London

OECD Tax Policy Studies (2010), 'Tax Policy Reform and Economic Growth'