University of the West of England, Bristol

An econometric study of the West of England LEP priority sectors

Client Report to the West of England LEP

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The West of England Local Enterprise Partnership (WoE LEP) wishes to study the structure and development of its priority sectors, particularly with regard to the causes of relative productivity, using the ONS micro data lab. UWE and njSE have been appointed to undertake this research. They present their findings in this report.

UWE and njSE have used their professional experience and expertise to provide this analysis for the WoE LEP. They cannot be held responsible, however, for any errors or omissions revealed by future evidence revisions, new publications or policy changes, or indeed, for the consequences of actions taken by the client and/or its partners on the basis of the report.

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1. EXECUTIVE SUMMARY

This research has explained some of the differences in economic performance between the West of England (WoE) and its constituent parts (places and sectors) and national 'control' averages and other sub-regional areas.

Part of the explanation why the WoE is doing so well is its sector composition. However, the text book drivers of productivity (capital and labour employed) seem to explain only a very small amount of the remaining productivity differentials. This paper recommends extensions to the research to allow a fuller identification of the specific local factors that are contributing to and limiting the WoE productivity advantage.

Overall, we find significant results that the WoE performed:

- better than the national average 'control group' (UK excluding London). Between 1998 and 2007 and in terms of average productivity, the WoE moved from being average to being 11.5% above average. Thereafter, from 2008-2011, thanks to the impact of recession and prolonged downturn, the local productivity premium slipped back to 7.2%.

- better than the seven other *'core' cities*, with a positive, though variable, productivity gap throughout the period under study.

- better and improving faster than five comparable *southern LEP areas*. Smaller sample sizes mean these estimates are more volatile, but the noteworthy point is that the WoE trend was more consistently positive over this period and only the Thames Valley LEP area, (benefiting from greater influence from "Greater London"), shows a bigger productivity gap.

As a leading UK conurbation, you would expect the West of England to have a positive productivity gap with the overall national 'control' group. It is more positive that there is a relatively good performance versus other 'core' cities and 'southern' LEP areas, and that the productivity trajectory is upwards.

In terms of WoE **priority sectors**:

- At a national level, all the WoE LEP's chosen *priority sectors* perform better than average, contributing positively to productivity gaps and increasingly so over time. This endorses the WoE LEP's opinion that these are sectors with above average growth potential and, possibly, worthy of its support.

- For the WoE itself, however, the performance of these sectors is variable and not always significantly better than how they are performing elsewhere.

- WoE *advanced engineering and aerospace* (AE&A) tends to be stronger than its national comparators; although volatile, typically it is approximately 10 per cent more productive than the national average for the sector over the whole period.

- The comparative figures for WoE *professional and legal services* (P&LS) move around a lot year-by-year. There was a strong and increasing positive effect in the

'boom' before the recent downturn but this has since eroded.

- *Creative industries* emerge over time as a modest 'winner' for the WoE, rising from about 12% below average up to 2005 to not being significantly different from the national average.

- Local *high-tech and low carbon* sectors are not significantly different from the same national sectors.

The key messages from the sector analyses are that AE&A is the only industry where WoE consistently outperforms its rivals but this advantage is volatile and cannot be taken for granted. P&LS tends to be a positive contributor but performance here can swing around. Productivity in the Creative industries has improved at a quicker rate in the WoE than nationally as it rose from a position of below average performance to one where it performs in line with the national average. The High-Tech and Low Carbon sectors show no clear WoE advantage. These differences suggest the LEP needs to adopt differential approaches within its work streams towards its priority sectors.

In terms of **explanatory factors**:

- Size of firm (number of plants), and capital and labour employed are important factors for explaining productivity gaps but their influence varies and can sometimes be unexpected. Moreover, this research finds that the inclusion of these standard *productivity drivers* leave most of the WoE's productivity advantage unexplained.

- Interestingly, this research finds that there are diseconomies of scale with regard to *multi-plant activities*, probably reflecting management and administrative inefficiencies and the nature of business productivity in sectors using multiple outlets.

- *Capital utilisation* is shown to be a positive factor nationally but capital stocks appear to increase labour productivity more in plants outside the WoE area. The LEP could aim to support efforts to raise capital efficiency across its patch.

- In contrast, the WoE's favourable productivity performance benefits from its *labour inputs*, particularly because of the strong numbers of local employers with large workforces. Part of the explanation for this may lie with the good performance of other (non-priority) sectors.

- Other factors affecting productivity gaps, such as agglomeration and network effects of infrastructure, ownership, innovation, trade engagement and entrepreneurial culture, are just a few of the other important factors that deserve further investigation.

The 'policy pointer' here is for the WoE LEP to consider ways to raise the local 'game' with respect to managerial efficiency and capital usage. Standard productivity drivers do not fully explain the WoE's productivity premium and further research is necessary to reveal additional policy avenues to explore.

In terms of **local areas,** there are changes over time that reflect the 'boom and bust' nature of the period under review, but:

- *South Gloucestershire* and *Bristol City* are consistently stronger performers than the national average.

These areas share mutually integrated spill over and structural advantages. They record a significant 10% or more productivity premium after 2004.

- *North Somerset* does not perform significantly differently from the national average until after 2003. The 2008/9 recession returned her to the average position.

- *Bath and North East Somerset* is more subdued than its neighbours, with a significant negative productivity gap averaging nearly 5% from 2002 onwards.

We suspect the differences between the WoE constituent parts reflect *broad demographics* (including education and skills and commuting patterns); the relative importance of *large, multinational businesses* in some areas; and historical patterns of *infrastructure and connectivity*, *business scale and scope, and sector specialisation*. These suspicions can only be confirmed through further research.

In productivity terms, there are differences that seem to favour the north and centre of the LEP area. This is not to say that there are not high value, strongly performing businesses and workers in all areas. It merely acknowledges the relative local depth and breadth of differences in the full range of productivity enhancing factors. These include the productivity drivers of investment, innovation, skills, entrepreneurship and competitiveness and the gamut of "agglomeration" factors (identified above and below).

In conclusion, in terms of productivity outcomes (and thereby, growth and earnings potential), recent trends show that the WoE economy benefits from the positive effects of its historical structure and cyclical development.

In common with the UK economy in general, the WoE suffers from a negative productivity gap with some of its international peers. Within the United Kingdom, however, particularly compared with other 'core' cities and a collection of similar' southern' LEP areas, the WoE does perform better than most.

Some of this reflects its effectiveness in terms of labour usage but that is not the case for its capital performance. In sector terms, the LEP's priority sectors seem appropriate but their actual contribution to the productivity gap varies. They cannot be considered uniformly or in isolation from the rest of the economy.

A significant part of the WoE productivity gap remains unexplained. It is suspected that this reflects a range of factors that are worthy of further research, including:

- Transportation and virtual connectivity
- Economic and demographic mass
- Physical, market and supply chain agglomeration and spill-overs
- Firm ownership, innovation and flexible working
- Intrinsic value and structural change

2. INTRODUCTION

2.1. **Research Context:**
The WoE LEP is developing the evidence base it needs to support its understanding, decision-making and actions in the WoE economy.

- It monitors past and current evidence through accessing and analysing official and survey data, as well as collating local intelligence from members and partners.

- It has invested in an input-output model of its economy, which a) details the macro structure, b) can be used to compare with peers and neighbours and c) can measure the impact of interventions.

- It has acquired macro projections that form a benchmark for planning and evaluation.

2.2. It now wishes to understand its business population in local sector terms, particularly with regard to its self-determined priority sectors. This research provides a significant part of that evidence by interrogating the ONS microdata, which enables local data to be investigated by bringing out differences in sector shape, share and performance. It shows the unique structure of local business sectors and compares this with other areas, particularly in terms of productivity differentials – the key driver of long-term growth in absolute and relative terms.

2.3. The main advantage of this data source is that it is comprehensive and collected in real time. The data is not freely available and can only be accessed by approved researchers working on defined and approved projects. A disadvantage with the data source, however, is that at small geographies the data can be volatile due to the small number of observations. Therefore caution needs be taken when interpreting the data, particularly from a single period.

2.4. Our research applies modern econometric techniques to the raw data in order to analyse absolute and relative characteristics and trends. This allows us to discover elements of relative success and failure and suggest broad causality. We then use the statistical results and analytical findings to derive policy implications.

2.5. The main use of this evidence and the findings of our analysis are that they will allow the WoE LEP to:

- understand its local economy in absolute terms and in relation to its peers

- specify strengths and weaknesses and

- identify opportunities and threats.

2.6. **Research Approach:**

This work will:

i) Examine firm-level data in detail
- for the 8 core cities in order to analyse productivity over time across SIC-defined industries to illustrate relative positions and gaps between LEPs.
- analysing productivity over time across SIC-defined industries to illustrate relative positions and gaps between comparator LEPs including Gloucestershire, Greater Cambridge and Greater Peterborough, Oxford City Region, Swindon and Wiltshire, and Thames Valley Berkshire.
- using two-year averages to ensure enough observations at the required level of geography (1998/99, 2000/01, 2002/03, 2004/05, 2006/07, 2008/09, 2010/11).
- illustrating relative positions and gaps between LEPs and to reveal how well they performed before and after the recession.
- identifying whether firms in the WoE LEP performed better or worse than those in other relevant LEP comparator areas.
- including broad SIC code controls to account for industrial sector differences across geographical areas.

ii) Assess whether the 'gaps' identified are due to disparities in capital, labour or industry (SIC) composition. In other words, we seek to identify the root cause of differences in LEP productivity performance in terms of workforce, capital and economic structure.

iii) Evaluate the four constituent (local authority bounded) parts of the WoE LEP and identify their individual paths relative to each other over time. We investigate whether firms in one WoE LEP area are growing faster or slower than the others.

iv) Appraise the 'gaps' across the four constituent parts of the WoE LEP.

2.7. This research forms a detailed baseline for the LEP of its economy's absolute and relative performance. In sector terms, it informs discussions of what the LEP area does well and where it lags its peers. From this, the LEP will be better informed on how to deal with a) what it does well, b) what it could do better and c) what it might ignore. The same applies across its four constituent parts.

2.8. The original brief was to focus on a detailed baseline for the LEP of its economy's absolute and relative performance. In sector terms, the purpose of the study was to provide evidence on what the LEP area does well and where it lags behind its peers. The analysis was also to be extended to each of the four local authorities in the area.

2.9. The original key requirements of the study were:

   i. A detailed examination of firm-level data across the eight Core City LEP areas and the 'Southern' LEP comparator areas of Gloucestershire; Greater Cambridge and Greater Peterborough; Oxford City Region; Swindon and Wiltshire; and Thames Valley Berkshire, in order to analyses productivity over time and across SIC-defined industries.

ii.   To identify the underlying cause of differences in LEP productivity in terms of workforce, capital and economic structure.

iii. Provide an examination of the four local authorities to identify their individual paths relative to each other over time and identify the causes of differences in performance.

iv.   Providing there are enough observations at this level, present an examination of the Enterprise Zone/Areas that identifies their individual paths relative to each other over time, and undertake an examination of the specified causes of differences in performance at this lower level of geography.

2.10. The study was largely able to meet the objectives and key requirements in full. The exception to this was the fourth key requirement. This was due to the fact there were not enough observations of businesses located in the Enterprise Zones/Areas to inform a reliable and robust analysis.

2.11. The remainder of the report has the following structure:

Background: provides contextual information on:

- UK Government's local economic policy.
- Productivity literature.
- UK spatial productivity performance

Data: describes the data used in the study, providing a description of its origins and variable construction.

Results: presents analyses and identifies the causes of the productivity differentials between the WoE and its sub-regions with the national average.

Discussion and Recommendations: discusses the main findings of the research and makes a number of recommendations.

Conclusion and Policy Review: draws together findings from the study in order to draw out the policy implications.

3.   BACKGROUND

3.1.   **UK Government's local economic policy:** The Coalition Government's programme includes support for communities and local government. Its local economic growth flagship policy has been the creation of Local Enterprise Partnerships (LEPs). The roles of the LEPs were set out in the local growth white paper published in October 2010. The LEPs were formed to mirror geographic areas that reflect the 'natural' local economy.

3.2.   The Government has also supported local economic development through the creation of Enterprise Zones. The first eleven Zones were announced by the Chancellor of the Exchequer in the 2011 national budget. The Government has now created 24 Enterprise Zones, including the Temple Quarter in Bristol.

3.3.   Lord Heseltine's review in 2012 "No stone unturned in the pursuit of growth" has strengthened the LEPs role in providing local economic leadership. Lord Heseltine's report clearly articulated the need for an enhanced role for LEPs. His proposal was that funding should be administered on a competitive basis through a single pot. LEPs would compete for this money by developing their local economic plan based on robust and reliable evidence. To this end, this study provides the WoE LEP with a bespoke analysis on local productivity growth.

3.4.   Productivity growth is at the heart of the Coalition Government's economic policy of achieving strong and sustainable economic growth. The Government's productivity related actions include:

- investing in infrastructure
- investing in science and technology
- increasing access to finance for business
- increasing the UK's exports and supporting inward investment
- encouraging business to invest
- creating a more educated workforce
- supporting local growth

Productivity Literature

3.5.   There are many theories of economic growth ranging from neo-classical growth theory (emphasising differences in factor endowments, capital/labour ratios and technology) to endogenous growth theory (emphasising technology, the knowledge base and the knowledge workers) to the new economic geography (emphasising the importance of spatial agglomeration, clustering and specialisation as the basis for increasing returns). What all of these theories have in common, however, is an agreement that the only way to improve the long-term living standards of a population is through productivity growth.

3.6.   Although productivity is a relatively easy concept to understand – the ratio of economic output to input (usually labour) – measuring productivity growth and its constituent parts have been much more challenging. To address some of these

complications, in 2008 ONS published their 'Productivity Handbook' to act as a reference source for users of productivity statistics. In order to understand the dynamics and determinants of productivity growth, ONS used a growth accounting framework that decomposed economic growth into the contributions of capital, labour and other inputs.

3.7. Capital and labour are routinely measured but quantifying 'other inputs' and its constituent parts has proved to be much trickier. In terms of trying to identify the 'other inputs' element of productivity growth a number of studies have explored the issue of 'intangible' capital. For example, Borgo *et al*. (2013) undertook an analysis of the UK knowledge economy and reported that intangible investment is greater than capital investment and accounted for 23% of labour productivity growth in 2008.

3.8. Alternative conceptual perspectives have attempted to measure different aspects of productivity growth. The HM Treasury report of productivity in the UK (2001) drew widely on the evidence base of existing academic and policy literature in order to identify both productivity differentials and those factors that might account for such differences. During this time, the Treasury identified five key drivers of productivity differentials: **skills, investment, enterprise, innovation and** (international) **competitiveness**.

3.9. **Skills:** The level of skills within an economy is defined by both its quantity and quality. Skills drive productivity growth by interacting with investments in physical capital, new technologies and organisational structures. The relationship was tested in an empirical study by Cambridge Econometrics (2003) who used simple pair-wise correlations to estimate productivity relationships for NUTS 2 level regions across Europe. As well as confirming positive relationships with skills (measured by the proportion of the population in higher education), they also identified the link with R&D expenditure and the degree of specialisation in high-tech sectors. The strongest association, however, was estimated between the level of productivity in a region and that in other nearby regions. The interpretation of this is that there are spatial productivity spillovers, some of which can be accounted for through the transmission of skills and knowledge across borders.

3.10. **Investment:** Capital investment is assumed to be an important determinant of productivity growth. In general, the more capital available to workers then the more productive the workers are. To test this assumption Webber *et al*. (2009) used plant-level data to examine the determinants of regional productivity differentials across regions of England. The authors concluded that investment in capital stock was an important determinant of productivity growth. They also identified a number of other factors that drive regional productivity growth including industry mix, ownership and skills. Moreover, the authors recognised and estimated the importance of location-specific factors, such as travel time and population density, which accentuate the importance and roles of agglomeration in enhancing productivity growth.

This issue of agglomeration was further explored in Rice and Venables (2004) who examine the determinants of spatial productivity differentials at the level of NUTS 3

regions across the UK. They found also that the proximity to economic mass had a significant effect on productivity growth.

3.11. **Enterprise:** Throughout the academic literature there is strong evidence that suggests that seizing new business opportunities and forcing other firms to either adapt or exit the market is important for productivity growth. Harris and Robinson (2005) used a decomposition analysis to look for sources of total factor productivity growth for UK manufacturing plants in UK regions. They concluded, in line with Schumpeter's concept of creative destruction, that entry and exit did indeed play a significant role.

In terms of enterprise and its link to industrial structure, Rizov and Walsh (2011) analysed the productivity differentials between rural and urban manufacturing enterprises by decomposing them into industry productivity effect and industry composition effect. Their results suggested that locations with high productivity are also characterised by industrial structure enhancing productivity.

3.12. **Innovation:** The successful exploitation of new ideas (innovation) is an important factor in driving productivity growth. The form that these innovations can take includes new technologies, new products, new processes and new ways of working. Without specifying the type of innovation, Haskel and Wallis (2013) explored the relationship between public sector investment in innovation and its effect of private sector productivity. The paper reports a positive correlation between the two and hence provides evidence of a spillover effect. The paper, however, does not identify the mechanism through which this spillover from innovation investment occurs.

3.13. **Competitiveness:** Competition improves productivity by creating incentives to innovate and forcing firms to work more effectively through imitations of organisational structures and technology. The presence of Multi-National Enterprises (MNEs) increases competition and can boost productivity in two ways. First, MNEs by nature are internationally competitive and therefore provide a direct boost to productivity growth in the local economy; and second, local firms can benefit through spillover effects. In an analysis of manufacturing firms in the UK, Girma *et al*. (1999) reported that foreign owned firms did indeed have higher levels of productivity than domestic owned firms, but were unable to identify any evidence of intra-industry productivity spillovers.

Criscuolo and Martin (2003) further investigated the impact of foreign ownership on productivity in an attempt to identify the characteristics that made MNEs more productive. They concluded that there was strong evidence of a productivity advantage for US firms that are consistently greater than other MNEs in the United Kingdom.

UK Spatial Productivity Performance

3.14. Businesses in the UK are less productive than those in some other developed economies. For example, the ONS estimates that productivity in the United Kingdom, as measured as output per hour was 21 percentage points below the average for the rest of the major G7 industrialised economics in 2012. This was the

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widest gap since 1992. It was also 3 percentage points below its level in the pre-recession year of 2007, and 16 percentage points below the counterfactual level: the level that would have been reached had productivity grown at the average rate achieved before the recession.

3.15. In terms of the UK's performance over time, the ONS reports that UK labour productivity grew steadily from the 1970 to 2008. However, between its peak in the first quarter of 2008 and the trough in the second quarter of 2009, labour productivity (output per worker) fell by 4.3 percent. Since then, average UK labour productivity has remained relatively flat but still some way below its trend growth rate, thereby suggesting it is falling further behind its potential. The ONS suggests that the reason for its sluggish productivity performance is multifaceted, but is associated with company behaviours, the flexibility of the labour market, the structure of the economy and the role of the financial sector.

3.16. In the most recent period, following 2012 when the UK labour market grew more strongly than output and productivity therefore fell, the data for 2013 seemed to have seen productivity becoming more stable. The latest estimates of UK productivity in the third quarter of 2013, however, suggest that on an output per hour basis, labour productivity decreased by 0.3 percent.

3.17. Productivity levels vary across the UK, generally falling as one moves further away from the centre of London. This disparity in productivity between England's capital and the UK's regions is clearly visible in Figure 1. It shows that productivity levels in South West England (including the WoE), as measured by GVA per hour worked, are 7 percent below the UK average and some 37 percent behind that of London.

Figure 1: Productivity by Region (nominal GVA per hour worked)
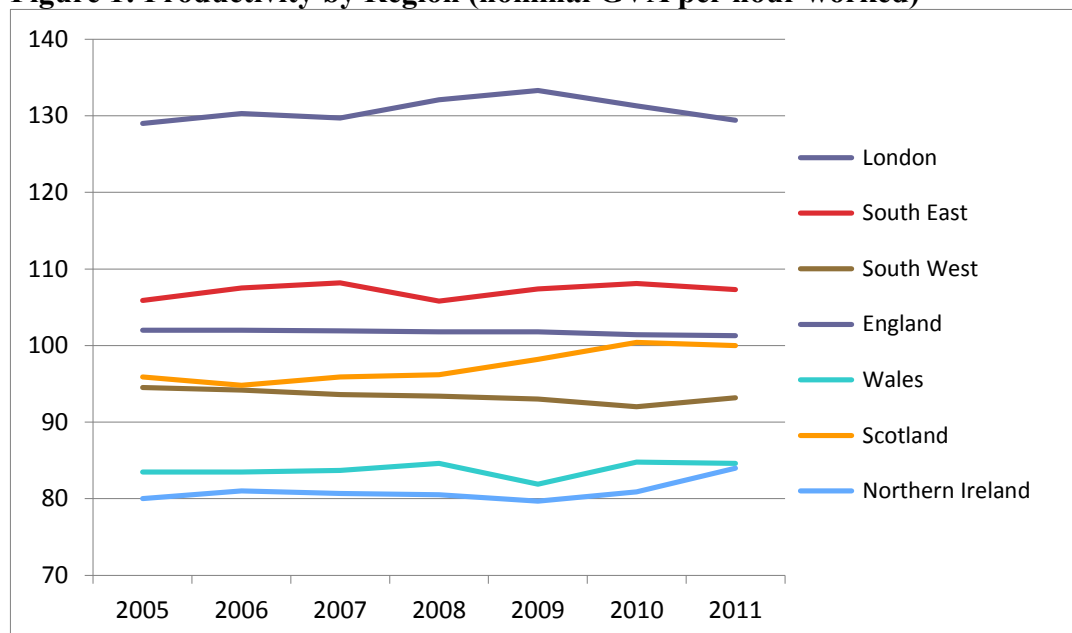
Source: ONS

3.18. The lowest level of geography that the ONS publish 'official' productivity statistics is at the NUTS1 regional level as shown in Figure 1. This causes difficulties for policymakers who need information at a much lower level of geography. As such, the ONS has published a number of experimental statistics at a lower level of geography. Figure 2 uses their estimates to illustrate the productivity of a sample of LEP sub-regions. It reveals that the WoE has higher rates of productivity than its comparator Core City LEPs and, since 2004, has grown at a faster rate.

Figure 2: Nominal GVA per hour worked, by WoE LEP comparator sub-regions using the weighted average of the NUTS3 areas, 2004-2011
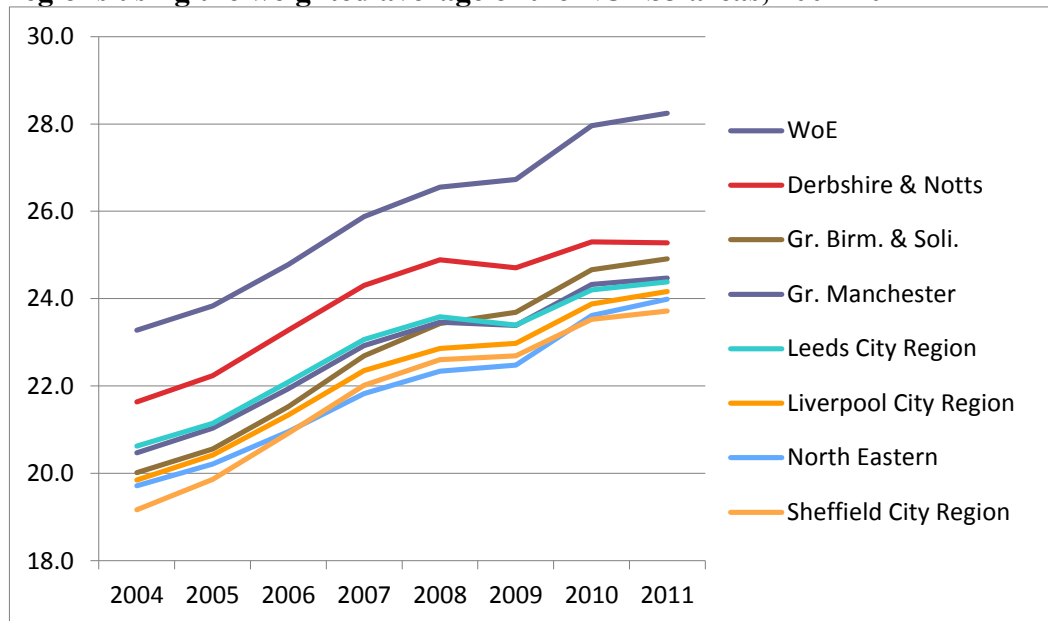
Source: ONS, workings carried out by WoE LEP Economic Intelligence Steering Group

3.19. In terms of productivity growth, the overall picture is not as encouraging. When compared against all other LEP sub-regions, WoE LEP area was ranked equal 16th amongst 39 LEPs. It is a commonly held view and an empirical fact across countries and regions that the more prosperous an economy is in terms of GDP then the lower the rate of increase. What is more important, however, is whether an economy is fulfilling its potential and whether there are barriers which can be removed that are restricting its achievement.

3.20. The lowest level of geography that the ONS publish productivity statistics for is NUTS3. Due to the small sample size the data is smoothed in order to reduce some of the inherent volatility, however, caution should still be taken when interpreting the results. Figure 3 presents the results for both WoE NUTS3 sub-regions. They show that both areas are above the UK and English national average. The City of Bristol has experienced an increase in its productivity over this time period, whereas productivity rates appear to have declined across the combined sub-regions of BANES, North Somerset and South Gloucestershire.

Figure 3: Nominal (smoothed) GVA per hour worked indices; NUTS3 sub-regions 2004 - 2011
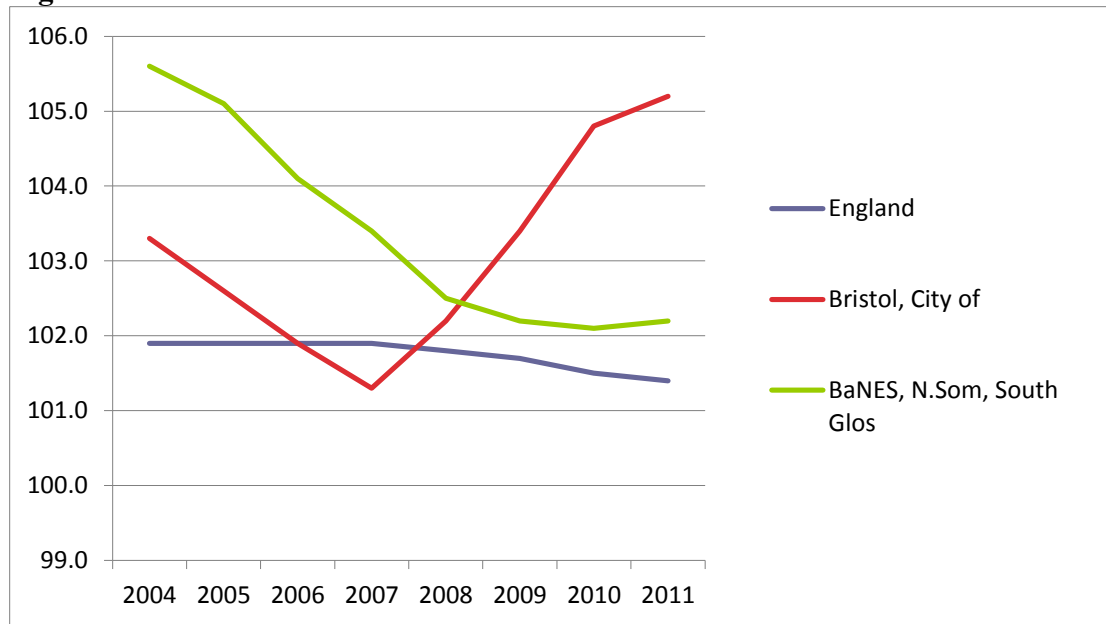
Source: ONS

3.21. All the ONS's productivity outputs are constructed from data for individual firms collected through the ONS surveys. Since 2004, the ONS has provided secure access to confidential microdata for statistical analysis by accredited researcher econometric experts. Accordingly, in this study, analysis of individual survey returns has enabled us to look at individual drivers of productivity.

3.22. Webber and Horswell (2009) used the ONS microdata to present the pattern of labour productivity across England and Wales at a district/unitary authority level. Figure 4 shows a broad centre-periphery pattern overall with the highest values more clearly concentrated in and close to London. There are also higher values present in the main conurbations and along the M4 corridor, which extends to and includes the WoE jurisdiction. There appears to be a concentration of areas with higher levels of labour productivity in the outer South East and the London-Birmingham axis. In comparison, relatively low levels of productivity are evident in Wales, the South West and the North East.

Figure 4: Labour productivity, England and Wales

Std Deviation: LLABPROD

- < 2.73 (8)
- 2.73 - 2.97 (44)
- 2.97 - 3.21 (138)
- Mean = 3.21
- 3.21 - 3.45 (129)
- 3.45 - 3.69 (41)
- > 3.69 (8)
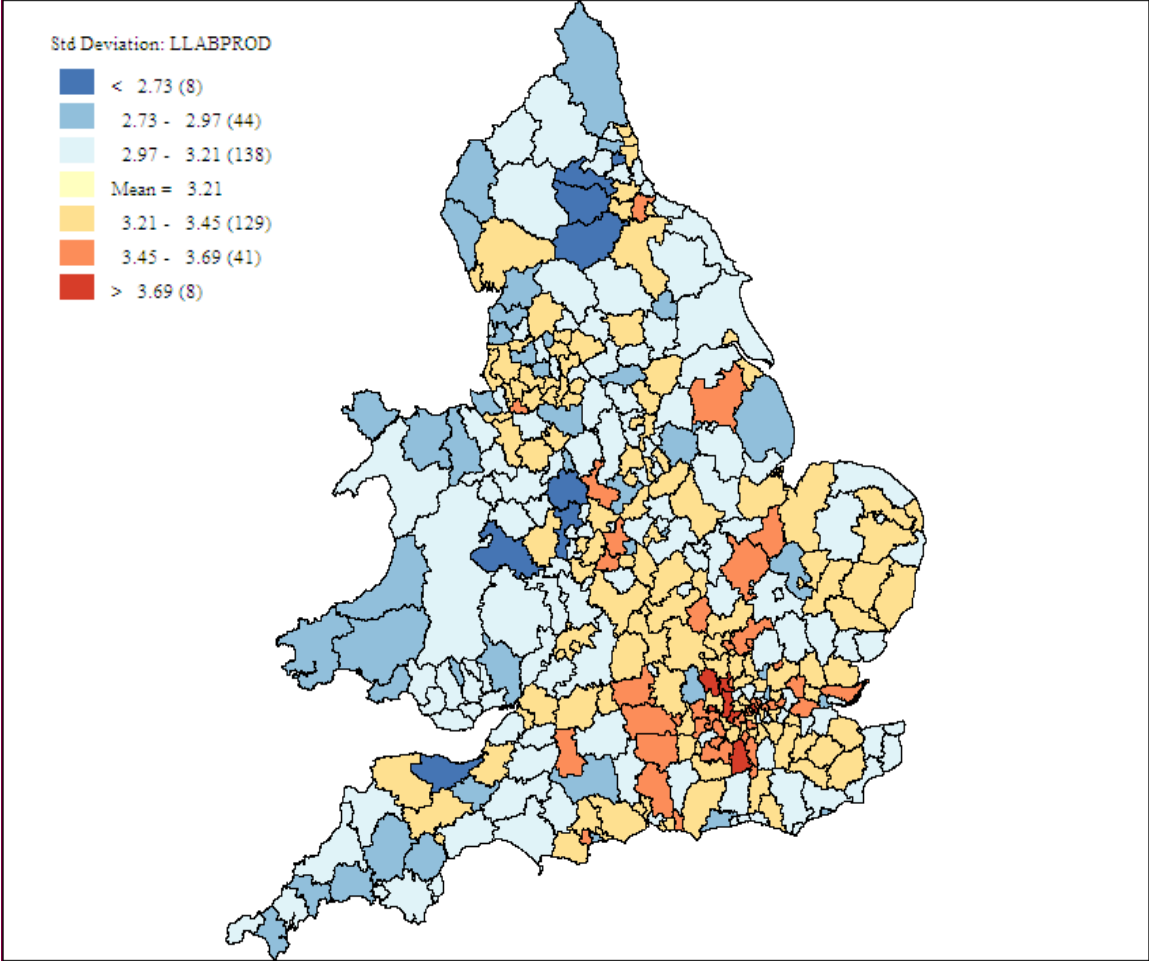
Source: Webber and Horswell (2009)

4. DATA

4.1.   This section reports on the data sets and statistical framework used to model productivity.

Datasets

4.2.   The analysis presented here uses plant level data held by the Office for National Statistics in their Annual Respondents Database (ARD), their Annual Business Survey (ABS) and their capital stock estimates. Our sample includes all plants across the UK excluding those in Northern Ireland.

4.3.   The ARD draws on the Annual Business Inquiry (ABI) and brings together a wide range of data relating to individual business units (ONS, 2002). This data set is constructed from a compulsory business survey. It includes all firms with greater than 250 employees in England, which are surveyed on an annual basis as a statutory requirement, but only a sample of firms with fewer than 250 employees firms, which are sampled on a random basis (see ONS, 2002, p.2).

4.4.   The main implication of this sampling frame is that the sample of firms included year on year will change. Hence, a large number of firms are needed in each year to ensure validity; the ARD provides information on about 68,000 establishments who have approximately 400,000 local plants (also called local units). This dataset was created for the Economic Analysis and Satellite Accounts Division of the ONS for research purposes and is available from 1998 to 2008 for the production, construction, distribution and service industries.

4.5.   The ABS replaced the ARD in 2009 and data is currently available between 2009 and 2011. It is the largest business survey conducted by the ONS in terms of the combined number of respondents and the variables it covers. It is also the key resource for understanding the detailed structure and performance of businesses across the UK; it is also a large contributor of business information to the UK National Accounts. The ABS provides a number of high-level indicators of economic activity, such as the total value of sales and work completed by businesses, the value of purchases of goods, materials and services, stocks, capital expenditure, and total employment costs. By combining ABS with employment information from the Business Register and Employment Survey (BRES), it is possible to measure value added and costs per head.

4.6.   The ONS also permits access to estimates of firm level capital stock estimates. These estimates can be merged into the ARD and ABS data sets.

Variables

4.7.   This empirical investigation analyses the data set at the plant level. It accounts for the numbers of plants within a firm by using the variable *llunit*, which is the log of the number of plants within the firm establishment. The vast majority of establishments in the UK have only one plant (such as an independent newsagent) but there are also many examples of chain stores and other establishments that have more than one local unity (such as Tesco, John Lewis or Spar).

4.8.   GVA at factor cost per worker is used as the measure of productivity, measured at the plant level (and therefore work-based) rather than the place of worker residence.

4.9.   Data on firm-specific capital stock is obtainable from the ONS and is matched with firm-specific data within the ARD. Although this is not identical to the Treasury investment productivity driver (CURDs, 2003), it represents the current stocks of past capital investments.

4.10.   Standard Industry Classifications (SIC) were employed in the analysis to control for differences in productivity across sectors. The SICs experienced a major change during our period of study when SIC indicators were reclassified from the SIC1992 to the SIC2002 and then to the SIC2007. To facilitate an effective analysis and continuity, all SIC1992 and SIC2002 codes were reclassified to the SIC2007 codes.

4.11.   The WoE LEP stated that they would like to include analyses of their Revised Priority Sectors, which are 'AE&A', 'creative industries', 'P&LS', 'high-tech', and 'low carbon' industries. A full list of the subdivisions of these categories can be found in Section 11.

4.12.   The geographical location of firms is of interest. The ARD and ABS data sets include a variable relating to the local authority district of the plant. When required, local authority identifiers were then merged in order to generate new variables that indicated whether the plant is in the WoE LEP area, a WoE LEP defined comparator area or in a Core City. WoE LEP itself can be divided into four local authority areas:

- Bath and North East Somerset (BANES)
- Bristol City
- North Somerset
- South Gloucestershire

These local authority areas were merged to cover the WoE LEP area.

4.13.   Similar hierarchical merging was undertaken in order to generate area identifiers for the following LEPs comparator areas of interest:

- Swindon and Wiltshire
- Oxfordshire
- Gloucestershire
- Greater Cambridge and Greater Peterborough
- Thames Valley Berkshire

4.14. There is also the desire to compare the WoE LEP region with UK Core City regions. In order to maintain relevance for all local authorities in the WoE LEP area, the decision was taken to include all local authorities in comparator Core City regions. So, for instance, instead of using only the firms in the Birmingham local authority to represent the Birmingham Core City region, we included all firms in the Cannock Chase, East Staffordshire, Lichfield, Tamworth, Birmingham, Solihull, Bromsgrove, Redditch and Wyre Forest local authorities, which collectively represent the Greater Birmingham and Solihull LEP. Our Core City regions are captured using the following LEP areas:

- Greater Birmingham and Solihull LEP
- D2N2 (Derby, Derbyshire, Nottingham, Nottinghamshire) LEP
- Leeds City Region LEP
- Liverpool City Region LEP
- Manchester LEP
- Newcastle and the North East LEP
- Sheffield City Region LEP

4.15. The decision was also taken to recognise the centric nature of the UK and include two extra area identifiers to capture the London effect: one capturing the City of London and one capturing the rest of the London local authorities. Here, these areas are called:

- City of London
- London (excluding City of).

4.16. The variables used in this analysis are described in Table 1.

Table 1: Variable descriptions

Variable name	Description
LabProd	Gross value added at factor cost divided by the number of employees
West of England LEP	= 1 if the plant is in a local authority district within the West of England LEP area = 0 otherwise
Manchester LEP	= 1 if the plant is in a local authority (LA) district within the Manchester LEP area = 0 otherwise
Greater Birmingham and Solihull LEP	= 1 if the plant is in a LA district within Greater Birmingham and Solihull LEP area = 0 otherwise
Newcastle and the North East LEP	= 1 if the plant is in a LA district within the Newcastle and the North East LEP area = 0 otherwise
Leeds City Region LEP	= 1 if the plant is in a LA district within the Leeds City Region LEP area = 0 otherwise
Sheffield City Region L:EP	= 1 if the plant is in a LA district within the Sheffield City Region LEP area = 0 otherwise
Notts D2N2	= 1 if the plant is in a LA district within the D2N2 LEP area = 0 otherwise
Liverpool City Region LEP	= 1 if the plant is in a LA district within the Liverpool City Region LEP area = 0 otherwise
City of London	= 1 if the plant is in a City of London LA district = 0 otherwise
London (excluding City of)	= 1 if the plant is in a LA district within the London Enterprise Panel LEP area = 0 otherwise
Swindon and Wiltshire	= 1 if the plant is in a LA district within the Swindon and Wiltshire LEP area = 0 otherwise
Oxford	= 1 if the plant is in a LA district within the Oxfordshire LEP area = 0 otherwise
Gloucestershire	= 1 if the plant is in a LA district within the Gloucestershire LEP area = 0 otherwise
Cambridge and Peterborough	= 1 if the plant is in a LA district within the Greater Cambridge and Greater Peterborough LEP area = 0 otherwise
Thames Valley	= 1 if the plant is in a LA district within the Thames Valley Berkshire LEP area = 0 otherwise
Advanced engineering & aerospace	= 1 if the plant is listed as operating in advanced engineering / aerospace SIC codes = 0 otherwise
Creative industries	= 1 if the plant is listed as operating in the creative industries SIC codes = 0 otherwise
Professional and legal services	= 1 if the plant is listed as operating in the professional and legal services SIC codes = 0 otherwise
High-tech	= 1 if the plant is listed as operating in the high-tech SIC codes = 0 otherwise
Low Carbon	= 1 if the plant is listed as operating in the low carbon SIC codes = 0 otherwise
Ln (unit)	The natural logarithm of the number of local units in the establishment
Ln (capital)	The natural logarithm of the amount of capital stock in the plant
Ln (employment)	The natural logarithm of the number of employees

Notes: A full list of the sector subdivisions, as classified and provided to us from the WoE LEP, can be found in section 11.

5. RESULTS: THE WOE LABOUR PRODUCTIVITY PREMIUM

5.1. In all the regression tables presented in this report, the coefficients relating to areas represent a percentage difference in labour productivity in that area relative to the sample average across all other areas, which we term 'a control'.

5.2. Two pieces of information are required to understand each column of results. First, any coefficients marked ***, ** or * are found to be statistically significantly different from the sample average. Second, the initial column in each table contains area coefficients that represent the gaps in productivity that we seek to explain, using further regression analysis in later columns.

5.3. We recognise that plants in the London region have above average labour productivity. Accordingly, we have included in all regressions two additional variables: one relating to the City of London and one relating to the rest of the London Enterprise Panel area. As our a priori expectations are that labour productivity will be higher in these areas, we also expect these coefficients to be strongly positive and significantly different from the sample average. Including these two extra area variables in the regression affects the sample's average labour productivity estimate of the control areas, since the control area now represents all areas excluding the City of London and the London Enterprise Panel area.

5.4. It would be possible to include a further area variable that captures the whole of the South East in which we also expect labour productivity to be higher than the average. However, we decided not to follow this strategy as such an area variable would include several LEPs that have a disparate range of labour productivity gaps. This also means that the interpretation of the coefficients corresponding to all area variables must be interpreted relative to all other plants not included in the area variables included in the regression – i.e. relative to the control group areas.

5.5. The easiest way to put this knowledge across is through an example. Table 2 presents the results of a regression analyses that seek to identify whether labour productivity varies across Core City LEPs. The coefficient for the WoE commences in our table in 1998-1999 at a value of 0.011. This means that labour productivity was on average 1.1 percent above the national average (once we exclude the other LEPs, the City of London and London (excluding City of) from that national average). The estimated difference from the average for plants in the WoE LEP could have occurred by chance as it is not statistically different from zero (signified through the use of an '*' to represent statistical significance at the 10% level). As we look across the row, we see that the coefficient increases to 0.036 in 2000-2001, which is statistically significantly different from zero, and indicates an emerging labour productivity gap between plants in the WoE and firms in areas in the control group. This gap continues to increase until the 2006-2007 period where it reaches 11.5 percent, after which it begins to diminish but stabilises at about 7.0-7.5 percent.

Table 2: Determinants of labour productivity, whole sample

		1998-99	2000-01	2002-03	2004-05	2006-07	2008-09	2010-11
	N	838,278	951,349	969,328	1,021,812	922,606	998,653	1,024,279
Spatial	West of England LEP	0.011	0.036***	0.052***	0.085***	0.115***	0.074***	0.072***
		(0.007)	(0.007)	(0.007)	(0.006)	(0.007)	(0.011)	(0.007)
	Manchester LEP	-0.009*	0.009*	0.056***	0.045***	0.050***	-0.002	0.024***
		(0.005)	(0.005)	(0.004)	(0.004)	(0.005)	(0.007)	(0.005)
	Greater Birmingham and Solihull LEP	0.002	-0.016***	0.001	0.035***	0.010**	0.049***	0.045***
		(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.008)	(0.006)
	Newcastle and the North East LEP	-0.115***	-0.066***	0.054***	0.019***	0.010	0.006	-0.015***
		(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.010)	(0.006)
	Leeds City Region LEP	-0.066***	-0.069***	-0.048***	-0.048***	-0.048***	-0.061***	-0.047***
		(0.005)	(0.005)	(0.004)	(0.004)	(0.005)	(0.007)	(0.005)
	Sheffield City Region LEP	-0.080***	-0.057***	-0.061***	-0.048***	-0.049***	-0.059***	-0.061***
		(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.009)	(0.006)
	Notts D2N2	-0.032***	-0.029***	-0.004	-0.040***	-0.017***	-0.035***	-0.022***
		(0.006)	(0.006)	(0.005)	(0.006)	(0.006)	(0.009)	(0.006)
	Liverpool City Region LEP	-0.061***	-0.053***	0.008	-0.025***	-0.056***	-0.104***	-0.048***
		(0.007)	(0.006)	(0.006)	(0.006)	(0.007)	(0.010)	(0.006)
	City of London	0.210***	0.343***	0.266***	0.385***	0.170***	0.332***	0.406***
		(0.014)	(0.014)	(0.013)	(0.014)	(0.012)	(0.020)	(0.013)
	London (excluding City of)	0.105***	0.147***	0.124***	0.087***	0.021***	0.078***	0.112***
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Firm	Ln (unit)	-0.070***	-0.060***	-0.060***	-0.037***	-0.046***	-0.074***	-0.060***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	R^2	0.035	0.030	0.030	0.013	0.017	0.034	0.025
	F statistic	2684.32***	2305.78***	2358.31***	1068.20***	1208.73***	2355.44***	1798.81***

Notes: Equations estimated using OLS. Robust standard errors are presented in parentheses. ***, ** and * denote the variable is statistically significant at the 1%, 5% and 10% level respectively. Dependent variable in each regression is Ln (LabProd)

5.6.   Coefficient estimates for the other Core City LEP areas are also presented in Table 2. It is noteworthy that although the WoE LEP productivity gap commenced in the same place as the Greater Birmingham and Solihull LEP productivity gap, plants in the WoE LEP area seem to have improved their performance to a relatively larger extent. Summative profiles for the Core City LEPs between 1998 and 2011 are presented in Figure 5.

Figure 5: Productivity gap, based on Table 2
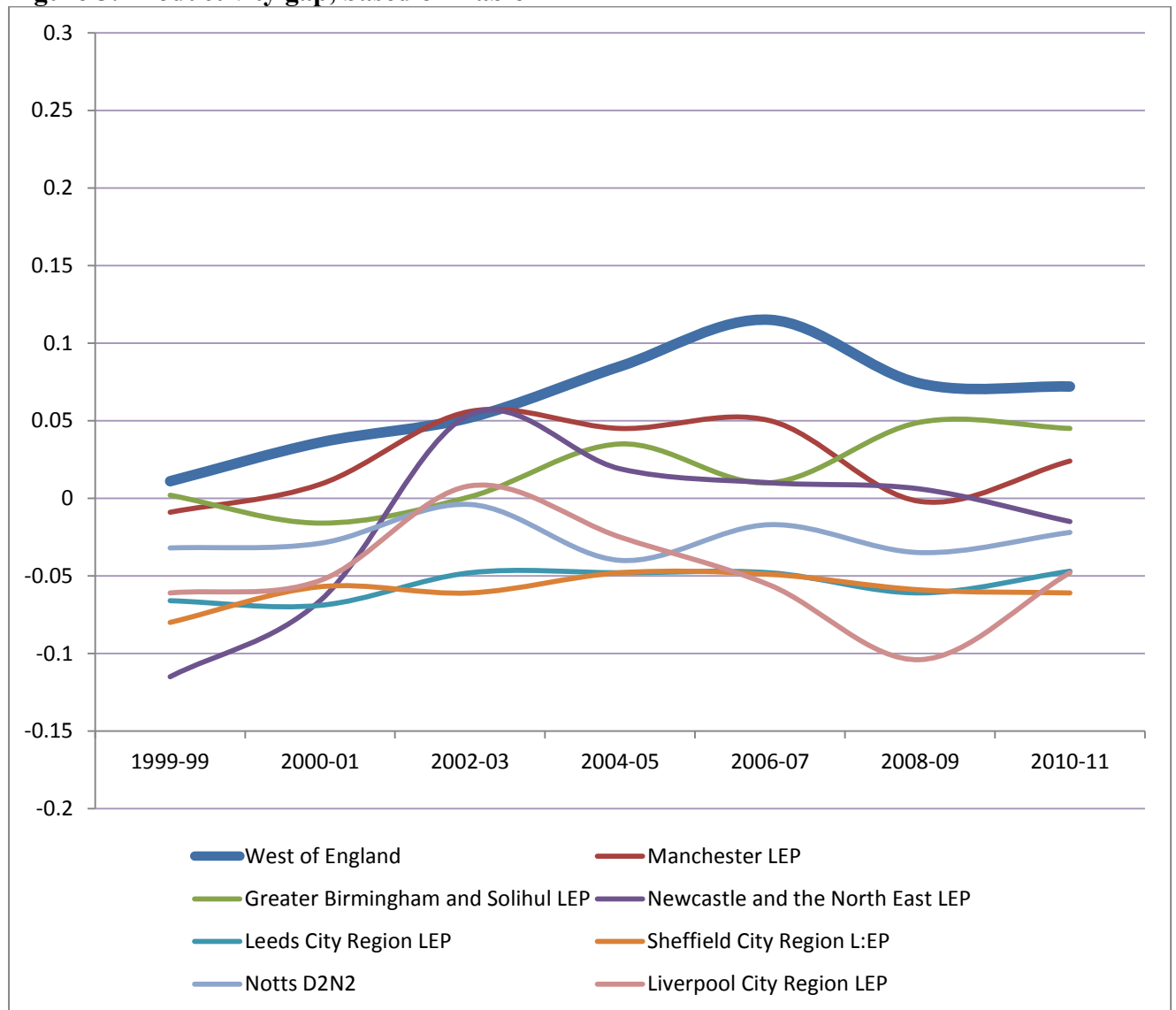
Notes: Lines smoothed

5.7.   It is natural for the productivity gap to fluctuate due to increases and decreases of prices and costs over time. However, the pleasing thing from the WoE LEP perspective is that their productivity gap is consistently positive relative to this average.

5.8.   A similar type of analysis can be carried out for comparator LEP areas. This is presented in Table 3 and Figure 6.

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Table 3: Determinants of labour productivity, whole sample

		1998-99	2000-01	2002-03	2004-05	2006-07	2008-09	2010-11
	N							
Spatial	West of England LEP	0.030***	0.054***	0.057***	0.092***	0.121***	0.080***	0.083***
		(0.007)	(0.007)	(0.007)	(0.006)	(0.007)	(0.011)	(0.007)
	Swindon and Wiltshire LEP	0.118***	0.132***	0.094***	0.000	-0.009	0.106***	0.010
		(0.015)	(0.015)	(0.013)	(0.014)	(0.013)	(0.021)	(0.009)
	Oxfordshire LEP	0.068***	0.077***	0.031***	0.035***	0.032***	0.050***	0.034***
		(0.010)	(0.009)	(0.009)	(0.008)	(0.008)	(0.013)	(0.009)
	Gloucestershire LEP	0.046***	-0.013	-0.077***	-0.080***	-0.013	0.037***	0.061***
		(0.010)	(0.010)	(0.009)	(0.009)	(0.009)	(0.013)	(0.009)
	Great Cambridge and Greater Peterborough LEP	0.057***	0.070***	0.042***	0.053***	0.060***	0.057***	0.088***
		(0.007)	(0.007)	(0.007)	(0.006)	(0.006)	(0.010)	(0.007)
	Thames Valley Berkshire LEP	0.217***	0.211***	0.143***	0.178***	0.055***	0.126***	0.165***
		(0.009)	(0.008)	(0.008)	(0.007)	(0.007)	(0.012)	(0.008)
	London City	0.230***	0.360***	0.270***	0.391***	0.176***	0.338***	0.417***
		(0.014)	(0.014)	(0.013)	(0.014)	(0.012)	(0.020)	(0.013)
	London (excluding city of)	0.125***	0.164***	0.128***	0.093***	0.027***	0.084***	0.123***
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Firm	Log (unit)	-0.070***	-0.060***	-0.060***	-0.036***	-0.046***	-0.074***	-0.060***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	R^2	0.035	0.030	0.030	0.013	0.017	0.034	0.026
	F statistic	3334.48***	2876.64***	2891.89***	1337.74***	1449.74***	2874.27***	2230.20***

Notes: Equations estimated using OLS. Robust standard errors are presented in parentheses. ***, ** and * denote the variable is statistically significant at the 1%, 5% and 10% level respectively. Dependent variable in each regression is Ln (LabProd)

Figure 6: Productivity gap, based on Table 3
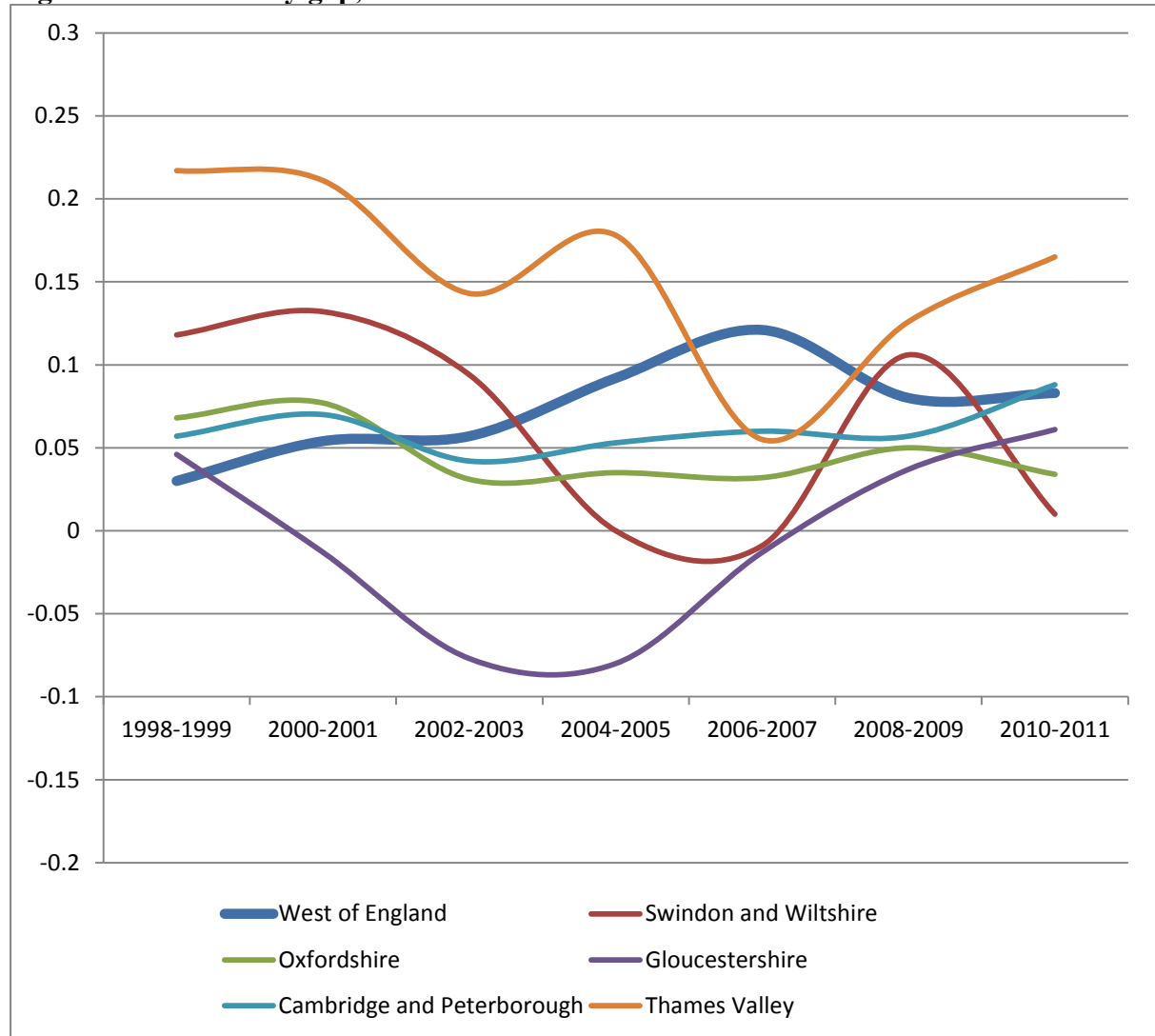
Notes: Lines smoothed

5.9. Several points are worth emphasising in Table 3 and Figure 6. First, as the size of the sample for each of these comparator LEP areas is smaller than for the Core Cities, the corresponding lines are much more variable and sensitive to the inclusion and exclusion of plants; this means that we should interpret these results with greater caution. Second, plants in the Thames Valley Berkshire LEP are the only ones from these comparator groups that are, on average, (almost) consistently outperforming plants within the WoE LEP, with plants in most other areas included here performing less well. Third, and as shown in Figure 5, the trend for the WoE is upwards and hence it labour productivity is increasing faster than the average.

5.10. Of course, these productivity gaps represent raw estimates that do not take into consideration the differences in industrial structure, capital stock and the contributory effect of the size of the workforce. It is therefore worth investigating the reasons for this higher than average labour productivity in the WoE LEP, and this is where we now proceed.

Baseline assessment: 1998-1999

5.11.   Table 4 presents four columns of results for the 1998-1999 time-period. Column 1 illustrates that plants' gross value added at factor cost per worker was greatest in the City of London, where labour was 22 percent more productive than the average, but was also very high in the rest of London, where it was on average 12 percent more productive. Plants in the WoE were 2.2 percent more productive than the average. Column 1 also shows that there were some diseconomies of scale associated with having more than one plant in the establishment – these diseconomies of scale are usually thought to be associated with administrative or managerial inefficiencies associated with the complexity of organising and running complex multi-site businesses.

5.12.   We need to know why plants in the WoE LEP area were performing better than the average. By including extra variables in the regression we are able to identify what plants in the WoE LEP area would look like if we took account of particular attributes. In other words, if the differences in capital stocks were included in the equation then how much of the gap in labour productivity remains.

5.13.   Accordingly, in column 2 we include the (revised) priority sectors that are thought to give the WoE LEP its relative strength. Here, we find that all these sectors do contribute strongly to labour productivity measures. Creative industries were particularly labour productivity enhancing in the 1998-1999 time period, and they were more than twice as productive as the average firm. Firms operating in the low carbon priority sector were also much more productive than the average plant, as they are estimated here to have been about 87 percent more productive than the average plant. Plants operating in the AE&A, P&LS and high-tech priority sectors were also between 32 percent and 49 percent more productive than the average plant.

5.14.   Including differences in sector compositions reduces the area coefficients; in the case of the WoE the reduction is by 0.4. This implies that part of the explanation why the WoE was identified as doing so well is because of its sector composition. Plants in the WoE were still 1.8 percent above the sample average for the year and this requires further explanation.

5.15.   Column 3 augments the model by including firm-specific capital stocks. But, instead of reducing the WoE coefficient, which it does for the other two area variables corresponding to the City of London and London, the productivity gap for the WoE increases to 3.5 percent. This implies that plants in the WoE area are, on average, even more productive than the average plant in our sample once we take into account capital stocks.

5.16.   The inclusion of the capital variable, which is associated with an increase in the coefficient size for plants in the WoE, is implying that the capital that we have in our area is not as productive as it is elsewhere, that is to say, it is not enhancing labour productivity as much in the WoE as it is elsewhere. Part of this finding may be due to the underlying industrial structure that is not fully captured through the inclusion of the industry variables that capture the influence of priority sectors on the local economy, and that focus on the priority sectors may not be the best thing to do to understand fully labour productivity growth in the WoE LEP area.

Table 4: Determinants of labour productivity: 1998-1999, whole sample

		1	2	3	4
	N	838,278	838,278	814,881	814,881
Spatial	West of England	0.022***	0.018**	0.035***	0.028***
		(0.007)	(0.007)	(0.007)	(0.007)
	City of London	0.222***	0.186***	0.174***	0.158***
		(0.014)	(0.014)	(0.013)	(0.012)
	London (excluding city of)	0.117***	0.106***	0.076***	0.071***
		(0.003)	(0.003)	(0.003)	(0.003)
Industry	Advanced engineering & aerospace		0.489***	0.696***	0.701***
			(0.010)	(0.009)	(0.009)
	Creative industries		1.113***	0.943***	0.897***
			(0.007)	(0.006)	(0.006)
	Professional and legal services		0.354***	0.535***	0.535***
			(0.008)	(0.007)	(0.007)
	High-tech		0.329***	0.199***	0.137***
			(0.010)	(0.009)	(0.010)
	Low Carbon		0.874***	0.510***	0.480***
			(0.010)	(0.007)	(0.007)
Firm	Log (unit)	-0.070***	-0.066***	-0.080***	-0.157***
		(0.000)	(0.000)	(0.000)	(0.001)
	Log (capital)			0.213***	0.205***
				(0.001)	(0.001)
	Log (employment)				0.084***
					(0.001)
	R²	0.034	0.088	0.203	0.214
	F statistic	7294.87***	7722.45***	16022.00***	16337.98***

Notes: Equations estimated by OLS. Robust standard errors in parentheses. ***, ** and * denote the variable is statistically significant at the 1%, 5% and 10% level respectively. Dependent variable in each regression is Ln (LabProd)

5.17. Inclusion of the employment variable is designed to capture economies or diseconomies of scale that are associated with the size of the work force. Several things are worthy of note here. First, the magnitude of the *unit* variable changes from -0.080 to -0.157. This implies that there are very important diseconomies of scale associated with administrative and managerial burdens of organising a multi-plant firm. Managers need to understand why this is the case and attempt to identify how this diseconomy can be alleviated – it also looks like a very fruitful area for organisations like the WoE LEP to provide support. Second, part of the labour productivity advantage of firms in the WoE is due to the larger size of their workforces; this is illustrated by a reduction in the magnitude of the WoE variable coefficient from 3.5 percent to just less than 3 percent.

5.18. Another important issue that arises from the analysis presented above is that the current empirical investigation, based on the inclusion of the variables that capture priority sectors, diseconomies of scale due to administrative and managerial burdens of multi-plant firms, capital stocks and employment-related scale effects still leaves

most of the labour productivity advantage of the WoE unexplained. Further analysis is required to improve understanding of the labour productivity advantage that plants in the WoE have, how this can be sustained over the longer term and, potentially, how this can be improved further.

5.19.   This analysis is now extended over time to assess whether the magnitude of the labour productivity gap for the WoE is sustained over the longer time period, starting from the 2000-2001 period and moving to the 2010-2011 period, which corresponds to the most up to date data currently available.

2000-2001

5.20.   Table 5 presents the results of the analysis of the 2000-2001 data. The first strong observation is that the labour productivity gaps have increased from the baseline estimates suggesting that either the baseline estimates were on the low side or that the labour productivity growth that occurred between the two time periods favoured these larger conurbations. In the case of the WoE, plants now appear to be about 4.5 per cent more productive than the average.

5.21.   The inclusion of the priority sector variables does explain part of the WoE's labour productivity premium, with the gap reducing from by about 5 percent and hence inclusion of these industry variables are explaining about 1/9th of the premium. Also noticeable is that the magnitudes of 'AE&A' and 'P&LS' have increased, suggesting that they have become relatively more productive between these two time periods, while the coefficients for 'creative industries', 'high-tech' and 'low carbon' firms have dropped marginally.

5.22.   Augmentation of the model to include capital stock increases the magnitude of the WoE coefficient, suggesting again that the capital that plants in the WoE have access to does not enhance labour productivity as much in the WoE as it does elsewhere.

5.23.   Finally, including the employment variable in the regressions reduce the magnitude of the WoE variable coefficient only marginally, with the labour productivity premium for the WoE remaining about 6.5 percent.

Table 5: Determinants of labour productivity: 2000-2001, whole sample

		1	2	3	4
	N	838,278	838,278	814,881	814,881
Spatial	West of England	0.046***	0.039***	0.067***	0.065***
		(0.007)	(0.007)	(0.006)	(0.006)
	City of London	0.353***	0.273***	0.242***	0.227***
		(0.014)	(0.013)	(0.012)	(0.011)
	London (excluding city of)	0.157***	0.144***	0.114***	0.115***
		(0.003)	(0.003)	(0.003)	(0.003)
Industry	Advanced engineering & aerospace		0.531***	0.788***	0.776***
			(0.011)	(0.009)	(0.009)
	Creative industries		1.007***	0.825***	0.784***
			(0.006)	(0.005)	(0.005)
	Professional and legal services		0.493***	0.680***	0.666***
			(0.008)	(0.007)	(0.007)
	High-tech		0.302***	0.229***	0.183***
			(0.012)	(0.011)	(0.012)
	Low Carbon		0.746***	0.397***	0.390***
			(0.008)	(0.006)	(0.006)
Firm	Log (unit)	-0.060***	-0.054***	-0.066***	-0.134***
		(0.000)	(0.000)	(0.000)	(0.001)
	Log (capital)			0.247***	0.238***
				(0.001)	(0.001)
	Log (employment)				0.072***
					(0.001)
	R^2	0.029	0.074	0.190	0.198
	F statistic	6259.39***	7344.51***	14844.17***	15066.80***

Notes: Equations estimated by OLS. Robust standard errors in parentheses. ***, ** and * denote the variable is statistically significant at the 1%, 5% and 10% level respectively. Dependent variable in each regression is Ln (LabProd)

2002-2003

5.24. The 2002-2003 regression results explain a similar story. First, the labour productivity premium for the WoE continued to grow between this and the preceding time period, and was at about 5.3 percent. Part of this can be explained by the presence of priority sectors in the region, with the labour productivity gap falling from 5.3 to 4.2 percent.

5.25. Augmentation of the model to include capital stock increases the magnitude of the WoE coefficient, suggesting again that the capital that we have in our area does not enhance labour productivity as much in the WoE as it is elsewhere. But, this time, the effect of including capital is much smaller. This is evidence to suggest that either our capital stocks were becoming more labour productivity enhancing or that capital stocks were becoming less labour productivity enhancing in other areas; it is possible that both of these issues were occurring at the same time.

Table 6: Determinants of labour productivity: 2002-2003, whole sample

		1	2	3	4
	N	838,278	838,278	814,881	814,881
Spatial	West of England	0.053***	0.042***	0.058***	0.056***
		(0.006)	(0.006)	(0.006)	(0.006)
	City of London	0.266***	0.233***	0.203***	0.186***
		(0.013)	(0.013)	(0.012)	(0.012)
	London (excluding city of)	0.124***	0.112***	0.085***	0.084***
		(0.003)	(0.003)	(0.003)	(0.003)
Industry	Advanced engineering & aerospace		0.483***	0.735***	0.735***
			(0.010)	(0.009)	(0.009)
	Creative industries		0.873***	0.951***	0.952***
			(0.005)	(0.005)	(0.005)
	Professional and legal services		0.263***	0.547***	0.548***
			(0.009)	(0.007)	(0.006)
	High-tech		0.244***	0.253***	0.225***
			(0.010)	(0.010)	(0.010)
	Low Carbon		0.332***	0.325***	0.325***
			(0.010)	(0.009)	(0.009)
Firm	Log (unit)	-0.060***	-0.060***	-0.065***	-0.124***
		(0.000)	(0.000)	(0.000)	(0.001)
	Log (capital)			0.210***	0.206***
				(0.001)	(0.001)
	Log (employment)				0.065***
					(0.001)
	R^2	0.030	0.067	0.158	0.166
	F statistic	6386.32***	6308.07***	13268.13***	13698.59***

Notes: Equations estimated by OLS. Robust standard errors in parentheses. ***, ** and * denote the variable is statistically significant at the 1%, 5% and 10% level respectively. Dependent variable in each regression is Ln (LabProd)

5.26. Inclusion of the employment variable again suggests significant scale economies are attainable from large workforces and that this is partially related to the diseconomies of scale associated with the administrative and managerial difficulties of having multi-plant firms. The larger workforce sizes that are present in the WoE LEP areas continue to explain a small part of the WoE labour productivity premium.

5.27.   The results for the 2004 – 2005 time period regression analyses are presented in Table 7. These indicate a continued improvement in the labour productivity premium for plants in the WoE LEP region from 5 percent in 2002-2003 to almost 9 percent, relative to those in all other areas. Of particular interest is that the average labour productivity of plants in the WoE not significantly different from the labour productivity of plants in the outer London region.

Table 7: Determinants of labour productivity: 2004-2005, whole sample

		1	2	3	4
	N	838,278	838,278	814,881	814,881
Spatial	West of England	0.087***	0.064***	0.066***	0.065***
		(0.006)	(0.006)	(0.006)	(0.006)
	City of London	0.387***	0.225***	0.249***	0.245***
		(0.014)	(0.012)	(0.012)	(0.012)
	London (excluding city of)	0.089***	0.074***	0.050***	0.050***
		(0.003)	(0.003)	(0.003)	(0.003)
Industry	Advanced engineering & aerospace		0.587***	0.812***	0.809***
			(0.010)	(0.010)	(0.010)
	Creative industries		0.914***	1.095***	1.097***
			(0.004)	(0.004)	(0.004)
	Professional and legal services		0.838***	0.962***	0.957***
			(0.007)	(0.007)	(0.007)
	High-tech		0.370***	0.405***	0.400***
			(0.011)	(0.010)	(0.010)
	Low Carbon		0.442***	0.406***	0.408***
			(0.012)	(0.010)	(0.010)
Firm	Log (unit)	-0.037***	-0.031***	-0.034***	-0.045***
		(0.000)	(0.000)	(0.000)	(0.001)
	Log (capital)			0.231***	0.228***
				(0.001)	(0.001)
	Log (employment)				0.012***
					(0.001)
	R^2	0.013	0.084	0.189	0.189
	F statistic	2829.59***	7670.90***	15445.08***	14656.38***

Notes: Equations estimated by OLS. Robust standard errors in parentheses. ***, ** and * denote the variable is statistically significant at the 1%, 5% and 10% level respectively. Dependent variable in each regression is Ln (LabProd)

5.28.   A larger part of the labour productivity premium for plants in the WoE LEP area is becoming due to the presence of priority sector firms. In the previous time period, about 20 percent of the premium was explained and this proportion and this has now increased to about 25 percent. The added value provided by firms operating in these sectors is mainly due to changing consumer demands and improvements in the

productive efficiencies of plants. Of note is that the magnitudes of the coefficients of all the priority sectors have increased from the 2002-2003, which suggests that these sectors were increasing in importance for the productivity measure of the national economy.

5.29.   There remains an increase, albeit small, in the WoE variable coefficient associated with the inclusion of the capital stock variable, and the WoE variable coefficient again drops slightly with the further inclusion of the employment variable. This suggests stability in results and points to consistent policy initiatives.

5.30.   It needs to be emphasised that once variations in employment size, capital stocks and priority sectors have been taken into account, plants in the WoE now appear to be more productive that plants in London, but much less productive than plants in the City of London. Part of the explanation behind this result could be the adverse effect of congestion and strong market competition in the London area that reduces value added, the growing influence of other not listed sectors that are more abundant in the WoE area, and / or a better use of the labour force in terms of the ratio of part time to full time workers.

2006 - 2007

5.31.   As the boom time prolonged, the labour productivity premium for plants in the WoE continued to rise. By the 2006-07 period and relative to the average British plant, the productivity premium for plants in the WoE was nearly 12 percent. Table 8 illustrates that the labour productivity premium of both the City of London and of the rest of London was already beginning to fall.

5.32.   The importance of the priority sectors continued to increase and, by this time period, they accounted for about 35 percent of the labour productivity premium of the WoE. 'AE&A', 'creative industries', 'high-tech' and 'low carbon' industries increased in importance, while the relative importance of 'P&LS' dropped marginally.

5.33.   In line with the previous year's results, capital stocks and employment remain important determinants of labour productivity but this effect is universal and does not explain the WoE productivity premium for 2006-2007.

Table 8: Determinants of labour productivity: 2006-2007, whole sample

		1	2	3	4
	N	838,278	838,278	814,881	814,881
Spatial	West of England	0.118***	0.077***	0.080***	0.080***
		(0.007)	(0.006)	(0.006)	(0.006)
	City of London	0.173***	0.130***	0.121***	0.120***
		(0.012)	(0.011)	(0.011)	(0.011)
	London (excluding	0.024***	0.013***	0.005*	0.005*
	city of)	(0.003)	(0.003)	(0.003)	(0.003)
Industry	Advanced engineering		0.772***	0.999***	0.997***
	& aerospace		(0.009)	(0.008)	(0.008)
	Creative industries		1.128***	1.333***	1.334***
			(0.004)	(0.004)	(0.004)
	Professional and		0.513***	0.752***	0.750***
	legal services		(0.009)	(0.008)	(0.008)
	High-tech		0.435***	0.437***	0.435***
			(0.010)	(0.010)	(0.010)
	Low Carbon		0.877***	0.721***	0.722***
			(0.016)	(0.011)	(0.011)
Firm	Log (unit)	-0.046***	-0.049***	-0.044***	-0.048***
		(0.000)	(0.000)	(0.000)	(0.001)
	Log (capital)			0.217***	0.216***
				(0.001)	(0.001)
	Log (employment)				0.004***
					(0.001)
	R^2	0.017	0.109	0.209	0.209
	F statistic	3223.43***	10814.74***	19310.29***	17854.71***

Notes: Equations estimated by OLS. Robust standard errors in parentheses. ***, ** and * denote the variable is statistically significant at the 1%, 5% and 10% level respectively. Dependent variable in each regression is Ln (LabProd)

2008 - 2009

5.34. The start of the recent recession was associated with a drop in the labour productivity premium of plants in the WoE LEP area relative to the British average, with this gap falling from 12 to 8 percent, as shown in Table 9. There is evidence of greater enhancing effects on labour productivity of plants operating in the high-tech and low carbon sectors, although an alternative interpretation would be that the enhancing effects from plants operating in other sectors declined; again, both of these effects may have occurred simultaneously for different reasons and to different extents in different LEPs, with only further research being able to reveal which interpretation holds more weight. Table 9 illustrates that the labour productivity premium of both the City of London and of the rest of London increased strongly again, perhaps due to the closure of less efficient firms or due to reduced demand for goods considered

luxuries. Nevertheless, it remains unclear why these areas behaved differently from the other areas of Britain.[1]

Table 9: Determinants of labour productivity: 2008-2009, whole sample

		1	2	3	4
	N	838,278	838,278	814,881	814,881
Spatial	West of England	0.077***	0.055***	0.048***	0.044***
		(0.011)	(0.010)	(0.009)	(0.009)
	City of London	0.335***	0.267***	0.229***	0.224***
		(0.020)	(0.019)	(0.016)	(0.016)
	London (excluding city of)	0.081***	0.078***	0.077***	0.078***
		(0.004)	(0.004)	(0.004)	(0.004)
Industry	Advanced engineering & aerospace		0.589***	0.671***	0.654***
			(0.007)	(0.006)	(0.006)
	Creative industries		0.254***	0.361***	0.356***
			(0.010)	(0.008)	(0.008)
	Professional and legal services		0.562***	0.628***	0.629***
			(0.010)	(0.008)	(0.008)
	High-tech		1.235***	0.989***	0.984***
			(0.007)	(0.005)	(0.005)
	Low Carbon		1.418***	0.970***	0.969***
			(0.013)	(0.009)	(0.009)
Firm	Log (unit)	-0.075***	-0.057***	-0.072***	-0.098***
		(0.000)	(0.000)	(0.000)	(0.001)
	Log (capital)			0.258***	0.253***
				(0.001)	(0.001)
	Log (employment)				0.027***
					(0.001)
	R^2	0.034	0.103	0.240	0.242
	F statistic	6410.18***	7811.25***	27469.52***	26523.33***

Notes: Equations estimated by OLS. Robust standard errors in parentheses. ***, ** and * denote the variable is statistically significant at the 1%, 5% and 10% level respectively. Dependent variable in each regression is Ln (LabProd)

5.35. The potential rebalancing of the economy by i) moving away from the production of luxuries and ii) moving towards more efficient production processes, seemed to result in the preservation of plants who were more affected by capital stock. For the first time in the period examined in this document, capital stocks now explain part of the labour productivity premium of the WoE LEP area albeit a very small component at only 12 percent under this model. This apparent shift may be associated with the closure of plants that were being held back by a lack of or inefficiencies in capital stocks.

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[1] An alternative interpretation is that the drop in 2006-7 was due to reasons outside this document's remit.

5.36.   The final time period under examination here, 2010 – 2011, saw little difference or recovery from pre-recession periods, as shown in Table 10. The labour productivity premium in the WoE remained at about 7.5 percent.

Table 10: Determinants of labour productivity: 2010-2011, whole sample

		1	2	3	4
	N	838,278	838,278	814,881	814,881
Spatial	West of England	0.076***	0.052***	0.055***	0.054***
		(0.007)	(0.007)	(0.008)	(0.008)
	City of London	0.410***	0.333***	0.298***	0.295***
		(0.013)	(0.012)	(0.014)	(0.014)
	London (excluding city of)	0.116***	0.114***	0.108***	0.108***
		(0.003)	(0.003)	(0.004)	(0.004)
Industry	Advanced engineering & aerospace		0.629***	0.661***	0.649***
			(0.007)	(0.009)	(0.009)
	Creative industries		0.311***	0.347***	0.345***
			(0.010)	(0.013)	(0.013)
	Professional and legal services		0.573***	0.661***	0.662***
			(0.009)	(0.011)	(0.011)
	High-tech		1.302***	0.957***	0.950***
			(0.005)	(0.006)	(0.006)
	Low Carbon		1.223***	0.790***	0.791***
			(0.013)	(0.012)	(0.012)
Firm	Log (unit)	-0.060***	-0.044***	-0.056***	-0.074***
		(0.000)	(0.000)	(0.001)	(0.001)
	Log (capital)			0.266***	0.263***
				(0.001)	(0.002)
	Log (employment)				0.019***
					(0.001)
	R²	0.025	0.098	0.233	0.233
	F statistic	4861.30***	10485.38***	12625.69***	12170.02***

Notes: Equations estimated by OLS. Robust standard errors in parentheses. ***, ** and * denote the variable is statistically significant at the 1%, 5% and 10% level respectively. Dependent variable in each regression is Ln (LabProd)

5.37.   Table 10 also illustrates that the contributory effects on labour productivity of plants operating in the priority sectors remained stable from the previous time period. The only noticeable difference from the previous time period, 2008-2009 shown in Table 9, is that the amount of the labour productivity gap that has been explained by the fully specified model. In 2008-2009, 43 per cent of the productivity premium was explained by the factors included in the full model and this fell to 30 per cent in 2010-2011. This suggests that the importance of other factors that have not been included in models here may have begun to have an increasing effect on labour productivity.

# 6. RESULTS: LABOUR PRODUCTIVITY PREMIUMS AND GAPS WITHIN THE WoE

6.1.   This section replicates the analysis presented in the previous section but instead of pooling all local authorities into one area – the WoE LEP area – the analysis presented in this chapter examines all local authorities in the WoE as separate entities. For ease of comparison, we retain the comparator areas of the City of London and the rest of London. This means that the coefficients corresponding to all area variables must be interpreted relative to all other plants not included in the area variables included in the regression – i.e. relative to the control group areas.[2]

6.2.   In Table 11 we present the coefficient estimates of the fitted model, which includes our area variables and the number of units in the firm. The results are presented for all time periods in our study: 1998-1999 to 2010-2011. Due to the smaller number of plants behind these coefficients and because of the randomness of the sampling frame for smaller firms, there will inevitably be greater variability across the estimates.

6.3.   The results for 1998-1999 suggest there are different labour productivity gaps and premiums across the local authorities within the WoE LEP area. The labour productivity premium for Bristol and South Gloucestershire appear to be about 2½ and 9 percent respectively, which were significantly greater than the sample average of the rest of the sample of plants across the rest of Britain (not included in the area variables). In the same time period, average labour productivity estimates in North Somerset and BANES were insignificantly different from the average.

6.4.   Following the rows to the right illustrates a number of interesting phenomena. First, there is a very small but still important productivity gap that is emerging between plants across Britain and plants in the BANES area; this gap has remained fairly stable since 2002-2003 around 5 percent.

6.5.   Second, from commencing at a labour productivity position that was not significantly different from the national average, plants in North Somerset have managed to increase their labour productivity rates faster than the average such that by the 2010-2011 period these firms were between 3 and 4 percent more productive. This is clearly a success story which appears to have been building over this time period although the evidence is based on a small sample of plants and the evidence is on an upward trend albeit variable.

6.6.   Third, the labour productivity of plants in the Bristol local authority have also been on an upward trend and have improved from a starting position of about 2 percent more productive in 1998-99 to about 11 percent more productive, all relative to the average. This is a huge increase and may be attributable to developments around Cabot Circus.

6.7.   Fourth, plants in the South Gloucestershire local authority have been improving their performance in a similar fashion from about 9 percent more productive in 1998-99 to about 12 percent more productive. All this should be held in context that the

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[2]   Note that the variables included differ from earlier models and, therefore, the results will also differ.

improvements in added value at factor cost per worker are affected by changes in consumer demands and improvements in efficiencies productive.

6.8.   These trajectories are presented in Figure 7. Using this media, it is clearer that plants in North Somerset have suffered most from the 2008 recession, although this finding and conclusion needs to be treated with due caution due to the fairly small sample.

Figure 7: Productivity gaps and premiums, based on Table 11
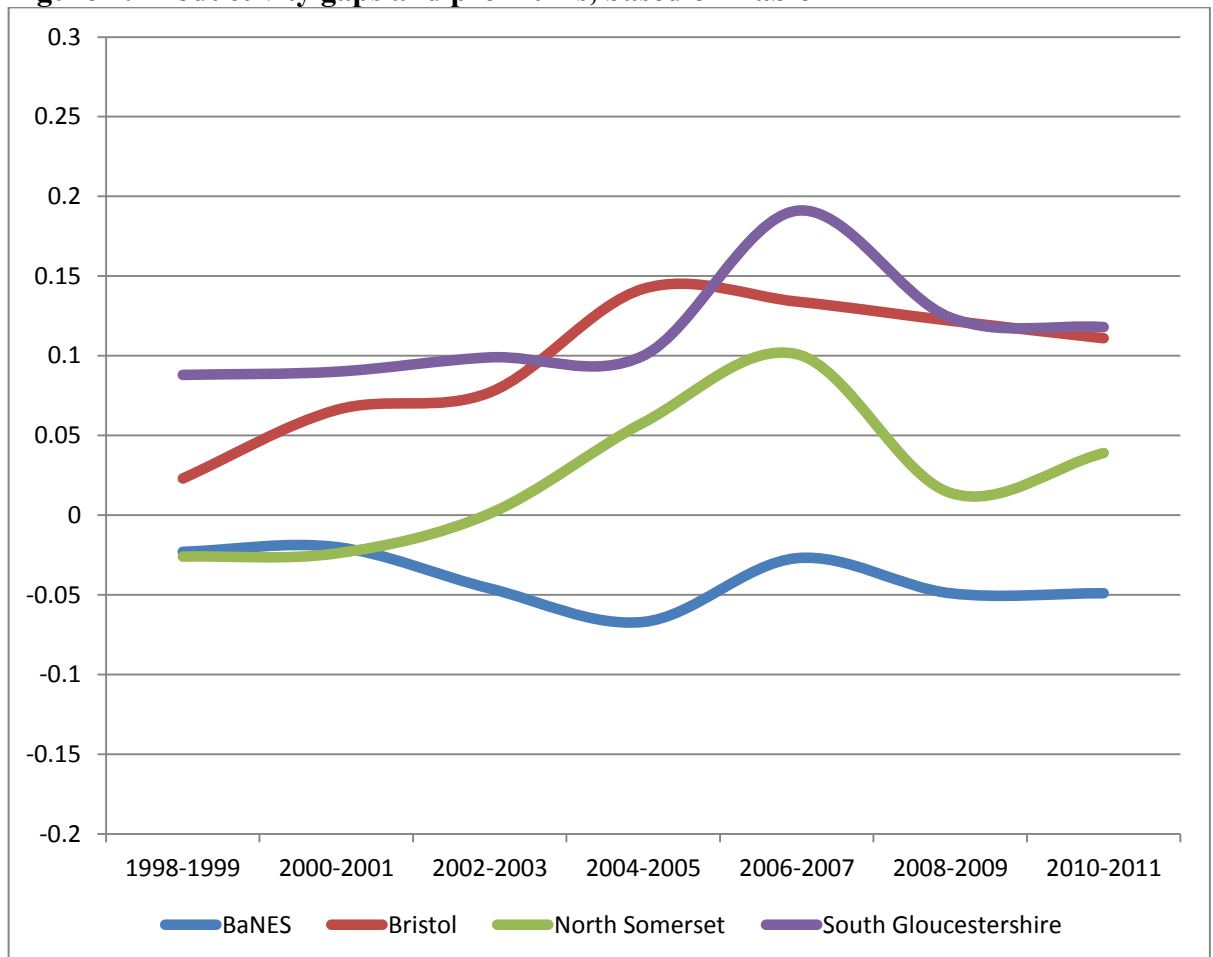
Notes: Lines smoothed

6.9.   It is also worth noting that the trajectory of plants in London and the City of London has been upwards at a faster rate during the same time period and, therefore, the gap between plants in the WoE LEP and the City of London has increased significantly. This pattern is in line with the empirically backed belief that the London area is usually first to be affected by and climb out of recessions, relative to other regions within Britain. This finding, however, also elucidates a movement of the labour productivity puzzle across the British landscape towards greater skewness in relative performance and towards greater centricity. The WoE LEP needs to consider whether it has the ability to influence this trend, slowing and potentially reversing this deterioration.

Table 11: Determinants of labour productivity, whole sample

		1998-99	2000-01	2002-03	2004-05	2006-07	2008-09	2010-11
	N	838,278	951,349	969,328	1,021,812	922,606	998,653	1,024,279
Spatial	BANES	-0.023	-0.020	-0.046***	-0.067***	-0.027*	-0.049*	-0.049***
		(0.018)	(0.018)	(0.017)	(0.016)	(0.016)	(0.028)	(0.017)
	Bristol	0.023**	0.066***	0.077***	0.142***	0.134***	0.122***	0.111***
		(0.010)	(0.010)	(0.009)	(0.010)	(0.010)	(0.016)	(0.010)
	North Somerset	-0.026	-0.024	0.001	0.058***	0.101***	0.014	0.039**
		(0.020)	(0.019)	(0.016)	(0.016)	(0.017)	(0.026)	(0.016)
	South Gloucestershire	0.088***	0.090***	0.099***	0.100***	0.191***	0.124***	0.118***
		(0.016)	(0.015)	(0.014)	(0.014)	(0.013)	(0.020)	(0.014)
	City of London	0.222***	0.353***	0.266***	0.387***	0.173***	0.335***	0.410***
		(0.014)	(0.014)	(0.013)	(0.014)	(0.012)	(0.020)	(0.013)
	London (excluding City of)	0.117***	0.157***	0.124***	0.089***	0.024***	0.081***	0.116***
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Firm	Ln (unit)	-0.070***	-0.075***	-0.075***	-0.075***	-0.075***	-0.075***	-0.075***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	R²	0.034	0.034	0.034	0.034	0.034	0.034	0.034
	F statistic	4173.55***	3673.62***	3673.62***	3673.62***	3673.62***	3673.62***	3673.62***

Notes: Equations estimated using OLS. Robust standard errors are presented in parentheses. ***, ** and * denote the variable is statistically significant at the 1%, 5% and 10% level respectively. Dependent variable in each regression is Ln (LabProd)

6.10. Table 12 presents a set of regressions that seek to explain these productivity gaps in the 1998-1999 period. Although 40 percent of the London and 29 percent of the City of London premiums have been explained in the models (difference between coefficient in column one and column five), the same high proportions have not been explained for the local authorities in the WoE LEP area.

Table 12: Determinants of labour productivity: 1998-1999, whole sample

		1	2	3	4
	N	838,278	838,278	814,881	814,881
Spatial	BANES	-0.023	-0.049***	-0.026	-0.026
		(0.018)	(0.017)	(0.017)	(0.017)
	Bristol	0.023**	0.012	0.035***	0.031***
		(0.010)	(0.010)	(0.010)	(0.009)
	North Somerset	-0.026	-0.010	-0.007	-0.018
		(0.020)	(0.020)	(0.019)	(0.019)
	South Gloucestershire	0.088***	0.105***	0.108***	0.091***
		(0.016)	(0.016)	(0.015)	(0.015)
	City of London	0.222***	0.186***	0.174***	0.158***
		(0.014)	(0.014)	(0.013)	(0.012)
	London (excluding city of)	0.117***	0.106***	0.076***	0.071***
		(0.003)	(0.003)	(0.003)	(0.003)
Industry	Advanced engineering & aerospace		0.489***	0.696***	0.701***
			(0.010)	(0.009)	(0.009)
	Creative industries		1.113***	0.943***	0.897***
			(0.007)	(0.006)	(0.006)
	Professional and legal services		0.355***	0.535***	0.535***
			(0.008)	(0.007)	(0.007)
	High-tech		0.329***	0.199***	0.137***
			(0.010)	(0.009)	(0.010)
	Low Carbon		0.874***	0.510***	0.480***
			(0.010)	(0.007)	(0.007)
Firm	Log (unit)	-0.070***	-0.066***	-0.080***	-0.157***
		(0.000)	(0.000)	(0.000)	(0.001)
	Log (capital)			0.213***	0.205***
				(0.001)	(0.001)
	Log (employment)				0.084***
					(0.001)
	R^2	0.034	0.088	0.203	0.214
	F statistic	4173.55***	5795.41***	12325.43***	12838.15***

Notes: Equations estimated by OLS. Robust standard errors in parentheses. ***, ** and * denote statistically significant at the 1%, 5% and 10% level respectively. Dependent variable in each regression is Ln (LabProd)

6.11. Priority sectors, capital stocks and firm size have not explained any of BANES's labour productivity differences from the average, although the average labour productivity of plants in the BANES area would appear to have been lower without their priority sector plants. Also, plants in BANES are doing better than would be expected given their available capital stocks.

6.12. Priority sectors again explain part of the labour productivity premium that plants in the Bristol local authority have, but there is also evidence that the capital that they have is not as productive as it is elsewhere.

6.13. The results indicate that plants in the North Somerset local authority were performing as productively as the average plant across the rest of Britain in the 1998-1999 period.

6.14. An interesting finding is that plants in the priority sectors may not be the most productive in South Gloucestershire, as once we account for plants in these sectors the average productivity of plants in other sectors is higher, illustrated by a movement from 9 percent to 10½ percent. Part of this productivity premium may have been due to the presence of relatively large firms that are able to reap greater economies of scale.

2000 – 2001 & 2002 - 2003

6.15. Tables 13 and 14 present a set of regressions that seek to explain the local productivity gaps in the 2000-2001 and 2002-2003 periods, respectively. The same points raised in the previous time period also apply here. The only exception is for plants in Bristol where the main issue seems to be that capital is not as productive as it is elsewhere. Further research would be necessary to identify why this is the case.

Table 13: Determinants of labour productivity: 2000-2001, whole sample

		1	2	3	4
	N	951,349	951,349	948,287	948,287
Spatial	BANES	-0.020	-0.040**	0.003	0.006
		(0.018)	(0.017)	(0.016)	(0.016)
	Bristol	0.066***	0.053***	0.093***	0.093***
		(0.010)	(0.010)	(0.009)	(0.009)
	North Somerset	-0.024	-0.026	-0.021	-0.024
		(0.019)	(0.018)	(0.017)	(0.017)
	South Gloucestershire	0.090***	0.107***	0.111***	0.099***
		(0.015)	(0.014)	(0.013)	(0.013)
	City of London	0.353***	0.273***	0.242***	0.227***
		(0.014)	(0.013)	(0.012)	(0.011)
	London (excluding city of)	0.157***	0.144***	0.114***	0.115***
		(0.003)	(0.003)	(0.003)	(0.003)
Industry	Advanced engineering & aerospace		0.531***	0.788***	0.776***
			(0.011)	(0.009)	(0.009)
	Creative industries		1.007***	0.825***	0.784***
			(0.006)	(0.005)	(0.005)
	Professional and legal services		0.493***	0.680***	0.666***
			(0.008)	(0.007)	(0.007)
	High-tech		0.302***	0.229***	0.183***
			(0.012)	(0.011)	(0.012)
	Low Carbon		0.746***	0.397***	0.390***
			(0.008)	(0.006)	(0.006)
Firm	Log (unit)	-0.075***	-0.057***	-0.066***	-0.134***
		(0.000)	(0.000)	(0.000)	(0.001)
	Log (capital)			0.247***	0.238***
				(0.001)	(0.001)
	Log (employment)				0.072***
					(0.001)
	R^2	0.034	0.074	0.190	0.198
	F statistic	3673.62***	5511.95***	11421.79***	11840.65***

Notes: Equations estimated by OLS. Robust standard errors in parentheses. ***, ** and * denote the variable is statistically significant at the 1%, 5% and 10% level respectively. Dependent variable in each regression is Ln (LabProd)

Table 14: Determinants of labour productivity: 2002-2003, whole sample

		1	2	3	4
	N	969,328	969,328	966,531	966,531
Spatial	BANES	-0.046***	-0.061***	-0.056***	-0.053***
		(0.017)	(0.017)	(0.016)	(0.016)
	Bristol	0.077***	0.065***	0.090***	0.090***
		(0.009)	(0.009)	(0.008)	(0.008)
	North Somerset	0.001	0.002	0.001	0.000
		(0.016)	(0.016)	(0.015)	(0.015)
	South Gloucestershire	0.099***	0.089***	0.100***	0.092***
		(0.014)	(0.014)	(0.013)	(0.013)
	City of London	0.266***	0.233***	0.203***	0.186***
		(0.013)	(0.013)	(0.012)	(0.012)
	London (excluding city of)	0.124***	0.112***	0.085***	0.084***
		(0.003)	(0.003)	(0.003)	(0.003)
Industry	Advanced engineering & aerospace		0.483***	0.735***	0.735***
			(0.010)	(0.009)	(0.009)
	Creative industries		0.873***	0.951***	0.952***
			(0.005)	(0.005)	(0.005)
	Professional and legal services		0.263***	0.547***	0.548***
			(0.009)	(0.007)	(0.006)
	High-tech		0.244***	0.253***	0.225***
			(0.010)	(0.010)	(0.010)
	Low Carbon		0.332***	0.325***	0.325***
			(0.010)	(0.009)	(0.009)
Firm	Log (unit)	-0.075***	-0.057***	-0.065***	-0.124***
		(0.000)	(0.000)	(0.000)	(0.001)
	Log (capital)			0.210***	0.206***
				(0.001)	(0.001)
	Log (employment)				0.065***
					(0.001)
	R²	0.034	0.068	0.159	0.167
	F statistic	3673.62***	4736.67***	10215.26***	10770.61***

Notes: Equations estimated by OLS. Robust standard errors in parentheses. ***, ** and * denote the variable is statistically significant at the 1%, 5% and 10% level respectively. Dependent variable in each regression is Ln (LabProd)

6.16. As the boom period in the mid-2000s progressed and faltered, the effects on labour productivity across our constituent areas evolved in different ways. Tables 15 to 17 present a set of regressions that seek to explain these productivity gaps in the 2004-2005 to 2008-2009 period. These three periods can be discussed together as they illustrate very similar findings.

Table 15: Determinants of labour productivity: 2004-2005, whole sample

		1	2	3	4
	N	1,021,812	1,021,812	959,110	959,110
Spatial	BANES	-0.067***	-0.078***	-0.072***	-0.072***
		(0.016)	(0.015)	(0.015)	(0.015)
	Bristol	0.142***	0.106***	0.103***	0.101***
		(0.010)	(0.009)	(0.009)	(0.009)
	North Somerset	0.058***	0.058***	0.061***	0.061***
		(0.016)	(0.015)	(0.013)	(0.013)
	South Gloucestershire	0.100***	0.079***	0.089***	0.086***
		(0.014)	(0.013)	(0.012)	(0.012)
	City of London	0.387***	0.225***	0.250***	0.245***
		(0.014)	(0.012)	(0.012)	(0.012)
	London (excluding city of)	0.089***	0.074***	0.050***	0.050***
		(0.003)	(0.003)	(0.003)	(0.003)
Industry	Advanced engineering & aerospace		0.587***	0.812***	0.809***
			(0.010)	(0.010)	(0.010)
	Creative industries		0.914***	1.095***	1.097***
			(0.004)	(0.004)	(0.004)
	Professional and legal services		0.837***	0.961***	0.956***
			(0.007)	(0.007)	(0.007)
	High-tech		0.370***	0.405***	0.400***
			(0.011)	(0.010)	(0.010)
	Low Carbon		0.442***	0.405***	0.408***
			(0.012)	(0.010)	(0.010)
Firm	Log (unit)	-0.075***	-0.057***	-0.034***	-0.045***
		(0.000)	(0.000)	(0.000)	(0.001)
	Log (capital)			0.231***	0.228***
				(0.001)	(0.001)
	Log (employment)				0.012***
					(0.001)
	R²	0.034	0.084	0.189	0.189
	F statistic	3673.62***	5764.67***	11890.01***	11522.85***

Notes: Equations estimated by OLS. Robust standard errors in parentheses. ***, ** and * denote the variable is statistically significant at the 1%, 5% and 10% level respectively. Dependent variable in each regression is Ln (LabProd)

6.17.   Table 12, representing estimates for the 1998-1999 period, again highlight that although 40 percent of the London and 29 percent of the City of London premiums have been explained in the models, the same high proportions have not been explained for the local authorities in the WoE LEP area.

6.18.   The labour productivity gaps of BANES and North Somerset in the 2004-2005 time period remain unexplained by the presence of plants in the priority sectors, capital stocks and employment related scaled economies. An explanation of this would require further scrutiny.

6.19.   About 30 percent of Bristol's labour productivity gap is explained by the model with most due to the presence of plants in the priority sectors. Nevertheless, over 70 percent of the labour productivity premium remains unexplained and hence lies outside of this report's remit. Further research is necessary to gather evidence that can be used to formulate policy to further improve the productivity premium of plants in the Bristol local authority.

6.20.   It appears that by the 2004-2005 time period about 20 percent of South Gloucestershire's productivity premium was due to plants operating in priority sectors. Again, capital appears to be more productive elsewhere but, by the 2008-2009 time period, this capital issue seems to have been resolved.

Table 16: Determinants of labour productivity: 2006-2007, whole sample

		1	2	3	4
	N	922,606	922,606	920,415	920,415
Spatial	BANES	-0.027*	-0.040***	-0.048***	-0.048***
		(0.016)	(0.014)	(0.014)	(0.014)
	Bristol	0.134***	0.092***	0.089***	0.089***
		(0.010)	(0.009)	(0.009)	(0.009)
	North Somerset	0.101***	0.070***	0.092***	0.091***
		(0.017)	(0.015)	(0.014)	(0.014)
	South Gloucestershire	0.191***	0.130***	0.140***	0.139***
		(0.013)	(0.012)	(0.011)	(0.011)
	City of London	0.173***	0.130***	0.121***	0.120***
		(0.012)	(0.011)	(0.011)	(0.011)
	London (excluding city of)	0.024***	0.013***	0.005*	0.005*
		(0.003)	(0.003)	(0.003)	(0.003)
Industry	Advanced engineering & aerospace		0.772***	0.999***	0.997***
			(0.009)	(0.008)	(0.008)
	Creative industries		1.128***	1.333***	1.334***
			(0.004)	(0.004)	(0.004)
	Professional and legal services		0.513***	0.752***	0.750***
			(0.009)	(0.008)	(0.008)
	High-tech		0.435***	0.436***	0.435***
			(0.010)	(0.010)	(0.010)
	Low Carbon		0.877***	0.721***	0.722***
			(0.016)	(0.011)	(0.011)
Firm	Log (unit)	-0.075***	-0.057***	-0.044***	-0.048***
		(0.000)	(0.000)	(0.000)	(0.001)
	Log (capital)			0.217***	0.216***
				(0.001)	(0.001)
	Log (employment)				0.004***
					(0.001)
	R^2	0.034	0.110	0.209	0.209
	F statistic	3673.62***	8120.15***	14866.49***	14039.40***

Notes: Equations estimated by OLS. Robust standard errors in parentheses. ***, ** and * denote the variable is statistically significant at the 1%, 5% and 10% level respectively. Dependent variable in each regression is Ln (LabProd)

Table 17: Determinants of labour productivity: 2008-2009, whole sample

		1	2	3	4
	N	998,653	998,653	972,038	972,038
Spatial	BANES	-0.049*	-0.072***	-0.043*	-0.041*
		(0.028)	(0.027)	(0.022)	(0.022)
	Bristol	0.122***	0.103***	0.083***	0.078***
		(0.016)	(0.015)	(0.013)	(0.013)
	North Somerset	0.014	0.019	0.008	0.006
		(0.026)	(0.025)	(0.022)	(0.022)
	South Gloucestershire	0.124***	0.077***	0.071***	0.065***
		(0.020)	(0.019)	(0.017)	(0.017)
	City of London	0.335***	0.267***	0.229***	0.224***
		(0.020)	(0.019)	(0.016)	(0.016)
	London (excluding City of)	0.081***	0.078***	0.077***	0.078***
		(0.004)	(0.004)	(0.004)	(0.004)
Industry	Advanced engineering & aerospace		0.589***	0.671***	0.654***
			(0.007)	(0.006)	(0.006)
	Creative industries		0.255***	0.361***	0.356***
			(0.010)	(0.008)	(0.008)
	Professional and legal services		0.562***	0.627***	0.629***
			(0.010)	(0.008)	(0.008)
	High-tech		1.235***	0.989***	0.984***
			(0.007)	(0.005)	(0.005)
	Low Carbon		1.418***	0.970***	0.969***
			(0.013)	(0.009)	(0.009)
Firm	Log (unit)	-0.075***	-0.057***	-0.072***	-0.098***
		(0.000)	(0.000)	(0.000)	(0.001)
	Log (capital)			0.258***	0.253***
				(0.001)	(0.001)
	Log (employment)				0.027***
					(0.001)
	R^2	0.034	0.103	0.241	0.242
	F statistic	3673.62***	5867.01***	21131.48***	20839.97***

Notes: Equations estimated by OLS. Robust standard errors in parentheses. ***, ** and * denote the variable is statistically significant at the 1%, 5% and 10% level respectively. Dependent variable in each regression is Ln (LabProd)

6.21.   The results of regressions based on the 2010-2011 dataset are presented in Table 18. They should be seen in context and as a reflection of the long 1990s-2008 economic boom and as an indication of the effects of the economic downturn. There would have been plant closures, employee layoffs, changes in the importance of sectors to the economy and, potentially, changes in combinations of capital and labour used in the production process within and between plants.

6.22.   In 2010-2011, plants in BANES were approximately 5 percent less productive than the average British plant, but much of this can be attributed to differences in capital stocks and scale economies in the workforce. Much of this is probably correlated with the relative intensity of other industries to the local economy, and this is worthy of further investigation to identify whether assistance can be given to firms in specific industries to enable them to make even more productive, smarter use of their capital stocks and employees.

6.23.   Bristol's average labour productivity premium of 11 percent relative to the national average is partly attributable to the relative abundance of plants operating in priority sectors, but this only explains about a quarter of the premium; the relative abundance of capital stocks or employees has not explained the remaining 9 percent productivity premium. We need to look elsewhere to identify why this premium relative to the national average is present and why the gap between Bristol and London has increased over time.

6.24.   The labour productivity premium of plants in North Somerset in the 2010-2011 period was about 4 percent; neither the presence of plants in the priority sectors nor the abundance of relative abundance of capital stock or employees could explain this premium. An adequate explanation of the persistence in this productivity premium requires further scrutiny.

6.25.   The productivity premium across plants in South Gloucestershire of about 12 percent is partly (35%) due to the presence of plants operating in the priority sectors and capital stocks (16%) but again almost 50 percent of this productivity premium has not been explained using this restricted model that includes priority sectors, capital stocks and employee size.

Table 18: Determinants of labour productivity: 2010-2011, whole sample

		1	2	3	4
	N	1,024,279	1,024,279	509,121	509,121
Spatial	BANES	-0.049***	-0.063***	-0.034*	-0.032
		(0.017)	(0.016)	(0.020)	(0.020)
	Bristol	0.111***	0.087***	0.092***	0.090***
		(0.010)	(0.010)	(0.012)	(0.012)
	North Somerset	0.039**	0.032**	0.039**	0.038*
		(0.016)	(0.015)	(0.020)	(0.020)
	South Gloucestershire	0.118***	0.077***	0.058***	0.055***
		(0.014)	(0.013)	(0.018)	(0.018)
	City of London	0.410***	0.333***	0.298***	0.295***
		(0.013)	(0.012)	(0.014)	(0.014)
	London (excluding City of)	0.116***	0.114***	0.108***	0.108***
		(0.003)	(0.003)	(0.004)	(0.004)
Industry	Advanced engineering & aerospace		0.629***	0.661***	0.649***
			(0.007)	(0.009)	(0.009)
	Creative industries		0.311***	0.347***	0.344***
			(0.010)	(0.013)	(0.013)
	Professional and legal services		0.573***	0.660***	0.662***
			(0.009)	(0.011)	(0.011)
	High-tech		1.302***	0.957***	0.950***
			(0.005)	(0.006)	(0.006)
	Low Carbon		1.223***	0.790***	0.791***
			(0.013)	(0.012)	(0.012)
Firm	Log (unit)	-0.075***	-0.057***	-0.056***	-0.074***
		(0.000)	(0.000)	(0.001)	(0.001)
	Log (capital)			0.266***	0.263***
				(0.001)	(0.002)
	Log (employment)				0.019***
					(0.001)
	R²	0.034	0.098	0.233	0.233
	F statistic	3673.62***	7871.56***	9715.53***	9565.63***

Notes: Equations estimated by OLS. Robust standard errors in parentheses. ***, ** and * denote the variable is statistically significant at the 1%, 5% and 10% level respectively. Dependent variable in each regression is Ln (LabProd)

7. RESULTS: PRIORITY SECTORS, CAPITAL STOCKS & EMPLOYMENT: DIFFERENT EFFECTS ACROSS THE WoE

7.1.   Table 19 presents the results of analysis to determine, statistically, whether the WoE LEP is affected differently by the relative abundance of capital stocks, priority sectors and employment size.

7.2.   This large table has five main panels. The first three panels can be interpreted in line with the discussion above. However, the additional benefit of this analysis is presented in the next two panels, labelled "West of England – Industry" and "West of England – Firm."   The interpretation of these variables is best done through the use of an example. A positive sign on the "WoE – Advanced engineering & aerospace" variable will indicate that plants operating in the AE&A sector in the WoE LEP area are doing better than AE&A than in all other areas. In the 1998-1999 time period the coefficient for "Advanced engineering & aerospace" is 0.693, suggesting that plants in this sector have, in general, about 70 percent greater productivity than the average British plant. By adding the "Advanced engineering & aerospace" coefficient with the "WoE - Advanced engineering & aerospace" coefficient we get (0.693 + 0.247 =) 0.94, which suggest that plants operating in the advanced engineering & aerospace priority sector in the WoE are about 95 percent more productive than the average plant in Britain and with AE&A plants being (0.247 / 0.693) 35% more productive in the WoE area in the 1998-1999 period.

7.3.   Looking across the rows of the variables in these two additional panels reveals that AE&A plants have been, on average, about 10 percent more productive than similar plants in other parts of Britain over this entire time period. Similarly, plants operating in the P&LS priority have been about 6 percent more productive. Plants operating in the low carbon and high-tech priority sectors have had about the same levels of productivity over this time period. This is important because it appears that this sector is a priority for the country, but not a particular priority specifically for the WoE.

7.4.   It is of interest that the plants operating in the creative industries sector who appear to have been about 17 percent less productive relative to similar plants elsewhere in Britain in the 1998-1999 period but were equally productive by the 2010-2011 period. This implies that plants in the creative industries were less productive in the WoE areas in 1998-1999 relative to elsewhere in Britain, but this gap diminished over time with that plants operating in this industry can now be as productive in the WoE as they are elsewhere. What, why and how something changed over time is worthy of further investigation as is can inform future policy formation.

7.5.   The same principle applies to the interpretations of the penultimate panel, which illustrates that the economics of scale benefits attributable to larger workforce size were greater in the WoE LEP area than elsewhere but this did decline over time (as did the average effect across all British plants) and the effect seems more turbulent during the recession periods.

7.6.   The beneficial effects of larger capital stocks are slightly smaller across plants in the WoE. The reason for this is unclear.

Table 19: Determinants of labour productivity, whole sample

		1998-99	2000-01	2002-03	2004-05	2006-07	2008-09	2010-11
	N	814,881	948,287	966,531	959,110	920,415	972,038	509,121
Spatial	West of England	-0.219***	-0.037	0.021	-0.043	0.258***	-0.067	0.159***
		(0.031)	(0.027)	(0.026)	(0.026)	(0.027)	(0.047)	(0.043)
	City of London	0.158***	0.228***	0.186***	0.246***	0.120***	0.225***	0.295***
		(0.012)	(0.011)	(0.012)	(0.012)	(0.011)	(0.016)	(0.014)
	London (excluding City of)	0.071***	0.115***	0.084***	0.050***	0.005*	0.078***	0.108***
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Industry	Advanced engineering & aerospace	0.693***	0.774***	0.732***	0.805***	0.996***	0.653***	0.646***
		(0.010)	(0.009)	(0.009)	(0.010)	(0.008)	(0.006)	(0.009)
	Creative industries	0.900***	0.787***	0.954***	1.098***	1.331***	0.355***	0.344***
		(0.006)	(0.005)	(0.005)	(0.004)	(0.004)	(0.008)	(0.013)
	Professional and legal services	0.532***	0.662***	0.548***	0.953***	0.748***	0.628***	0.663***
		(0.007)	(0.007)	(0.007)	(0.007)	(0.009)	(0.008)	(0.011)
	High-tech	0.139***	0.182***	0.225***	0.402***	0.435***	0.985***	0.951***
		(0.010)	(0.012)	(0.010)	(0.010)	(0.010)	(0.005)	(0.006)
	Low Carbon	0.482***	0.390***	0.323***	0.408***	0.724***	0.972***	0.790***
		(0.007)	(0.006)	(0.010)	(0.011)	(0.012)	(0.009)	(0.012)
Firm	Log (unit)	-0.156***	-0.133***	-0.123***	-0.044***	-0.049***	-0.098***	-0.074***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
	Log (capital)	0.205***	0.238***	0.206***	0.228***	0.216***	0.254***	0.263***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
	Log (employment)	0.082***	0.070***	0.065***	0.012***	0.005***	0.027***	0.019***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

West of England - Industry	WoE - Advanced engineering & aerospace	0.247***	0.031	0.099**	0.120***	0.011	0.130***	0.079*
		(0.044)	(0.039)	(0.041)	(0.035)	(0.038)	(0.040)	(0.044)
	WoE - Creative industries	-0.175***	-0.183***	-0.090***	-0.023	0.048**	0.077	0.028
		(0.039)	(0.031)	(0.029)	(0.028)	(0.023)	(0.068)	(0.065)
	WoE - Professional and legal services	0.077**	0.102**	-0.008	0.118***	0.091**	0.138***	-0.013
		(0.036)	(0.043)	(0.041)	(0.038)	(0.041)	(0.051)	(0.076)
	WoE - High-tech	-0.127	0.119	0.059	-0.100*	-0.045	-0.085*	-0.024
		(0.090)	(0.098)	(0.075)	(0.055)	(0.061)	(0.051)	(0.032)
	WoE - Low Carbon	-0.120***	-0.071	0.048	0.004	-0.086*	-0.344***	0.053
		(0.046)	(0.050)	(0.045)	(0.061)	(0.048)	(0.066)	(0.062)
West of England - Firm	WoE - Log (unit)	-0.075***	-0.060***	-0.015***	-0.024***	0.043***	-0.001	0.026***
		(0.007)	(0.006)	(0.006)	(0.005)	(0.006)	(0.008)	(0.009)
	WoE - Log (capital)	-0.026***	-0.029***	0.002	0.012*	-0.043***	-0.012	-0.015
		(0.007)	(0.008)	(0.006)	(0.006)	(0.006)	(0.008)	(0.010)
	WoE - Log (employment)	0.091***	0.063***	0.013**	0.024***	-0.033***	0.021**	-0.023***
		(0.007)	(0.006)	(0.005)	(0.005)	(0.006)	(0.008)	(0.008)
	R^2	0.214	0.198	0.166	0.189	0.209	0.242	0.233
	F statistic	9492.58***	8754.48***	7953.60***	8514.24***	1421.15***	15391.91***	7072.74***

Notes: Equations estimated by OLS. Robust standard errors in parentheses. ***, ** and * denote the variable is statistically significant at the 1%, 5% and 10% level respectively. Dependent variable in each regression is Ln (LabProd)

8. Discussion and recommendations

8.1.   The research provides a productivity baseline of the WoE, and its constituent parts, relative to a national average. The analysis has identified some strong findings, which lead to clear recommendations.

8.2.   There is evidence of diseconomies of scale for firms with multiple plants, probably due to additional management and administrative burdens.
   a. **Recommendation 1:** WoE LEP to consider providing support and guidance for managers of multi-plant facilities.

8.3.   There is clear evidence that the chosen WoE priority sectors have been nationally more productive than the average sector, however the performance of the WoE's priority sectors compared to the national average for that sector has been variable.
   a. **Recommendation 2:** Support for the WoE priority sectors should be focussed at the individual needs of the priority sector.
   b. **Recommendation 3:** A wider analysis beyond just the priority sectors should be carried out in order to identify other sectors where the WoE has a competitive advantage, and thereafter identify whether support mechanisms are needed to further this advantage.

8.4.   There is evidence that the capital stocks in the WoE have not been as productive as they were elsewhere although the reason for this is unclear. For example, it could be that the capital in the WoE is used less efficiently or that the explanation is associated with the area's sector composition.
   a. **Recommendation 4:** The policy implication is different depending on the reason for this effect, therefore the recommendation is that further research be undertaken to identify the reason for capital not being as productive in the WoE as for the nation as a whole.

8.5.   Larger employers, as measured by the number of employees, contribute positively to the productivity differential in the WoE.
   a. **Recommendation 5:** Support mechanisms should be put into place to support 'anchor' companies, as well as providing support for companies with potential to enable them to become anchors of the future.

8.6.   There are important differences in productivity performance between the constituent parts of the WoE.
   a. **Recommendation 6:** Tailored support should be focussed at the individual needs of each area that build on their strengths and address areas of weaknesses. These support mechanisms should be developed with the understanding that there are important benefits that spillover to the other constituent parts of the WoE.

8.7.   By exploring the effects of capital, labour and industrial structure on productivity growth, this report has identified some important findings and identified areas worthy of LEP support. One of the strongest findings, however, was that these factors only account for a limited part of the productivity differential in the WoE.

      a.   **Recommendation 7:** In order to make sure that policy is focussed on the appropriate levers, further research is required to identify outstanding factors in explaining productivity differentials.

8.8.   The remaining part of this section identifies how future research can build on the current knowledge of the drivers and constrictors of productivity growth in the WoE.

8.9.   The growth accounting framework, as reported by ONS (2008) breaks productivity growth into three constituent parts, capital, labour and other inputs, we will discuss options for future research under these three headings.

8.10.   **Capital:**

This research has identified that capital in the WoE is not as productive in the WoE as it is nationally, the reason behind this is unclear and any future research could attempt to identify why this is the case by exploring the two hypotheses that the capital in the WoE is being used less efficiently or alternatively that this is a result of the underlying industrial structure.

8.11.   **Labour:**

Labour, as controlled for in the current model, captures an economy of scale effect but does not control for the type and quality of labour. This is particularly important in recent periods due to the considerable change in the labour market since the onset of the recession. Such changes include a shift away from full-time to part-time work and an increase in temporary contracts. Further research could attempt to build these factors into the model and identify whether skills shortages are a prime area for investment to stimulate economic growth or whether such investment would benefit less productivity enhancing sectors only.

8.12.   **Other inputs:**

The ONS grouped the other diverse and wide-ranging elements of productivity growth into one category 'other inputs'. The following discussion further breaks down this category to identify a number but not an exhaustive list of potential areas that could explain the drivers and restrictors to productivity growth in the WoE area. Data dependant, further research could build these factors into a fuller model of productivity growth for the WoE.

8.13. **Innovation**

Investment is one of HM Treasury's five key drivers of productivity and is based in the exploitation of new ideas. Innovation can take the form of new technologies, developing new products or processes and developing new corporate structures, all in order to boost productivity. Research in this area has focussed on investment in patent applications, R&D and intangible assets. The challenge when producing local productivity growth models is availability of data. Further work would focus on exploring the possibility of inclusion of innovation in any local productivity model.

The usual way to identify the effect of innovation on productivity is to assess whether current productivity growth is attributable to *previous* innovations. This tends to provide strong evidence that innovation is crucial for productivity growth.

However, we are aware of some research that is currently been undertaken for another core city where they are attempting to identify which types of innovations lead to *future* productivity growth. Knowledge of the relevance of these issues within the WoE LEP area could enable the WoE LEP to tailor policies that could enable their plants to improve the area's productivity premium even further.

8.14. **Industrial structure**

Different areas have different comparative advantages, and these are associated with differences in industrial structures. The priority sector analysis used in this report was useful in that it corroborates the WoE LEP's choice to prioritise a number of above average productive sectors. However, undertaking a full analysis of all sectors will provide a fuller understanding of the WoE's sector strengths and weaknesses. Any such analysis will identify not only the most productive sectors nationally but also whether the WoE has a relative competitive advantage. This knowledge will be important when targeting interventions. It can also be useful in helping to identify industries to target for inward investment.

8.15. **Connectivity**

Transportation links:
Although good transport infrastructure is a necessary rather than sufficient condition for economic competitiveness, there are few examples of successful economic development in places that lack such infrastructure. Investment frequently improves links to and reinforces the relative advantage of existing urban areas. It may lead to local markets being supplied by more productive businesses in less peripheral areas, which are then able to supply local markets more efficiently thanks to increased access and thereby increasing the benefits from scale economies and competitiveness. Improvements in connectivity can also expose businesses in more peripheral regions, previously protected, to increased competition – which may be beneficial if this prompts more and

better innovation and, hence, improved productivity. It may, however, lead to prices being driven down locally and can threaten the viability of existing, local businesses.

Use of the web:
Restricted local markets might be expanded through the use of web-based marketing and sales. Lack of access to specialist suppliers and services might be eased by web-based searches, networks and purchasing. The limited scope of local labour markets might be expanded through internet job search and recruitment – although residential location and access remain constraints for potential recruits.

Aggregation of supply chains and market potential:
Many suppliers in more remote areas are relatively small and relatively isolated one from another. Although there are exceptions, any one supplier of goods or services is unlikely to be able to make a significant impact in terms of establishing contacts, marketing or ensuring significant supply volumes to volume markets in more distant markets. There are examples of rural, quality food producers, for example, which have been able to combine forces and to successfully market, under a joint brand name, a range and volume of goods that can be supplied to major retailers and supermarket chains.[3] This represents a form of aggregation of local supply chains and market potential in a way that can overcome peripherality and fragmentation.

Capitalising on intrinsic value:
It may be possible to promote and support activities that derive value and market potential specifically from the locations and the attributes of these products or services that derive intrinsic value from their location in order to offset what are otherwise the disadvantages of poor accessibility and peripherality; examples include World Heritage Sites, port access or motorway interchanges. The branding and supply of local products in the food and drink sector is a well-documented example. This can also be combined with the aggregation of supply chains and marketing as outlined in the previous paragraph. Local accommodation and visitor attraction is another obvious and well-tried example where it is the intrinsic attractions of a local area that provide the basis for competitive strength. It is clear, however, that in a very competitive overall market, the quality of visitor attractions, effective aggregation and marketing of what is on offer and the efficiency of the supply chain including its insertion into e-marketing a sales media are crucial.

8.16. **Agglomeration Effects:**

Economic Mass:
Rice and Venables (2004) looked at the impact on productivity of economic mass, measured as the size of the working-age population within a given drive

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[3] An example is Mey Selections, brand name of North Highlands Products Ltd, formed by farmers and other producers in Caithness to supply and market a range of products now distributed on-line, through independent retailers and through Sainsbury supermarkets.

time of each NUTS 3 area across Great Britain. They find a significant effect of proximity to economic mass on productivity. This is greatest for mass within 40 minutes drive time and tapers off quite steeply to zero beyond around 80 miles. Their findings suggest that doubling mass raises productivity in a given area by 3.5 percent. They also report that the effects of economic mass on productivity are greater in the less productive areas.

Clustering:
Clustering in physical space has been much emphasised in recent studies, emphasising the role of face to face contact and easy access in promoting trust, collaboration, knowledge exchange and knowledge generation. It is seen as reinforcing market relations between buyers and suppliers, reinforcing supply chains, creating economies of scale and scope through networking and joint activities as well as stimulating knowledge generation and innovation. It may increasingly be possible to replicate some, at least, of this in a variety of forms through the promotion of clustering, networking and density of contacts in virtual or electronic space, although this is likely have different effects in different sectors.

8.17. **Spatial spillovers**

Using plant level productivity data, Webber and Horswell (2009) identified the importance of local spatial spillovers. They reported that areas with higher labour productivity values do have adjoining areas that also have relatively high labour productivity values and vice versa. This suggests that there may be effects that are causing spatial dependence or spatial autocorrelation. Put another way, it is possible that plant level labour productivity levels are influenced by the proximity of geographically close competitive firms and that, for instance, plants in the Bristol local authority benefit from being close to the BANES local authority. On the other hand it may be that firms in a particular area benefit from some factor that it displays strong and systematic differences across space – such as accessibility, labour supply or economic potential, and that these issues generate spatial spillovers.

8.18. **Ownership:**

Much research has been undertaken into the productivity differentials of MNE's and those of domestic companies. Productivity advantages of MNE's can result from their ability to benefit from geographical specialisation, while internalising knowledge across the whole group. In order for local economies to fully benefit from such inward investments the degree of integration into the local economy is of central importance. Such investments can act as a catalyst in driving local productivity growth. The first round effects are obvious but second round effects can occur through the attraction of supply chain investments and through spillover effects. Further research could build into the model ownership characteristics to understand what effects MNE's have on the productivity growth in the WoE.

9. Conclusion and policy review

9.1.   Using data from the ONS's microdata lab this report provides the WoE LEP with an evidence base of the productivity differentials of the WoE and its constituent sub-regions compared to a national average. The report attempts to explain the root causes of the differences in productivity performance in terms of capital, labour and industrial structure.

9.2.   The productivity premium of WoE has grown over the overall period, although the gap has rescinded somewhat since the onset of the recession in 2008. The WoE LEP area is the most productive of the Core Cities LEP areas and only lags Thames Valley Berkshire LEP of the six southern comparator LEPs.

9.3.   The analysis reveals that firms with multi-plants are suffering from diseconomies of scale, which is thought to be due to additional administrative and management burdens attributable to running and organising multi-plant firms. This is an important finding and one worthy of further investigation by the WoE LEP.

9.4.   The WoE priority sectors and their larger employers positively contribute to the productivity differential. However, the analysis showed that capital stock on the other hand does not enhance labour productivity as much in the WoE as it does elsewhere and this makes it appear that plants in the WoE have a lower level of productivity. All these factors together account for only a limited proportion of the productivity advantage, which means that the majority of the productivity differential is still to be accounted for, and hence the reasons for this productivity gap lie elsewhere.

9.5.   When comparing the performance of plants in the priority sectors within and outside of the WoE, the overall performance is variable. Plants in the AE&A in the WoE consistently outperform the average for the sector as a whole. The performance of plants in the Creative Industries in the WoE were below the national average in the early years of the analysis but by the end of the period under examination here the WoE Creative Industries sector had caught up with the national average. WoE P&LS plants outperformed the national average for the earlier periods but in the latest period results are comparable with the national average, and hence the WoE may be losing its comparative advantage in this area. Low Carbon and High-tech generally perform in-line with the sector averages throughout the period suggesting that the WoE doesn't necessarily have a comparative advantage in this industry.

9.6.   In terms of its constituent parts, South Gloucestershire and City of Bristol are consistently better performers than average. The productivity premium of both areas has increased over the whole period, however, since the recession their productivity premiums have dropped and the gap with London widened.

9.7.   The productivity premium in South Gloucestershire is partly explained by plants operating in its priority sector, capital stocks and size of workforce, but nearly half its premium remains unaccounted for.

9.8.   City of Bristol's productivity premium is explained to a limited extent by its priority sectors whereas the other variables shed very little insight. As only a fraction of Bristol's productivity premium is accounted for, further research is required.

9.9.   Over the entire period North Somerset increased their productivity rate faster than the national average, moving from a position of average productivity at the start of the period to nearly 4 per cent above the average by the end of the period. The variables under study, however, shed relatively little light on this productivity differential and therefore further research is required.

9.10.   BANES performance on the other hand has consistently been below the national average by approximately 5 per cent level. Much of this difference can be attributed to capital stocks and scale economies in the workforce but it may also be due to her industrial structure. A fuller examination of the role of industrial structure on labour productivity may reveal that BANES is performing better than the average after a complete range of industries has been incorporated into the model.

9.11.   Without a fuller understanding of the characteristics that are driving or hindering productivity differentials in the WoE and its constituent parts, the WoE LEP will only be able to make investments based on partial information.

Policy Review:

9.12.   This research has identified a number of key issues that should influence the LEP's overall strategy, policy priorities and intervention decisions which are now discussed in the policy review. In broad terms, we recommend that the LEP uses the findings of this report to influence its approach towards:

i)   **Productivity factors**

The LEP should to inform its debate about strategic priorities and guide its interventions in terms of prioritising:

- Technical and process innovation
- Local clustering, scale economies and agglomeration
- Sector and skills specialisation
- Inward investment and export promotion
- Infrastructure and capital support
- Entrepreneurship and business support

In particular, this research shows that the efficiency and effectiveness of capital usage is an important issue that could be improved for the WoE. It is not just whether local firms have the latest, technologically advanced, equipment and software. It is also whether that capital is utilised optimally in

terms of inherent physical potential and applied human skills.

ii)   Priority sectors:

The LEP might consider the adoption of policies that assist in:

- Maintaining and developing the comparative and competitive advantages of local *AE&A*
- Underpinning and promoting potential strengths in *professional and legal service*s
- Building the *creative industries* into a more secure position in terms of both the depth and breadth of its coverage and engagement
- Improving the performance of the other priority sectors (*high-tech and low carbon*), where feasible, to match or better national averages, perhaps by extending local sector footprints.

We also strongly suggest:

- A full review of other areas for potential advantage, particularly with regard to the range of sector and other economic factors that might influence absolute and relative productivity performance generally. It is also recommended that the analysis is extended to not only identify the most level of advantage that is measurable with the most recent data, but also to gain an understanding of where comparative advantages are increasing in the area and where such advantages may be fading. Policy initiatives could be designed to alleviate declines and strengthen advantages.

9.13.   There is already considerable local knowledge about priority sectors within the business networks created within and by the LEP. This report indicates a need to interpret this knowledge carefully with respect to wider comparators of relative performance. The WoE area is unlikely to be able to compete in all potential facets of its priority sectors. For example, its creative and financial sectors will never be able to compete directly (and probably would not want to) with all aspects of their equivalents in London. Similarly, there are elements of global aerospace that may never be feasible locally.

9.14.   A *first key element*, then, is to know what you can do well (current potential), could do well (future potential) and could do better (past potential). In most cases, marginal improvements rather than major new innovation will be feasible. Positive demonstration effects are vital, however, to procuring effective dissemination of best practice and learning.

9.15.   A *second key element* is to adopt a framework for how wider agglomeration and spillover effects are to be considered. Again, we suggest that further research might be useful to understand the parts of the productivity gap that remain unexplained: the other factors that are affecting the WoE's absolute and relative performance.

iii) Company[4] characteristics:

- **Anchors:** often 'prime' businesses that give sectors the scale and scope for strong forward momentum – establishments that are already economically significant for local capacity in terms of output and employment and are worthy of encouragement and defence;

- **Beacons:** often established but rapidly growing and/or innovative businesses that act as leaders in competitive enhancement, technological progress, network building and co-operative dissemination – establishments that are leading supply chains in terms of innovation and competitiveness;

- **Catalysts:** often 'new' businesses with products or services that have the potential to transform or create sectors and markets in more value added directions – establishments that are at the cutting edge of technological, market or organisational added value and may be pointing towards areas of novel, future growth;

- **Drifters:** often firms that have unrealised potential – establishments that could contribute more to growth than they do. Even though they may never be at the leading edge of innovative development, these companies may still be able to 'raise their game'.

9.16.   Such intellectual classification of firms might enable the LEP to tailor its business activities in its priority sectors in a way that has more chance to maximise the impact of its interventions.

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[4] ABCD companies reflect Strategic Economics' classification of companies that might be engaged in, and with, advancing local economic development: firms capable of furthering long-run economic performance in relative and absolute terms.

10. BIBLIOGRAPHY

Bailey, T. and Gatrell, A. (1995), *Interactive Spatial Data Analysis*, London, Longman

Boddy, M., Hudson, J., Plumridge, A., & Webber, D. (2005*). Regional productivity differentials: explaining the gap*. Discussion Papers, (0515).

Borgo, M. D., Goodridge, P., Haskel, J., & Pesole, A. (2013). Productivity and Growth in UK Industries: An Intangible Investment Approach*. *Oxford Bulletin of Economics and Statistics*, *75*(6), 806-834.

Cambridge Econometrics (2003) *A study on the factors determining Regional Competitiveness in the EU* European Commission, Brussels.

Criscuolo, C., & Martin, R. (2009). Multinationals and US productivity leadership: evidence from Great Britain. *The Review of Economics and Statistics*, *91*(2), 263-281.

Copus, A, and MacLeod, M, *Slippery or Soft? Is Peripherality Changing,* paper presented at Regional Science Association Conference, 2004

Copus, A, Skuras D and Tsegenidi, K, *Innovation and Peripherality, An Empirical Comparative Study of SMEs in Six EU Member States,* paper presented at the European Regional Science Association Conference, 2006

Defra, *ICT in England's Rural Economies* 2005

Dimara, E, Goudis, A and Skuras, D, *Business Networks And Local Development In Selected Peripheral European Regions,* paper presented at Regional Science Association Conference, 2004

Florida, R. (2002), *The rise of the creative class and how it is transforming work, leisure, community and everyday life*, New York, Basic Books.

Gardiner B., Martin R. and Tyler P. (2004) Competitiveness, productivity and economic growth across the European regions, *Regional Studies38*, 1037-1059

Great Britain Department for Business, & Innovation & Skills. (2010). Local growth: realising every place's potential (Vol. 7961). The Stationery Office.

Grimes, S., *How well are Europe's businesses connected to the digital economy?* paper presented at Regional Science Association Conference, 2004

Girma, S, Greenaway D, and Wakelin, K. (1999) Wages, productivity and foreign ownership in UK manufacturing. *University of Nottingham.*

Goodhall, B. The Dictionary of Human Geography, London, Penguin 1987.

Harris, R., & Robinson, C. (2005). Impact of Regional Selective Assistance on sources of productivity growth: Plant-level evidence from UK manufacturing, 1990–98. *Regional Studies*, *39*(6), 751-765.

Haskel, J, and Wallis, G. Public support for innovation, intangible investment and productivity growth in the UK market sector. *Economics Letters* 119.2 (2013): 195-198.

Heseltine, M. (2012). No stone unturned: in pursuit of growth.

HM Treasury (2001), Productivity in the UK 3: the Regional Dimension
http://www.hm-treasury.gov.uk/documents/enterprise_and_productivity/the_evidence/ent_prod3_index.cfm

Irwin, E and Bockstael, N (2004) Endogenous spatial externalities: Empirical evidence and implications for the evolution of exurban residential land use patterns. In Aneslin, L., Florax, R J G M., and Rey S J, (Eds.) *Advances in*

spatial econometrics: Methodology, tools and applications, 359-380, Springer, Berlin

Keeble, D., Offord, J., Walker, S. (1988): *Peripheral Regions in a Community of Twelve member states.* Luxembourg: Office for Official Publications of the European Communities.

Kotkin, J. and DeVol, R. C. (2001), *Knowledge-Value Cities in the Digital Age*, Santa Monica CA, Milken Institute.

McCann, P, *Geography, Trade and Growth: problems and Possibilities for The New Zealand Economy,* New Zealand Treasury Working Paper 03/03, 2003

ONS (2007) The ONS productivity handbook: a statistical overview and guide. *Palgrave Macmillan, 2007.*

ONS (2012) The Productivity Conundrum, Interpreting Recent Behaviour of the Economy, August.

ONS (2013) Sub regional Productivity, April.

ONS (2013) Labour Productivity, December.

ONS (2014) International Comparisons of Productivity – Final Estimates 2012, February.

Preston P, Cawley A, Metykova M, *Broadband and rural areas in the EU: From technology to applications and use*, Telecommunications Policy Volume: 31, Issue: 6-7   Pages: 389-400, 2007

Rice, P. and Venables, A. (2004), 'Spatial determinants of productivity: analysis for the regions of Great Britain', *CEP Discussion Paper* No 642, London, London School of Economics and Political Science.

Rizov, M. & Walsh, P. P. (2011). Is there a rural–urban divide? Location and productivity of UK manufacturing. *Regional Studies*, *45*(5), 641-656.

Rodgers, E M, (1962) *Diffusion of Innovation*, The Free Press, New York

Schurmann, C. and Talaat, A, *The European Peripherality Index.* paper presented at European Regional Science Association Conference, 2002.

Voss P R, Long D D, Hammer R B, and Frieddman S, (2006) County child poverty rates in the US: A spatial regression approach, *Population Research Policy Review* **25**, 369-391

Webber, D. J., Hudson, J., Boddy, M. & Plumridge, A. (2009). Regional productivity differentials in England: Explaining the gap. *Papers in Regional Science*, *88*(3), 609-621.

Webber, D. & Horswell, M. (2009). *Winners and Losers: Spatial variations in labour productivity in England and Wales* (No. 0912).

West of England LEP (2014) Quarterly Economic Intelligence.

West of England LEP (2014) Economic Context.

Wrigley N, Holt T, Steel D and Tranmer M (1996) Analysing, modelling and resolving the ecological fallacy, in Longley P and Batty M (Eds.) *Spatial analysis: Modelling in a GIS environment*, GeoInformation International, Cambridge, England, 23-40

11. SECTOR DEFINITIONS[5]

Advanced Engineering and Aerospace
- Manufacture of electrical equipment (27)
- Manufacture of machinery & equipment n.e.c (28)
- Manufacture of weapons & ammunition (25.4)
- Manufacture of communication equipment (26.3)
- Manufacture of air & spacecraft machinery (30.3)
- Manufacture of military fighting vehicles (30.4)
- Manufacture of medical & dental instruments & supplies (32.5)
- Research & experimental development on natural sciences & engineering (72.1)
- Repair & maintenance of aircraft & spacecraft (33.16)
- Repair of electrical equipment (33.14)
- Engineering activities & related technical consultancy (71.12)
- Manufacture of non-electronic instruments & appliances for measuring, testing & navigation, except industrial process control equipment (26.51/3)
- Manufacture of non-electronic industrial process control equipment (26.51/4)

Creative Industries
- Programming & broadcasting activities (60)
- Creative, arts & entertainment activities (90)
- Sound recording & music publishing activities (59.2)
- Advertising (73.1)
- Specialised design services (74.1)
- Photographic activities (74.2)
- Printing of newspapers (18.11)
- Pre-press & pre-media services (18.13)
- Book publishing (58.11)
- Publishing of directories and mailing lists (58.12)
- Publishing of newspapers (58.13)
- Publishing of journals and periodicals (58.14)
- Other publishing activities (58.19)
- Publishing of computer games (58.21)
- Other software publishing (58.29)
- Motion picture, video and television programme production activities (59.11)
- Motion picture, video and television programme post-production activities (59.12)
- Motion picture projection activities (59.14)
- Motion picture distribution activities (59.13/1)

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[5] These SIC-based definitions are those agreed and used by the WoE LEP, and provided to us for analysis.

- Video distribution activities (59.13/2)
- Computer Programming Activities (62.01)
- News agency activities (63.91)
- Architectural activities (71.11)

Professional and Legal Services
- Financial service activities, except insurance & pension funding (64)
- Insurance, reinsurance and pension funding (65)
- Activities auxiliary to financial services and insurance activities (66)
- Legal and accounting activities (69)
- Activities of head offices; management consultancy activities (70)
- Market research and public opinion polling (73.2)

High Tech
- Manufacture of electronic components & boards (26.1)
- Manufacture of computers and peripheral equipment (26.2)
- Manufacture of consumer electronics (26.4)
- Manufacture of irradiation, electro-medical & electrotherapeutic equipment (26.6)
- Manufacture of electrical & electronic equipment for motor vehicles (29.31)
- Repair of electronic & optical equipment (33.13)
- Manufacture of electronic instruments & appliances for measuring, testing & navigation, except industrial process control equipment (26.51/1)
- Television, radio transmitters and apparatus for telephony and telegraphy (33.20)
- Telecommunications services (61.90)
- Computer Hardware Consultancy/Other Software Consultancy and Supply (62.02)
- Maintenance and repair of office, accounting and computing machinery (95.11)
- Other Computer Related Activities (62.09)
- Publishing of Software (58.29)
- Data Processing / Data Base Activities (63.11)

Low Carbon
- Water collection, treatment & supply (36)
- Recovery of sorted materials (38.32)
- Technical testing & analysis (71.2)
- Manufacturing of other general purpose machinery (28.29)
- Site preparation (43.12)
- Plumbing, heat & air conditioning installation (43.22)