Productivity and Wider Economic Impact Study

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Prepared for
Peninsula Rail Task Force

Prepared by
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EXECUTIVE SUMMARY

The Peninsula Rail Task Force (“the Task Force”) was formed to argue the case for additional investment in the peninsula’s rail network to provide improved connectivity and access to London and other major conurbations.

Given that one of the key measures of economic performance is productivity, the Task Force commissioned Parsons Brinckerhoff to review productivity data across the South West Peninsula as well as comparing this with data from other parts of the United Kingdom (UK). In addition, the work undertaken by the University of the West of England (UWE) and partners in 2005 on the linkages between connectivity and productivity was also reviewed.

Other more recent approaches were also taken into account, including DfT’s guidance on “Wider Impacts” (focussing on agglomeration impacts) and the research work undertaken on the regional economic impacts of journey time improvements from HS2.

Taking the most recently available data from ONS, the picture is stark in terms of how productivity across the Peninsula lags behind that across the UK whilst also comparing poorly with the wider South West region. This is shown in the figure below.

**Workplace-based GVA per head in the South West Peninsula**

![Data Source: Workplace based GVA per head (NUTS3) at current basic prices, ONS (2012 data)](image)

The data is also important as it shows how the most peripheral areas such as those in Cornwall have considerably lower levels of productivity (Cornwall and the Isles of Scilly being the second lowest ranking sub-region across the whole of the UK).

The decreasing levels of productivity across the South West are matched by increasing rail journey times with locations west of Exeter experiencing significantly increased travel time given the characteristics of the route and infrastructure.

The data shows that even Somerset, with its relatively good rail connectivity, has productivity levels lower than the South West average. In Devon, despite comparatively high levels of economic activity in Exeter and Plymouth, is the ninth worst performing region in terms of productivity (out of 37 ‘NUTS2’ regions in the UK).
In addition, trend data shows that for several areas in the Peninsula, productivity as a proportion of the national average has been in decline in recent years. For Devon and Torbay, for example, this proportion has been falling since 2010. These trends will continue if no action is taken to address the region’s peripherality.

The 2005 research by UWE remains one of the most powerful pieces of work in this field. Its use of a vast database of individual company information enabled a robust relationship between journey time from London and productivity to be established. In broad terms, for every additional 100 minutes travel time from London, productivity decreases by 6%.

Given that increased productivity will generate a number of economic benefits, a series of indicative impact assessments were undertaken (based on different journey time improvement scenarios).

### Summary of Impacts per Journey Time Improvement Scenario

<table>
<thead>
<tr>
<th>Journey Time Improvement Scenario</th>
<th>Total GVA impact across South West Peninsula</th>
<th>Total FTEs generated</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 minutes</td>
<td>£300,000,000</td>
<td>1,500</td>
</tr>
<tr>
<td>30 minutes</td>
<td>£600,000,000</td>
<td>3,000</td>
</tr>
<tr>
<td>45 minutes</td>
<td>£900,000,000</td>
<td>4,500</td>
</tr>
<tr>
<td>60 minutes</td>
<td>£1,200,000,000</td>
<td>6,000</td>
</tr>
</tbody>
</table>

Research undertaken on the regional economic impacts of HS2 has also shown that connectivity improvements will help support increases in productivity. A series of ‘elasticities’ were developed showing the proportionate increases in productivity based on proportionate increases in connectivity through improved journey times.

The DfT’s WebTAG appraisal guidance has been developed in recent years to include the impacts of improved agglomeration, the technical term given to the density of economic activity in a particular area. Productivity is a fundamental part of agglomeration given that improved connectivity and accessibility (through faster journey times) enhances workers’ access to job markets and vice markets. By improving the linkages between workers and jobs, enhanced productivity will result as firms will be able to draw upon a much wider skillset in the labour market. The analysis undertaken for this study has therefore shown that the journey time improvements will give rise to agglomeration benefits.

As well as these technical evaluations of productivity improvements, extensive survey work undertaken across various businesses in the South West has shown that the perception of the region’s peripherality is another factor having an adverse impact on business investment and hence productivity levels. As well as actual connectivity, the proposed rail journey time improvements will also therefore improve the crucial perceptions of the region’s connectivity.

Unless action is taken to address the region’s relative peripherality, the long rail journey times from London into the Peninsula will continue to exacerbate this peripherality whilst infrastructure improvements will greatly assist the region’s economic connectivity and potential.

Improved rail infrastructure and the resulting improved journey times will help support additional employment in the region and by helping to reduce the ‘productivity gap’ between sub-regions in the Peninsula and other parts of the UK.

With the Peninsula continuing to be one of the most peripheral areas in the country (and experiencing the consequences of this on economic activity), improved access and connectivity will be a major factor in the regeneration of the region.
INTRODUCTION

1.1 Background to the Study

1.1.1 The Peninsula Rail Task Force (“the Task Force”) was formed to argue the case for additional investment in the peninsula’s rail network to provide improved connectivity and access to London and other major conurbations, and to its major regional centres, which are experiencing high levels of population growth.

1.1.2 The Task Force is concerned that despite the South West Peninsula having a larger economy than Merseyside, Sheffield, South Wales or Greater Bristol, investment in the region’s transport networks has not kept pace.

1.1.3 To demonstrate this, Government investment in the South West’s transport infrastructure is the lowest of any region in the UK (at £182 per head compared to £545 in London and is just £41 per head for the rail sector in the South West). In addition, the increasing disruption and frequency of severe weather incidents has exposed this under-investment and highlighted the fragility of the Peninsula’s rail links with the rest of the UK.

1.1.4 Although passengers number across the Peninsula have increased by 123% in the last decade (twice the national average), there are no significant enhancements to the rail network planned by Network Rail in the region over the next five years.

1.1.5 As this study demonstrates, the Peninsula’s economy is also severely disadvantaged through a ‘productivity gap’ whereby economic output per head (or per hour worked) lags behind that in other parts of the country.

1.1.6 As there is a link between low levels of productivity and poor connectivity to major urban areas, including London, the Task Force is therefore seeking to improve connectivity (and hence productivity) through faster rail journey times to / from the Peninsula. This fits in well with the ‘three point plan’ developed by the Peninsula covering the following objectives:

- “Resilient and reliable”;
- “With faster journey times, and better connectivity”; and
- “Sufficient capacity and comfort”.

1.1.7 The journey time improvements are crucial as they will enable greater connectivity to national and international markets, create opportunity and foster ambition, boosting growth from areas of overheating and thus enabling the Peninsula to reach its full potential.

1.2 Background to the Task Force

1.2.1 The Task Force brings together the public and private sector in the region including: Somerset County Council, Devon County Council, Torbay Council, Plymouth City Council, Cornwall Council, a representative of South West MPs, Heart of the South West and Cornwall and Isles of Scilly LEPs, Travel Watch South West, South West Chambers of Commerce and Plymouth University.

1.2.2 The five local authorities jointly prepared the South West Spine report to set the pretext for this case, principally the importance of the peninsula’s economy and large
scale population growth, high levels of passenger growth, and longstanding underinvestment. The first of these underpins the case for investment because of the large size of the peninsula’s economy, and track record of growth, but relatively low productivity. This, combined with the large scale population growth, creates an opportunity to make a large contribution to national economic growth if this potential can be realised.

1.2.3 A report by the Universities of Bath and UWE for the South West Regional Development Agency (Meeting the Productivity Challenge, April 2005) identified a strong relationship between journey time from London, and to a lesser extent other large conurbations, and productivity.

1.2.4 One of the ‘headline’ findings of the study was that productivity could be reduced by as much as 6% for every 100 minutes’ journey time from London.

1.3 Purpose of the Study

1.3.1 The Task Force required an update of the 2005 work with the main objectives being to:

a Update the Meeting the Productivity Challenge study;

b Validate the relationship between connectivity to London (by different modes) and productivity;

c Identify the economic benefit of a range of journey time enhancement scenarios; and

d Comment on the relationship between improving connectivity and high speed broadband (and the relative need for each).

1.3.2 The key outputs from the study are as follows:

- Establish how the relationship between productivity and journey time from London by different modes, derived in Meeting the Productivity Challenge, has changed and what is the current nature of that relationship;
- Benchmark the existing gap in productivity between the South West Peninsula and rest of the England and Wales; and
- Identify the role journey time improvements can play in closing the productivity gap.

1.3.3 These objectives will be achieved by means of the following:

- Provision of evidence and development of an empirical relationship between productivity and journey time from London;
- Benchmarking of the existing gaps in productivity between the South West Peninsula and rest of the England and Wales; and
- Identification of the role journey time improvements play in closing the ‘productivity gap’ and how this is impacted on by the roll out of high speed broadband and Wi Fi on trains.

1.4 Study Geography

1.4.1 The study ‘geography’ covers the local authority areas of Somerset County Council, Devon County Council, Torbay Council, Plymouth City Council and Cornwall Council.
1.4.2 There are three levels of geography that have been assessed as part of this study:

- **UK regions** – establishing the relationship between productivity and journey time from London and major cities for regions across the UK;
- **South West Peninsula** – identifying the productivity gap across the Peninsula and within the South West region; and
- **Peninsula Station Sub Regions** – this covers the areas served by Taunton, Tiverton Parkway, Exeter, Newton Abbot, Torbay, Totnes, Plymouth, Liskeard, St Austell, Truro and Penzance stations. This geographical level is needed to estimate the impact of journey time improvements on productivity within station sub regions.

1.5 Report Structure

1.5.1 The report is structured as follows:

- Chapter Two focuses on establishing the relationship between productivity and journey times. This comprises 1) a review of existing work on the relationship between productivity and journey time by different modes from London and major cities and 2) identification of the empirical relationship between journey time from London and productivity;
- Chapter Three shows the “Productivity Gap” by benchmarking the productivity of the economies of the South West Peninsula. Using appropriate maps and figures, these illustrate 1) GVA per head of the South West region compared to UK average and other UK regions, 2) GVA per head of the South West peninsula compared to other parts of the South West region and 3) GVA per head of sub regional areas to identify the decreases in productivity across the South West Peninsula;
- Chapter Four contains the evaluation of journey time scenarios. This comprises estimation of four journey time improvement scenarios, e.g. 15, 30, 45 and 60 minute journey time reductions between London Paddington and all principal stations west of Taunton (including Taunton); and
- Chapter Five contains a summary and conclusions.

1.5.2 The evaluation of journey time scenarios is based on the following methods:

i. A value of productivity improvement (based on the work and methodology derived by UWE in 2005);

ii. Productivity improvement impacts as derived for work on the regional impact of HS2; and

iii. The “Wider Economic Impacts” methodology as derived in the Department of Transport’s web-based Transport Appraisal Guidance (WebTAG).
2 ESTABLISHING THE RELATIONSHIP BETWEEN PRODUCTIVITY AND JOURNEY TIME

2.1 Introduction

2.1.1 In this chapter, we 1) review the existing work on the relationship between productivity and journey times and 2) identify the empirical relationship between journey time from London and productivity.

2.1.2 The main focus of the review of existing work is the 2005 research undertaken by the University of Bath and UWE. Given that economic appraisal guidance has developed considerably since 2005 (with the further development of DfT’s WebTAG appraisal guidance), other research work is also included in this review.

2.1.3 Based on these different methodologies and approaches, the empirical relationships between journey time (to/from London) and productivity are identified.

2.2 Review of 2005 Work

2.2.1 In 2004, the former South West of England Regional Development Agency (RDA) commissioned a team drawn from the University of West of England (UWE) and the University of Bath (with additional inputs from Liverpool John Moores University) to:

· Assess the determinants of productivity in the South West;
· Investigate the impact of public interventions on regional productivity; and
· Provide a robust evidence base on which to develop activities to improve regional productivity in the South West.

Review of Methodology

2.2.2 The core analysis drew on Office of National Statistics (ONS) data that had only been made available during the time of the 2004/05 research. This was the ‘Annual Respondents Database’ (ARD) containing information on individual firms across the UK. The data was collected from companies via a questionnaire (it is a legal requirement for the companies to complete and return the questionnaire).

2.2.3 One advantage of using the database for the productivity analysis was the very large number of companies surveyed. This meant that unlike some research studies where only a limited sample of data is available, the 2005 work by UWE was based on a vast database of company information. This greatly enhanced the robustness of the findings given the extent of the data available.

2.2.4 Although the database is not ‘user friendly’ given its size, it was possible to identify productivity differentials across industry, geography and time.

2.2.5 The main ‘downside’ of using the database is that it is a complex, time-consuming process to undertake updates based on more recent data. It is important to state the reasons for this:

· The database can only be used / accessed by those with specific accreditation – this is primarily due to the commercial confidentiality of the company data;
Accreditation can only be gained once specific training on the database has been undertaken (and passed). Following this, confidentiality forms need to be signed by the individuals who have undertaken the training; and

The next step is to formally request access to specific data from ONS. The data request is assembled and passed to ONS for review before release of the data is authorised. Based on our discussions with UWE, we understand this process can take two to three months.

2.2.6 This means that an update of 2005 work will require a formal request to be put to ONS from an accredited econometrician. Having had several discussions and a meeting with Professor Don Webber of UWE, we recommend that he is best placed to oversee any future request for updates given 1) he has the necessary accreditation and 2) he is extremely familiar with the database and the way it was used for the previous productivity analysis.

2.2.7 Returning to the methodology used in 2005, this was based on standard statistical and econometric methods, primarily:

- **Multivariate analysis**: to identify interrelationships between different sets of variables;
- **Ordinary Least Squares regression**: this is a standard method of regression used in econometric analysis. For the productivity analysis, this was used for cross-sectional analysis. The database can only be used/accessed by those with specific accreditation – this is primarily due to the commercial confidentiality of the company data;
- **‘Panel-data’ approach**: this enabled changes over time to be taken into consideration when assessing productivity (i.e. companies operating in the tourism sector may be growing at a faster rate than firms in the IT sector, and vice versa).

2.2.8 Before discussing the methodology and findings of the 2005 work in more detail, it is necessary to provide a brief summary of the contents of the report that accompanied the work. This indicates the topics covered, issues addressed as well as methods and findings:

1) **Introduction**: sets out the objectives and report structure;

2) **The Current Evidence Base**: discusses the basis for productivity measures, previous research and evidence from other geographies;

3) **Productivity in the South West**: using ONS data at the NUTS2 and NUTS3 levels, this examines productivity differentials and characteristics across the South West. Regression analysis on this data is also described;

4) **Regional Productivity Differentials**: this describes the process whereby the more detailed company-based data (based on the ARD database described in 2.2.2) was used in the econometric analysis; and

5) **Conclusions and Policy Implications**: sets out key findings and policy recommendations for policy makers.

2.2.9 Based on the above sections, it is Chapter 4 in the UWE work that contains the key findings that are relevant as this chapter reports the results using the in-depth business survey.
The key findings are as follows:

- **Basic regression results**: this shows that based firms are 30.2% less productive than those in London. Also, firms in the South West rank after Yorkshire, the North East and Wales amongst the worst performing of all regional economies;

- **Impact of distance on productivity**: the introduction into the regression analysis of ‘distance’ variables was statistically significant and it was the inclusion of these variables that reduced the deficit for most regions. As indicated in the UWE findings, it is journey time rather than distance to London and the nearest urban centre that were significant;

- **Capital stock levels**: capital stock refers to the economically productive assets owned by companies (such as plant, equipment, electronic software and machinery). The more capital stock owned by companies, the more output they are likely to produce and hence the higher the productivity from their workforces. The UWE research found that capital stock declines with distance. In other words, firms in peripheral regions (such as the South West) are at a double disadvantage in that not only is their productivity adversely affected by distance from London, capital stock levels also decline with distance; and

- **Pooled regression results**: when the observations from the regression analysis are ‘pooled’ over the entire time period, the impact of the amount of time it takes to travel to an area from a major conurbation (such as London) is represented by a value of -5.7%. This is the magnitude of the ‘productivity gap’ between the South West and London when journey time is the explanatory factor.

The key conclusions from this are summarised on Page 4.37 of the 2005 report:

“Reducing the time it takes for firms to move their goods to the main UK conurbations and places of demand will also increase productivity. A key issue for productivity appears to be the degree of peripherality”.

When concluding the report, the UWE team stated although not included in HM Treasury’s key determinants of regional productivity differentials, distance from major centres of population, employment, markets and business activity have emerged from recent studies as major factors.

Another important finding was that the benefits of being in close proximity to centres of economic activity (such as major towns) were much greater for less productive areas.

In the South West, where productivity is lower, there is a particular disadvantage given the lack of proximity to centres of economic activity. This disadvantage far outweighs the combination of skills and other factors that were found to impact on productivity differences.

Although the outcome of the research was clearly indicative, the regression analysis showed that every 100 minutes from London reduces productivity by approximately 6% (for the next four largest conurbations, every 100 minutes journey time reduces productivity by 2-3%).

Also of note is that the strength of the time/distance effect is such that even relatively small changes in journey times will have on productivity. This indicates that there will be a clear economic benefit of overcoming particular bottlenecks in the region (such as those on certain sections of the main line into the South West).
2.2.17 The overall conclusion was therefore that the time/distance penalty faced by businesses that are progressively further away from London is very considerable.

2.3 Conclusions from the 2005 Work

2.3.1 Although it has not been possible (or practical) to update the research from 2005 given the complexities associated with obtaining and using more up to date information from the ONS database, Parsons Brinckerhoff’s in-depth review of the work has been extremely beneficial and has indicated the following:

- Based on both a review of the 2005 report and several discussions (and a meeting) with the study’s main author from UWE, it is clear that this is one of the most comprehensive (if not the most comprehensive) assessments of the relationship between journey time and productivity;
- Although the econometric methods involved are those regularly used for analyses of this type, what differentiates the research from other studies is the use of the very large ARDS company level database. The breadth of data this provides gives the research considerable robustness since the results are based on a very large sample size (i.e. millions of observations are held on file for hundreds of thousands of firms across the UK);
- The approach used by UWE has also enabled the impact of distance (and journey time) on productivity to be separated from other factors – again, this would not be possible in a less comprehensive analysis; and
- Discussions with UWE have clearly indicated that no evidence or developments have emerged since 2005 to indicate that the survey findings need to be revisited or are no longer valid. In other words, no evidence has emerged to suggest that the “6% productivity reduction per 100 minutes travel time from London” relationship has changed.

2.3.2 During the course of the study, queries have been raised about the validity of the 2005 research. For example, the Economic Development team from Plymouth City Council (backed up by the view of a consultant from the Plymouth Business School with wide expertise in econometrics) suggested that the 2005 study might have overlooked a potential simultaneous equation bias, as low productivity firms tend to choose to locate further away from markets voluntarily, and the effects might have been slightly inflated due to this problem.

2.3.3 After discussing this with UWE, the response is that although this may be true, there will also be counterbalancing evidence that there are several instances of ‘high productivity’ firms in the South West that have located near to urban areas with relatively high levels of agglomeration (density of economic activity). Examples will include firms locating near to the major urban centres of Taunton, Exeter, Plymouth and Truro.

2.3.4 To conclude, the 2005 research remains valid given 1) the methodology used, 2) the comprehensive company level database utilised in the regression analysis and 3) the absence of any evidence coming to light since 2005 to suggest that the results should be adjusted.
2.4 Evidence from Other Work – HS2

2.4.1 Given the importance of connectivity and its impact on productivity, more recent studies have focussed on how productivity can be increased through better transport links and reduced journey times.

2.4.2 One of the most prominent recent examples is the work undertaken by KPMG for HS2 Ltd, the developers of the proposed high speed line linking London with Birmingham and eventually Manchester and Leeds.

2.4.3 The underlying theory behind the work is that reduced transport costs reduce barriers to trade, enabling markets to function more efficiently and hence stimulating competition and driving improvements in productivity.

2.4.4 Compared to more traditional economic appraisals where benefits such as journey time savings are quantified, the work by KPMG took a different approach in order to understand how investment in HS2 will have an effect on productivity and inter-regional competition and hence medium- to long-term economic growth.

2.4.5 Given the range of possible approaches and methods (ranging from ‘simple’ to ‘complex’), the approach using the productivity analysis is shown below as the mid-ranking Option 2.

Figure 2.1: Alternative Analytical Approaches

Source: HS2 Regional Economic Impacts, High Speed Two (HS2) Limited, September 2013

2.4.6 The approach used by KPMG is a good compromise between the ‘simple’ method of just focussing on how connectivity impacts on GVA and the more ‘complex’ approach where in-depth data on the interactions between supply and demand behaviour and labour markets has to be captured.
2.4.7 The key measure affecting productivity is ‘connectivity’. This comprises the following:

- Information reflecting the costs of travel (captured through generalised costs of travel – i.e. all elements of a journey put into monetary terms, including journey times, fares, waiting times, interchange times etc.);
- A ‘deterrence function’ or ‘decay curve’ (this represents the extent to which the opportunity to trade or interact reduces as the generalised cost of travel increases); and
- Information about what is being accessed or connected to (such as employees or businesses).

2.4.8 The decay curves referred to above are a key feature of this approach as they show the relationship between generalised costs and the proportion of people that make trips with this journey cost. An example is shown below.

Figure 2.2: Example of a Decay Curve

2.4.9 The decay curve shows that travellers are most sensitive to changes in generalised costs where the curve is steepest. Separate decay curves are produced for each travel mode and journey purpose.

2.4.10 When generalised costs decrease (due to, say, the speeding up of rail journey times through infrastructure improvements), connectivity increases. Based on the slope of the decay curve, the impact of this journey time change will be larger if 1) the journey is sensitive to journey time changes (as represented on the steep part of the curve) and 2) if the other area has a large number of other businesses with which to connect.

2.4.11 As part of their work, KPMG also specified a “production function” which shows the relationship between economic output and inputs to the production process for a given business. The production function is important as it shows how efficient the production process is by means of productivity indicators.
2.4.12 Given that different types of transport connectivity can affect the productivity of different areas, KPMG used statistical analysis to test this and to examine whether, and to what extent, transport connectivity can help to explain the differences in economic output between places.

2.4.13 The use of statistical analysis is similar to that used by UWE in 2005 when assessing the impacts on productivity. For the KPMG work, the findings provided elasticities used to forecast the impact on productivity of changes in connectivity. Elasticities are ratios representing the proportionate change in one (dependent) variable over the proportionate change in another (independent) variable.

2.4.14 The elasticities estimated through the production function process are shown in the table below.

Table 1: Estimated Elasticities of Productivity with Respect to Connectivity

<table>
<thead>
<tr>
<th></th>
<th>Construction</th>
<th>Consumer services</th>
<th>Manufacturing</th>
<th>Producer services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail connectivity to labour</td>
<td>0.010</td>
<td>0.016</td>
<td>0.007</td>
<td>0.015</td>
</tr>
<tr>
<td>Car connectivity to labour</td>
<td>0.010</td>
<td>0.016</td>
<td>0.010</td>
<td>0.017</td>
</tr>
<tr>
<td>Rail connectivity to businesses</td>
<td>n/a</td>
<td>0.060</td>
<td>0.019</td>
<td>0.073</td>
</tr>
<tr>
<td>Car connectivity to businesses</td>
<td>0.025</td>
<td>0.048</td>
<td>0.014</td>
<td>0.056</td>
</tr>
</tbody>
</table>

*Note: The elasticity of productivity with respect to connectivity measures the sensitivity of productivity as connectivity changes. An elasticity of 0.01 (1%) means that a doubling of connectivity is expected to result in an increase in productivity of 1%.*

Source: HS2 Regional Economic Impacts, High Speed Two (HS2) Limited, September 2013

2.4.15 The benefit of the productivity improvements is that firms are able to produce more units of output for a given level of inputs (such as their capital stock and workforce). For businesses in the South West, this will enable them to compete more effectively for the larger markets that they will be able to serve as a result of journey time improvements on the main railway line into the region.

2.5 Conclusions from the HS2 Work

2.5.1 The work on the productivity impacts of HS2 reflected some of the latest thinking in this area and built upon existing research and methods. Similar to the 2005 research undertaken by UWE, the 2013 work on HS2 examines productivity in different regions across the UK and the relationships between this and connectivity.

2.5.2 The key conclusions are:

- The work uses several concepts and methods from economics and transport economics – these include decay curves and production functions;
- Extensive source data was used, including productivity data from different regions and travel time data for several point-to-point movements;
- The findings were in line with those from similar studies where elasticities of productivity with respect to connectivity typically lie in a range between 0.01 and 0.20; and
- Although the implied impacts on productivity from improved connectivity are lower than those indicated by the 2005 UWE, they nevertheless provide a useful
2.5.3 This work on HS2’s wider economic impact did, however, attract much high profile debate when first published in November 2013. This was based on the findings of another study published slightly earlier in September 2013 and which had reviewed previous work by KPMG on the impacts of high speed rail (Assessment of Methods for Modelling and Appraisal of the Sub-National, Regional and Local Economy Impacts of Transport, MVA Consultancy, September 2013).

2.5.4 The authors of the September 2013 report stated that there is no evidence that the direction of causation claimed in KPMG’s method between an increase in rail connectivity and increases in productivity, employment density and GVA has been established.

2.5.5 The authors also stated that the likelihood is that the direction of causation is two-way. In other words, it is possible that, rather than productivity and employment density being a function of connectivity, connectivity could be a function of productivity and employment density (i.e. more public transport has been provided in areas that have higher productivity).

2.5.6 Although we agree that connectivity by itself is not the only factor influencing productivity (this was one of the key strengths of UWE’s 2005 research, i.e. they separated out several factors influencing productivity of which distance / time was only one factor), it seems unlikely that more public transport has been provided on the basis of high productivity levels.

2.5.7 The vast majority of public transport infrastructure (especially that for rail) has been in place for a very long period of time and was built for largely commercial reasons during the industrial revolution when rail was seen as the main mode of transport for both goods and passengers.

2.5.8 The very few instances where new rail infrastructure has been built (i.e. HS1 to the Channel Tunnel and new lines such as the Borders Railway in Scotland) are largely associated with improving connectivity between key locations rather than a response to productivity issues.

2.5.9 On this basis, use of the HS2 research is valid for the purposes of this Productivity Study as it enables comparisons to be made between the findings of the 2005 research and the elasticity-based approach derived for HS2.

2.6 Evidence from Other Work – DfT WebTAG

2.6.1 The brief for the Productivity and Wider Economic Impact Study mentions the “Wider Economic Impacts” methodology developed as part of DfT’s WebTAG appraisal guidance.

2.6.2 In the brief, WebTAG Unit 2.8 is specifically mentioned. This unit has now been superseded and had been used to provide overall guidance to both the ‘Wider Impacts’ and ‘Regeneration’ methods developed by DfT. Units 3.5.8 (Regeneration) and 3.5.14 (Wider Impacts) provided more detailed guidance on the use of each method.

2.6.3 In January 2014, all the WebTAG units referred to above were replaced by Units A2.1 (Wider Impacts) and A2.2 (Regeneration) respectively. Although the principles of the
guidance from the original units remains in place, some alterations have been made to the methodologies and calculation formulae.

2.6.4 ‘Regeneration’ refers to the impact of transport infrastructure on access to labour markets and does not involve measures of productivity within the suggested approach. By contrast, ‘Wider Impacts’ guidance focuses on productivity and the role this plays in improvements to agglomeration (agglomeration being the technical term for the density of economic activity in a particular area).

2.6.5 Agglomeration has come to the fore in recent years given that observed productivity is higher in densely populated urban areas. This is because good transport links and connectivity enables workers with a diverse range of skills to access high value jobs. In addition, good connectivity allows businesses to draw upon a large pool of workers with suitable qualifications and skills. Both these positive aspects help to increase productivity in urban areas.

2.6.6 DfT’s WebTAG guidance has therefore sought to capture improvements in agglomeration by means of quantifying how changes in generalised costs (through journey time improvements) help generate increases in economic activity.

2.6.7 WebTAG Unit A2.1 sets out how these impacts are calculated. Two key elements are:

• “Effective density” measures the accessibility of each zone (in the study area) to jobs in the destination areas. Effective density depends on employment levels in the destination areas as well as average generalised costs adjusted for a distance decay parameter – the distance decay value is specified in the WebTAG database of input parameters and represents the extent to which impacts decline (or ‘decay’) over distance; and

• The final “agglomeration” calculation applies an elasticity of productivity to effective density (specifically, the elasticity is applied to the ratio of effective density in the ‘with scheme’ scenario over that for the ‘without scheme’ scenario).

2.6.8 The final agglomeration benefit total is a monetary amount based on the above parameters as well as GDP per worker and employment in each sector.

2.7 Conclusions from WebTAG “Wider Impacts”

2.7.1 There are several conclusions to be drawn from this method:

• Wider Impacts are primarily suited to densely populated, urban areas (such as a major town or city) - although the method can be used in an “inter-city” context, this is subject to uncertainty and requires several sensitivity tests to reflect the fact that the strength of impact of transport changes on agglomeration productivity diminishes with distance; and

• Wider Impacts are ideally calculated using the outputs of transport models (typically covering different modes) - in recent years, DfT have developed bespoke software (WITA - Wider Impacts in Transport Appraisal) to calculate productivity and agglomeration impacts using outputs from conventional transport models.

2.7.2 Although outputs from a transport model were not available for this study, we have considered the Wider Impacts method in detail and have used it here to demonstrate how the journey time improvements will boost agglomeration within the areas served by all the principal stations west of Taunton (including Taunton itself).
2.7.3 We have therefore analysed journeys between all districts in the South West Peninsula and the principal employment areas in Exeter and Plymouth. Given their size and importance in the region, both cities and their hinterlands are included in DfT’s Functional Urban Regions (FURs). A diagram showing FURs is shown in 4.3.2 in Chapter 4. FURs have been developed for Wider Impacts guidance to show the areas where agglomeration benefits are most likely to occur.

2.7.4 Since agglomeration improvements are derived from improvements in connectivity between jobs and workers, rail journey time improvements will have a 'regional' impact within the South West Peninsula. These will be in addition to the 'long distance' benefits discussed earlier. Agglomeration benefits are to be expected given that connectivity within the peninsula and access to jobs will be greatly improved with faster journey times to Exeter and Plymouth.

2.7.5 Two results of the agglomeration analysis are shown in Chapter 4.

2.8 Other Benefits of Improved Connectivity

2.8.1 Improved connectivity will help benefit the Peninsula’s economy in a number of other productivity-related ways and these are discussed here.

Sectoral Productivity Impacts

2.8.2 Improved productivity will also be achieved when connectivity improvements enable manufacturers to produce goods and services at lower input costs.

2.8.3 Although applicable to the transport of goods into and out of the Peninsula (rather than the movement of passengers as discussed above), the benefits of improved rail connectivity will be realised through a reduction in the ‘transport cost’ element of a manufacturer’s cost base.

2.8.4 This is illustrated below:

- Given the current long rail journey times into and out of the Peninsula, a high proportion of a manufacturers’ cost base will comprise transportation costs;
- Under the various journey time improvements proposed, the transport cost element of a firm’s cost base will reduce and thus more goods can be produced for the same amount of capital input;
- By being able to produce more goods for the same capital outlay (following the reduction in transport costs), productivity will increase.

2.8.5 The proposed rail journey time improvements will therefore boost productivity across a range of manufacturing and other sectors, thus helping to boost the economy of the Peninsula.

2.8.6 Such as outcome is also important to the Government at the current time given how even at a national level, productivity levels are below those from before the recession. Measures to boost productivity, including infrastructure improvements such as those being put forward here, will therefore have a major role to play.
2.8.7 As well as the ‘physical peripherality’ of the South West Peninsula (i.e. as defined through long journeys times and lack of accessibility / connectivity), perceptions of peripherality will also adversely affect the region’s economy as well as productivity levels.

2.8.8 These perceptions will adversely affect investment levels in the region as businesses will not be prepared to invest as much as they would otherwise do had there been better transport connectivity. Lower investment levels will also give rise to lower productivity as newer, more productive manufacturing processes and equipment will require investment within the region.

2.8.9 Although not readily quantifiable, there is little doubt that the Peninsula currently suffers from poor perceptions as to its accessibility and this was exacerbated by the recent severe weather events where the region appeared even more ‘cut off’ from the rest of the country.

2.8.10 The proposed journey time (and associated infrastructure) improvements for rail will therefore go a considerable way to redressing the negative perceptions of the Peninsula’s current peripherality relative to the rest of the UK.

2.8.11 By changing these perceptions, higher levels of investment and thus higher productivity are more likely to occur.

Evidence from Existing Business Surveys

2.8.12 As well as the empirical evidence discussed above, there is also a considerable body of evidence based on business surveys showing the impacts of transportation connectivity in the South West. Although the caveat must be added that the statistical robustness of some of these surveys is affected by relatively small sample sizes, the findings are nevertheless highly instructive and show how businesses perceive the impact of poor connectivity.

2.8.13 A summary of the key findings from a selection of surveys is shown below.

- **South West Business Survey - Key Findings (July 2011):**
  - 25% of surveyed companies cite ‘lack of investment’ as one of the factors restricting business growth (up from 16% in 2005) – although ‘investment’ is not fully defined, this could include investment in critical transport infrastructure;

- **Transport in the South West – Does It Matter for the Performance of the Economy? (South West Observatory, June 2010):**
  - The study notes that the availability of a good transport network could be vital in enabling both workers and businesses to be better matched (a key factor when aiming to boost an area’s productivity);
  - The study also notes that an improvement in the public transport network (coupled with the introduction of electrification and high speed rail) could help reduce fuel consumption and hence CO2 emissions.
- South West Local Enterprise Partnership Survey (Final Version, December 2013):
  - Of the businesses surveyed, poor transport connectivity was mentioned as a factor according to the following proportions: 15.4% (firms trading regionally), 16.7% (firms trading nationally) and 5.7% (firms trading internationally);
  - When asked about the reasons for their current location, almost 75% of businesses surveyed said that transport and logistics were ‘slightly important’, ‘important’ or ‘most important’;
  - Of the factors constraining growth, again, 75% of businesses surveyed said that transport infrastructure was ‘slightly important’, ‘important’ or ‘most important’ in terms of constraints;
  - Of the factors supporting growth, 75% of firms placed transport infrastructure in the ‘slightly important’, ‘important’ or ‘most important’ categories.

- Heart of the South West Business Survey 2012 (Final Report, January 2013):
  - In this survey, a relatively small proportion (11%) attributed their current ‘difficulties’ to poor transport infrastructure;
  - Again, a relatively small proportion (9%) attributed transport connectivity as one of the factors restricting business growth;
  - In terms of “hard to fill vacancies”, 19% of businesses surveyed attributed these to their remote location and / or poor public transport.

- The DR Company - Business Survey for South Hams, Teignbridge and West Devon (March 2015):
  - For firms seeking to recruit suitably skilled staff, the most frequent comments related to a lack of affordable housing and difficulties with transport, particularly in the South Hams area;
  - Constraints on business development were cited as including poor public transport (46% of businesses surveyed) whilst in West Devon and South Hams / Dartmoor respectively, 53% and 50% of businesses stated that poor public transport links were either a ‘constraint’ or a ‘significant constraint’;
  - Businesses in West Devon were more likely to report overcoming poor public transport links as the most important constraint to overcome, with 50% of the businesses that selected this option being based within the district;
  - When asked about ‘overcoming barriers to growth’, improved transport was mentioned as a factor according to the following proportions: South Hams (22%), Teignbridge (10%), West Devon (20%) and Dartmoor (16%);
- Businesses in the South Hams placed a higher importance on access to a suitably skilled, local workforce (through improved transport links etc.).

2.8.14 The March 2015 business survey also asked businesses about the perceived impact of the ‘Second Rail Route’ avoiding Dawlish.

2.8.15 Businesses in West Devon were most likely to agree or strongly agree that the second complementary route would be beneficial for their business (65%). This is to be expected given that the route could provide additional transport service into the West Devon area.

2.8.16 In addition, the majority of businesses that felt that the second rail route would improve access for their staff were in West Devon, with 40% of businesses in that district selecting ‘agree’ or ‘strongly agree’ to this statement.

2.8.17 To summarise the findings of all the above surveys, these indicate that transport infrastructure, public transport and connectivity issues are all important to businesses in the region. This is especially the case for access to suitably qualified staff where the current lack of connectivity is frequently preventing businesses from attracting (and retaining) suitably qualified staff.
3 IDENTIFICATION OF THE PRODUCTIVITY GAP

3.1 Introduction

3.1.1 In this chapter, the productivity of the economies of the South West Peninsula are benchmarked. Detailed data is available from ONS and this shows GVA per hour worked for different geographies.

3.1.2 The objective is to develop an evidence base of the productivity gap between the Peninsula and:

- The rest of the country;
- The rest of the South West region, and
- Within the Peninsula.

3.1.3 Although GVA per head is mentioned in the study brief, ONS note that there are two main limitations why this is not the preferred measure of regional productivity:

1) Firstly, by including all residential population (and not just those who are in employment), GVA per head includes residents who are not directly contributing to GVA. GVA per head is therefore understated in areas with high percentages of young people and pensioners; and

2) Secondly, GVA per head divides a workplace-based numerator (GVA) by a residence-based denominator (residential population). This means that this measure does not account for people commuting into and out of a region.

3.1.4 For these reasons, ONS consider that GVA per hour worked is a more appropriate measure of regional and sub-regional productivity. This is because this measure only counts the input of those who are directly employed in the production process (rather than the whole population) as well as providing a workplace-based labour input denominator to match the workplace-based GVA numerator (thus fully accounting for the impacts of commuting).

3.1.5 GVA per head data has, however, been used where this is the most disaggregated data provided by ONS (i.e. when comparing productivity across different NUTS2 and NUTS3 regions).

3.2 Productivity Data Collated By ONS

3.2.1 Productivity data is available at different levels of geography in the United Kingdom (UK). At a sub-regional level, data is collated at what is termed ‘NUTS2’ and ‘NUTS3’ levels. NUTS stands for ‘Nomenclature of Territorial Units for Statistics’ and is a hierarchical classification of administrative areas used across the European Union for statistical purposes.

3.2.2 The hierarchy of NUTS areas in the South West is defined as follows:

- The South West is one of 12 NUTS1 areas in the UK;
- NUTS2 areas in the South West are:
  - Gloucestershire, Wiltshire and Bristol/Bath area
  - Dorset and Somerset
Of these NUTS2 areas, the relevant areas in the Peninsula are divided into the following NUTS3 areas:
- Dorset and Somerset:  
  Somerset
- Cornwall and Isles of Scilly:  
  Cornwall and Isles of Scilly
- Devon:  
  Plymouth  
  Torbay  
  Devon CC

Although Local Administrative Units (LAU 1 level) are at a level of geography below that of NUTS3 (e.g. Devon comprises seven LAUs - East Devon, Exeter, Mid Devon, North Devon, South Hams, Teignbridge, Torridge and West Devon), ONS do not publish GVA estimates below NUTS3 level. This means that there are no official estimates at the local authority level.

There is a good reason for this as even at NUTS3 level, the estimates are 1) less timely, 2) subject to a higher degree of uncertainty (and revision) and 3) are only produced on a workplace basis. Other key issues are:

- For NUTS2 and NUTS3 data, the time lag is typically two years, with the most recent data currently available being that for 2012; and
- GVA estimates are partly based on sample surveys so the quality of the results varies according to sample size, with results for smaller areas subject to a greater degree of uncertainty than those for larger areas.

From discussions with ONS, we understand that although sub-NUTS3 GVA and productivity data can be derived from surveys of individual businesses, this is subject to considerable uncertainty given issues of data quality and data completeness. These uncertainties also make it difficult to compare data across different parts of the UK.

It is for these reasons that NUTS2 and NUTS3 level data is used for this analysis.

Recent Productivity Trends

In their Sub-regional Productivity summary of March 2014, ONS make several important comments based on the most recent data available. In the NUTS3 sub-regions, for example, the lowest productivity levels were often, but not always, rural areas of the UK.

Powys in Wales and Cornwall and Isles of Scilly in the South West had the lowest productivity at more than 30% below the UK average (note that this is very similar to the findings from the 2005 work by UWE and indicates that the ‘productivity gap’ has not changed in the intervening period).
When measuring productivity by GVA per hour worked, Figure 3.1 below shows that both Devon and Cornwall and the Isles of Scilly rank amongst the lowest performing NUTS2 regions in the UK. Cornwall and the Isles of Scilly is the lowest performing region by some considerable margin with its productivity being well under 70% of the national average.

**Figure 3.1: Nominal GVA per hour worked - lowest ranking NUTS2 subregions, 2012**

Source: Subregional Productivity, ONS. March 2014

Figures 3.2 and 3.3 below show productivity (GVA per hour worked) at the NUTS3 level. To emphasise the differences between those regions in the UK with the highest levels of productivity, Figure 3.1 shows the highest performing NUTS3 subregions with Figure 3.2 immediately below showing the worst performing subregions.

**Figure 3.2: Nominal GVA per hour worked - highest ranking NUTS3 subregions, 2012**

Subregional Productivity, ONS, March 2014
The data illustrated in Figure 3.3 clearly shows how relatively rural, peripheral areas such as Torbay and Cornwall and Isles of Scilly lag considerably behind other regions in terms of their productivity.

The data for Cornwall is particularly stark given that its productivity is over 40 percentage points lower than that observed in areas such as Swindon and Cheshire.

As well as productivity data for 2012, trend analysis undertaken by ONS over the period 2004 to 2012 provides another stark indicator of how productivity in Cornwall and the Isles of Scilly performed relative to that in other regions in the UK during the last decade. This is shown in Figure 3.4 below.
Between 2004 and 2012, GVA per hour worked increased in all NUTS2 sub-regions, but in some more than in others. So while some NUTS2 sub-regions performed better than the UK average (reflecting an increase in their productivity index), other sub-regions performed worse than the UK average (reflecting a decrease in their productivity index).

In Cornwall and the Isles of Scilly, GVA per hour worked increased less than the UK average and this is shown by the decrease in the productivity index in Figure 3.4 (this was the second worst performance in the UK, only behind North Yorkshire).

The data represented in Figure 3.4 thus shows how the ‘productivity gap’ between the most peripheral area in the South West and the national average is widening. If this trend continues (a 6% differential in the eight years between 2004 and 2012), the gap will widen and the region’s economic remoteness from the powerhouses of the UK economy will be severely exacerbated.
3.4 Quantifying the Productivity Gap

3.4.1 The productivity of the economies of the South West Peninsula has been benchmarked according to three different criteria as set out below.

GVA per Head of SW Region Compared to UK Average and Other Regions

3.4.2 Figure 3.5 below plots the average GVA per head in the UK and across all regions, including the South West. The GVA data is that for 2012 at ‘current’ prices and is at the NUTS1 (regional) level.

Figure 3.5: Workplace-based GVA per head at current basic prices

Data Source: Workplace based GVA per head (NUTS1) at current basic prices, ONS (2012 data)

3.4.3 The data in the figure indicates that the South West region ranks fourth of the twelve NUTS1 regions in the UK. The productivity for the South West is relatively high given that the NUTS1 region also includes the economies of Bristol, Swindon and other major urban areas in the south western part of the country.

3.4.4 Figure 3.6 overleaf shows GVA per head data at the lowest NUTS3 (sub-regional) level. The figure clearly shows how the far South West performs relatively poorly compared to other sub-regions in the UK.
Figure 3.6: GVA per head, **NUTS3 sub-regions** across the UK

GVA/Capita (£000s)

2011

- 10-12
- 12-14
- 14-18
- 18-25
- 25-30
- 30-35
- 35-130

Source: Office of National Statistics
Contains Ordnance Survey data © Crown copyright and database right 2014
3.4.5 Figure 3.7 below indicates how the GVA per head in the five areas forming the South West Peninsula differs from GVA per head at both a national and regional level.

**Figure 3.7: Workplace-based GVA per head in the South West Peninsula**

![Graph showing GVA per head in the South West Peninsula](image)

*Data Source: Workplace based GVA1 per head (NUTS3) at current basic prices, ONS (2012 data)*

3.4.6 The data represented in the figure shows how the more rural, peripheral areas in the Peninsula have lower productivity. GVA per head in Plymouth, Devon CC and Somerset are higher than those in Torbay and Cornwall and the Isles of Scilly for several reasons:

- Given its size and status as the region’s main commercial centre (alongside Exeter), productivity in Plymouth is relatively high. The city will also have relatively high agglomeration levels as businesses will have good access to a broad skills base whilst workers within commuting distance have access to jobs within the city;
- GVA per head in Somerset is also higher than that in Torbay and Cornwall due, in part, to the much better accessibility and connectivity between the county and other urban areas, including London (Taunton is, for example, less than two hours travel time by rail to London Paddington); and
- By contrast, Torbay and Cornwall and the Isles of Scilly do not benefit from close proximity to major urban centres. This is also compounded by poor accessibility and connectivity by the main transport links, including rail.

3.4.7 Figure 3.8 overleaf illustrates the geographical spread of productivity metrics across the South West. What is evident from the figure is the reduction in productivity from east to west as journey times increase whilst both connectivity and accessibility reduces.
Figure 3.8: GVA per head of SW Peninsula compared to other parts of the South West

Drop-Off in Productivity across the South West Peninsula

3.4.8 For the reasons given in 3.2.3, ONS do not collate productivity data at a sub-regional (Local Administrative Unit, LAU) level. Nevertheless, an equally powerful indicator is the extent to which productivity in the South West has performed relative to the national average since 1997.

3.4.9 In Figure 3.9, for example, national GDP per head is represented by the straight line (at the top of the figure) showing 100% throughout the time period.

3.4.10 For the other areas, the respective lines show the trend in terms of proportions of national average GVA per head.
3.4.11 What is clear from the figure is that not only is productivity across the South West Peninsula considerably lower than the national average, but also that trends over time show a widening of the ‘productivity gap’.

3.4.12 The key observations from the data are:

- Relative to the national average, productivity in Torbay is now (i.e. in 2012) less than 65% of the average. In 1997, this was significantly higher (75%);
- Although GDP per head in Cornwall and the Isles of Scilly relative to the national average increased to just over 65% in the early to late 2000s, there are clear signs of a downward trend since 2010; and
- Despite making something of a ‘recovery’ in terms of its share of the national average since the recession, Devon’s GDP per head as a proportion of the national average has also declined markedly since 2010.

3.4.13 The more recent data indicates that despite the start of the ‘recovery’ since the recession of 2008/09, several areas in the South West Peninsula are continuing to experience declines in productivity relative to the national average.

3.4.14 The ‘drop off’ in productivity across the Peninsula is also shown in relation to rail journey times between the South West and London. Figure 3.10 illustrates, for example, how journey times in excess of three hours (180 minutes) are matched by areas of relatively low productivity. This picture is even starker for journeys between London and Cornwall where journey times of four to five hours (or more) are the norm.
Figure 3.10: Sub-regional GVA per head & rail journey time to London

Minute | GVA/Capita (£000s)
--- | ---
60 - 90 | 13-14
91 - 120 | 14-15
121 - 150 | 15-16
151 - 180 | 16-17
181 - 210 | 17-18
211 - 240 | 18-20
241 - 270 | 20-30
271 - 300 |
301 - 330 |
331 - 369 |

Source: ONS/NPTDR
Contains Ordnance Survey data
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4 EVALUATION OF JOURNEY TIME SCENARIOS

4.1 Introduction

4.1.1 In this chapter, the methods and approaches described in Chapter 2 are used to estimate the economic (productivity) impact of the following journey time improvement scenarios:

- 15 minute journey time reduction between London Paddington and all principal stations west of Taunton;
- 30 minute journey time reduction;
- 45 minute journey time reduction; and
- 60 minute journey time reduction.

4.1.2 The study brief stated that two methods should be used for comparative purposes:

1) Value of productivity improvement (using the relationship derived by UWE as well as more recent work on the regional impacts of HS2); and

2) Wider Economic Impacts methodology (as discussed in Section 2.6).

4.1.3 Although the brief also asks for estimation of the maximum capital expenditure to achieve Benefit Cost Ratios (BCRs) of 1.5, 2.0 and 3.0 for each journey time improvement scenario, this has not been possible within the scope of this study as BCRs need to take account of a variety of metrics. These include scheme costs, revenue impacts and other 'transport economics' impacts (such as monetised journey time savings). All of these metrics are required for a Full Business Case where the BCRs provide an indicator of the extent to which discounted benefits exceed discounted costs (or vice versa).

4.1.4 It has been possible, however, to demonstrate several economic benefits associated with improved journey times. These include productivity improvements, other related economic impacts (such as GVA and employment impacts). In addition, DfT’s “Wider Impacts” guidance has been used to show the potential agglomeration benefits in the South West Peninsula.

4.2 Journey Time Improvement Scenarios

A) UWE Method

4.2.1 Based on the work undertaken by UWE, a series of productivity impacts for each journey time scenario have been analysed.

4.2.2 The current analysis assumes that the outcome of the journey time improvements will be a productivity gain based on the extent to which the improvements reduce the distance/time-based productivity gap. Taking the 15 minute journey time improvement as an example, Table 4.1 overleaf shows how this process works.
4.2.3 Table 4.1 shows current rail journey times to London Paddington from each principal station with the ‘productivity gap’ associated with each journey time from London shown in the next column. The journey times assuming the 15 minute reduction and resulting adjustments to the productivity gap are also shown.

4.2.4 Although it is currently assumed that the productivity impact is proportionate to the change in journey time (i.e. doubling journey times from 100 to 200 minutes from London will double the impact from a 6% loss in productivity to 12%), discussions are ongoing with UWE to understand whether this relationship holds over longer distances and journey times. Any adjustments will be reflected in the Final Report.

4.2.5 The productivity gains for each journey scenario are as follows:

- 15 minutes: +0.9%;
- 30 minutes: +1.8%;
- 45 minutes: +2.7%; and
- 60 minutes: +3.6%.

4.2.6 Having established the extent of the productivity gain for each journey time reduction, a series of indicative economic impacts have been derived. These are derived using the following data and processes (from a number of data sources):

- Increase in GVA per NUTS3 sub-region in the South West (utilising the latest GVA per head and population data from ONS);
- The proportion of GVA accounted for by workers’ income (rather than accruing to companies as profits etc.) – this data is also taken from the latest ONS statistical database;
- An estimate of the proportion of income that is spent in the region (utilising detailed household expenditure data from ONS);
- The level of expenditure that supports 1 Full Time Equivalent (FTE) position in the South West Peninsula (using observed data obtained by Parsons.
Productivity and Wider Economic Impact Study

Brinckerhoff in 2012 for the wider economic impact of widening the A303 from Wiltshire through to Devon); and

- Application of ‘indirect’ and ‘induced’ employment multipliers to reflect the additional FTE positions generated in indirect ‘supply’ industries / businesses as well as the additional FTEs supported by the expenditure of the new workers (again, these multipliers are taken from the economic impact work for the A303 project).

4.2.7

The series of tables below show the estimated economic impact of productivity improvements for each journey time scenario.

Table 4.2: Summary of Impacts – 15 minute journey time improvement

<table>
<thead>
<tr>
<th>NUTS3 Region</th>
<th>GVA increase</th>
<th>Direct FTEs generated</th>
<th>Indirect employment multiplier</th>
<th>Induced employment multiplier</th>
<th>Total FTEs generated</th>
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<tr>
<td>Somerset</td>
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<td>Torbay</td>
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<td>51</td>
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<td>1.1</td>
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<td>Devon CC</td>
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<td>365</td>
<td>1.3</td>
<td>1.1</td>
<td>547</td>
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<td>235</td>
<td>1.3</td>
<td>1.2</td>
<td>350</td>
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Table 4.3: Summary of Impacts – 30 minute journey time improvement

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<th>NUTS3 Region</th>
<th>GVA increase</th>
<th>Direct FTEs generated</th>
<th>Indirect employment multiplier</th>
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<th>Total FTEs generated</th>
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Table 4.4: Summary of Impacts – 45 minute journey time improvement

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<th>NUTS3 Region</th>
<th>GVA increase</th>
<th>Direct FTEs generated</th>
<th>Indirect employment multiplier</th>
<th>Induced employment multiplier</th>
<th>Total FTEs generated</th>
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Table 4.5: Summary of Impacts – 60 minute journey time improvement

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<thead>
<tr>
<th>NUTS3 Region</th>
<th>GVA increase</th>
<th>Direct FTEs generated</th>
<th>Indirect employment multiplier</th>
<th>Induced employment multiplier</th>
<th>Total FTEs generated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somerset</td>
<td>£314,172,000</td>
<td>940</td>
<td>1.3</td>
<td>1.2</td>
<td>1,482</td>
</tr>
<tr>
<td>Plymouth</td>
<td>£163,296,000</td>
<td>535</td>
<td>1.3</td>
<td>1.1</td>
<td>801</td>
</tr>
<tr>
<td>Torbay</td>
<td>£61,920,000</td>
<td>203</td>
<td>1.3</td>
<td>1.1</td>
<td>304</td>
</tr>
<tr>
<td>Devon CC</td>
<td>£446,184,000</td>
<td>1,461</td>
<td>1.3</td>
<td>1.1</td>
<td>2,188</td>
</tr>
<tr>
<td>Cornwall and Isles of Scilly</td>
<td>£253,512,000</td>
<td>941</td>
<td>1.3</td>
<td>1.2</td>
<td>1,399</td>
</tr>
</tbody>
</table>

4.2.8 The tables above provide an indication of how productivity improvements under different journey time scenarios will boost economic activity through increases to both regional GVA and employment.

4.2.9 To put the above GVA increase estimates into context, the impact of the 60 minute journey time reduction represents almost a 4% increase in total GVA for each of the five NUTS3 regions shown in the table.

4.2.10 Taking the ‘Devon CC’ area, approximately £446 million will be added to total existing (2012) GVA of £12.4 billion. In other words, the GVA impact of this journey time improvement is significant and clearly demonstrates the extent of economic benefits arising from essential infrastructure improvements.
4.2.11 The tables also indicate the extent to which ‘multiplier’ effects in the labour market will help support additional employment in support sectors whilst the expenditure of the new ‘direct’ employees will generate additional economic benefits.

B) HS2 Regional Impact Method

4.2.12 The method used to estimate the regional productivity impacts of HS2 (as reported in Section 0) are based on elasticities developed to quantify the proportionate impact of changes in connectivity.

4.2.13 The elasticities cover both ‘rail connectivity to labour’ and ‘rail connectivity to businesses’ as well as being developed for four different sectors in the economy (these are construction, consumer services, manufacturing and producer services). The respective elasticities are used to assess how much productivity will change given the improvements in connectivity (journey time).

4.2.14 As there are a large number of productivity impact permutations across the principal stations and industry sectors, an average productivity gain for stations in Somerset, Devon and Cornwall respectively has been derived. This approach is adopted given that the most accurate and reliable GVA (and productivity) data is available at NUTS3 sub-regional level.

4.2.15 As the elasticities are applied to proportionate changes in journey times, the impact of a 15 minute reduction on a 5 hour plus rail journey from Penzance to London will be lower than that on a sub-2 hour journey from Taunton to London. This reflects the ‘distance decay’ effect whereby the productivity impact of journey time improvements will be more apparent for comparatively shorter journeys (or for locations closer to London).

4.2.16 Based on a similar approach to that described in 4.2.6, a series of economic impacts has been derived for each journey time improvement scenario. These are shown for each NUTS3 sub-region in the tables below.

Table 4.6: Summary of Impacts (HS2 method) – 15 minute journey time improvement

<table>
<thead>
<tr>
<th>NUTS3 Region</th>
<th>GVA increase</th>
<th>Direct FTEs generated</th>
<th>Indirect employment multiplier</th>
<th>Induced employment multiplier</th>
<th>Total FTEs generated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somerset</td>
<td>£35,620,408</td>
<td>107</td>
<td>1.3</td>
<td>1.2</td>
<td>168</td>
</tr>
<tr>
<td>Plymouth</td>
<td>£11,990,323</td>
<td>39</td>
<td>1.3</td>
<td>1.1</td>
<td>59</td>
</tr>
<tr>
<td>Torbay</td>
<td>£4,546,595</td>
<td>15</td>
<td>1.3</td>
<td>1.1</td>
<td>22</td>
</tr>
<tr>
<td>Devon CC</td>
<td>£32,761,918</td>
<td>107</td>
<td>1.3</td>
<td>1.1</td>
<td>161</td>
</tr>
<tr>
<td>Cornwall and Isles of Scilly</td>
<td>£11,229,017</td>
<td>42</td>
<td>1.3</td>
<td>1.2</td>
<td>62</td>
</tr>
</tbody>
</table>
Table 4.7: Summary of Impacts (HS2 method) – 30 minute journey time improvement

<table>
<thead>
<tr>
<th>NUTS3 Region</th>
<th>GVA increase</th>
<th>Direct FTEs generated</th>
<th>Indirect employment multiplier</th>
<th>Induced employment multiplier</th>
<th>Total FTEs generated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somerset</td>
<td>£71,240,816</td>
<td>213</td>
<td>1.3</td>
<td>1.2</td>
<td>336</td>
</tr>
<tr>
<td>Plymouth</td>
<td>£23,980,645</td>
<td>78</td>
<td>1.3</td>
<td>1.1</td>
<td>118</td>
</tr>
<tr>
<td>Torbay</td>
<td>£9,093,190</td>
<td>30</td>
<td>1.3</td>
<td>1.1</td>
<td>45</td>
</tr>
<tr>
<td>Devon CC</td>
<td>£65,523,835</td>
<td>214</td>
<td>1.3</td>
<td>1.1</td>
<td>321</td>
</tr>
<tr>
<td>Cornwall and Isles of Scilly</td>
<td>£22,458,034</td>
<td>83</td>
<td>1.3</td>
<td>1.2</td>
<td>124</td>
</tr>
</tbody>
</table>

Table 4.8: Summary of Impacts (HS2 method) – 45 minute journey time improvement

<table>
<thead>
<tr>
<th>NUTS3 Region</th>
<th>GVA increase</th>
<th>Direct FTEs generated</th>
<th>Indirect employment multiplier</th>
<th>Induced employment multiplier</th>
<th>Total FTEs generated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somerset</td>
<td>£106,861,224</td>
<td>320</td>
<td>1.3</td>
<td>1.2</td>
<td>504</td>
</tr>
<tr>
<td>Plymouth</td>
<td>£35,970,968</td>
<td>118</td>
<td>1.3</td>
<td>1.1</td>
<td>176</td>
</tr>
<tr>
<td>Torbay</td>
<td>£13,639,785</td>
<td>45</td>
<td>1.3</td>
<td>1.1</td>
<td>67</td>
</tr>
<tr>
<td>Devon CC</td>
<td>£98,285,753</td>
<td>322</td>
<td>1.3</td>
<td>1.1</td>
<td>482</td>
</tr>
<tr>
<td>Cornwall and Isles of Scilly</td>
<td>£33,687,051</td>
<td>125</td>
<td>1.3</td>
<td>1.2</td>
<td>186</td>
</tr>
</tbody>
</table>
Table 4.9: Summary of Impacts (HS2 method) – 60 minute journey time improvement

<table>
<thead>
<tr>
<th>NUTS3 Region</th>
<th>GVA increase</th>
<th>Direct FTEs generated</th>
<th>Indirect employment multiplier</th>
<th>Induced employment multiplier</th>
<th>Total FTEs generated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somerset</td>
<td>£142,481,633</td>
<td>426</td>
<td>1.3</td>
<td>1.2</td>
<td>672</td>
</tr>
<tr>
<td>Plymouth</td>
<td>£47,961,290</td>
<td>157</td>
<td>1.3</td>
<td>1.1</td>
<td>235</td>
</tr>
<tr>
<td>Torbay</td>
<td>£18,186,380</td>
<td>60</td>
<td>1.3</td>
<td>1.1</td>
<td>89</td>
</tr>
<tr>
<td>Devon CC</td>
<td>£131,047,670</td>
<td>429</td>
<td>1.3</td>
<td>1.1</td>
<td>643</td>
</tr>
<tr>
<td>Cornwall and Isles of Scilly</td>
<td>£44,916,069</td>
<td>167</td>
<td>1.3</td>
<td>1.2</td>
<td>248</td>
</tr>
</tbody>
</table>

4.2.17 Again, to put these financial amounts into context, the total GVA increase in Somerset of £142.5 million (under the 60 minute journey time improvement) represents a 2% increase on total GVA of £8.7 billion in 2012.

4.2.18 Although the elasticity-based method derived for HS2 produces lower impacts compared to the time/distance-based productivity impact from the 2005 work, the magnitude of the potential impacts is still considerable and indicates that both GVA and employment will be boosted throughout the South West Peninsula.

4.3 WebTAG-Based Wider Impacts

4.3.1 As reported in Section 2.6, DfT’s “Wider Impacts” guidance takes account of productivity by quantifying agglomeration benefits. Since agglomeration primarily takes place within areas where journeys to/from work are possible, the analysis here has focused on how journey time improvements could boost agglomeration through better access to Plymouth and Exeter.

4.3.2 WebTAG indicates that this approach is suited to what it terms Functional Urban Regions (FURs). Plymouth and Exeter are the only FURs in the South West as shown in the extract from WebTAG Unit A2.1 overleaf.
Figure 4.1 shows both the ‘core’ area in both cities as well as the ‘hinterland’ covering the surrounding areas.

For the Wider Impacts (analysis), we have adopted the approach set out in Unit A2.1. The key steps are as follows:

- Obtain employment forecasts by industry sector for each Local Authority District (LAD) in the study area. The four sectors are the same as those in the HS2 analysis (construction, consumer services, manufacturing and producer services);
- Obtain GDP per worker (‘productivity’) data across all sectors and LADs;
- Obtain both agglomeration elasticities and distance decay parameters from the WebTAG database;
- Calculate generalised cost for both current and proposed journey times (the latter calculated for each of the four journey time scenarios). Generalised cost is used to derive ‘effective density’;
- Calculate ‘effective density’ using generalised costs (for both the current and journey time improvement scenario) and the distance decay parameters; and
- Calculate the monetised agglomeration totals based on 1) effective densities in both the current and journey time improvement scenarios, 2) the agglomeration elasticities by sector and 3) the employment and GDP per worker data.

The results of this process are a series of agglomeration benefits for each principal station west of Taunton. The quantified impacts represent the additional benefits generated over the ‘base’ position (i.e. before journey time improvements).

To reiterate, agglomeration benefits are shown as monetary values as they are derived from monetised generalised costs.

The values shown in the tables below represent agglomeration benefits across one single year (in this case, 2016). For economic appraisals of transport schemes where “Wider Impacts” can be included, annual forecasts of benefits would typically be summed over 60 years subject to standard appraisal discounting procedures.
4.3.8 The values shown in Table 4.10 below have also been summed across all four industrial / commercial sectors.

Table 4.10: Summary of Agglomeration Benefits (for year 2016, £millions, 2010 prices)

<table>
<thead>
<tr>
<th>Principal Station</th>
<th>15 minute improvement</th>
<th>30 minute improvement</th>
<th>45 minute improvement</th>
<th>60 minute improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taunton</td>
<td>8.0</td>
<td>16.4</td>
<td>25.2</td>
<td>33.8</td>
</tr>
<tr>
<td>Tiverton Parkway</td>
<td>3.6</td>
<td>8.0</td>
<td>11.9</td>
<td>16.7</td>
</tr>
<tr>
<td>Exeter St Davids</td>
<td>8.7</td>
<td>20.2</td>
<td>30.0</td>
<td>43.0</td>
</tr>
<tr>
<td>Newton Abbot</td>
<td>6.4</td>
<td>11.5</td>
<td>18.3</td>
<td>25.4</td>
</tr>
<tr>
<td>Torquay</td>
<td>8.5</td>
<td>17.4</td>
<td>25.7</td>
<td>35.6</td>
</tr>
<tr>
<td>Totnes</td>
<td>4.9</td>
<td>9.9</td>
<td>15.1</td>
<td>20.4</td>
</tr>
<tr>
<td>Plymouth</td>
<td>6.9</td>
<td>14.2</td>
<td>21.7</td>
<td>29.6</td>
</tr>
<tr>
<td>Liskeard</td>
<td>4.1</td>
<td>8.5</td>
<td>13.1</td>
<td>18.5</td>
</tr>
<tr>
<td>St Austell</td>
<td>8.2</td>
<td>16.4</td>
<td>25.7</td>
<td>35.0</td>
</tr>
<tr>
<td>Truro</td>
<td>10.4</td>
<td>22.6</td>
<td>35.1</td>
<td>49.0</td>
</tr>
<tr>
<td>Penzance</td>
<td>5.1</td>
<td>10.5</td>
<td>16.6</td>
<td>22.8</td>
</tr>
<tr>
<td>TOTALS</td>
<td>74.8</td>
<td>155.5</td>
<td>238.3</td>
<td>329.8</td>
</tr>
</tbody>
</table>
5 SUMMARY AND CONCLUSIONS

5.1.1 The study has examined the ‘productivity gap’ between the South West and other parts of the UK as well between different sub-regions within the Peninsula and the UK average.

5.1.2 What is evident is that productivity from Somerset westwards is progressively lower as the region becomes more peripheral and transport connectivity decreases. Even Somerset, with its relatively good rail connectivity to London (journey times are well under two hours), has productivity lower than the South West average.

5.1.3 The pattern of lowering productivity from Somerset westwards is aligned with increasing rail journey times the further west travel is undertaken. This is most noticeable for Cornwall where journey times between Penzance and London exceed five hours.

5.1.4 At the NUTS2 regional level, productivity in Cornwall and the Isles of Scilly is the lowest in the country, emphasising the relative peripherality of the county, exacerbated by poor transport connectivity and accessibility.

5.1.5 Even Devon, with its areas of high economic activity in Exeter and Plymouth, is the ninth worst performing region in terms of productivity (out of 37 NUTS2 regions). ONS trend data also shows that for several sub-regions in the Peninsula, productivity as a proportion of the national average has been in both short and long term decline in recent years. For Devon and Torbay, this proportion has been falling notably since 2010.

5.1.6 These trends will continue if no action is taken to address the region’s relative peripherality. The long rail journey times (as well as the recent storm-induced closures) exacerbate this peripherality and if addressed through infrastructure improvements, will greatly assist the region’s economic connectivity and potential.

5.1.7 Several in-depth analyses and research projects have shown a strong relationship between journey times and productivity. Although there has been debate as to the exact metrics linking improved transport links with increased productivity, there is no doubt that robust relationships between journey time and productivity have been identified.

5.1.8 Using different approaches, it has been possible to provide estimates of productivity gains, GVA impacts and employment increases within sub-regions in the South West Peninsula. These have been estimated for the different journey time scenarios.

5.1.9 Although there are different ways of assessing and calculating these impacts, the finding that productivity declines by approximately 6% for every 100 minutes travel time from London could potentially generate over £1 billion in additional GVA per annum across the Peninsula.

5.1.10 This will support additional employment in the region and by helping to reduce the ‘productivity gap’ between sub-regions in the Peninsula and other parts of the UK. With the Peninsula continuing to be one of the most peripheral areas in the country (and experiencing the consequences of this on economic activity), improved access and connectivity will be a major factor in the regeneration of the region.

5.1.11 Meanwhile, work continues to establish how improved transport connectivity will boost productivity and economic activity given high Government interest in this field.