

Productivity: understanding regional differences

What drives variations in economic performance across Britain?

Patricia Rice and Tony Venables find that access to cities has a big influence on regional productivity.

How can we explain the large and growing disparities in economic performance across the regions of Britain as documented in publications like the Treasury's report on the regional dimension of productivity (HM Treasury, 2001)?

Our research indicates that a key influence on variations in productivity across Britain's 'NUTS3' sub-regions is how close they are to 'economic mass' – the size of population of working age within driving time of 80 minutes or shorter. Indeed, according to our calculations, doubling the economic mass to which an area has access – for example, by reducing journey times to the nearest big cities – can raise its productivity by 3.5%.

Explaining Britain's regional inequalities

The latest data (ONS, 2003) indicate that GDP per head in London is 54% above the national average and even higher in inner London. In contrast, GDP per head in the North East, the poorest of the 11 broad (NUTS1) regions of Britain, is just 73% of the national average, falling to as low as 60% of the average in some of its NUTS3 sub-regions.

Moreover, these disparities have increased since 1995 with GDP per head in London and the South East growing relative to that in regions on the periphery – Scotland, the North East, the North West, Wales and the South West.

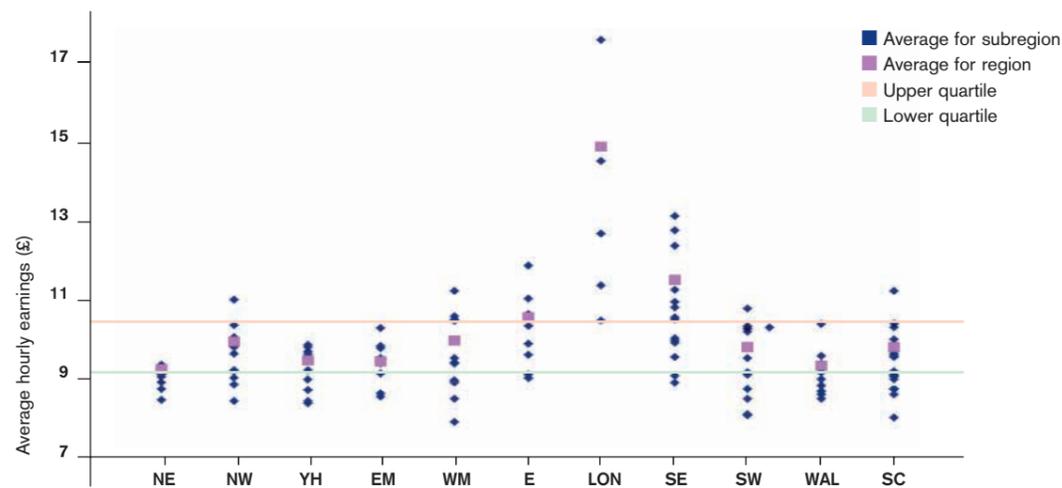
Regional inequalities in income per head arise from many different sources – differences in labour force participation, differences in employment rates, differences in the composition of skills and occupations and differences in productivity. All of these are correlated with one another but they may have distinct and separate causes.

In this research, we focus on disparities in income per worker and do not attempt to explain rates of labour force participation or employment. We examine regional variations in earnings and the role of three key variables: occupational composition; skill levels; and productivity benefits associated with 'agglomeration' or proximity to a large mass of economic activity.

Our analysis uses data on Britain's 126 NUTS3 administrative sub-regions. In order to compile a consistent dataset, a number of these are combined to give a sample of 119

If people are 30 minutes closer to a city in terms of driving times, their impact on productivity increases fourfold

Figure 1: Regional and subregional disparities in earnings



spatial units that we call 'areas'. The data cover the period 1998-2001 and the four years of data are averaged in order to remove some of the year-to-year volatility.

Several alternative measures of income are available at the NUTS3 level, including earnings and estimates of gross value added per worker. We focus on earnings, which means that we fail to account for income from non-employment sources but avoid problems arising from allocating profits and other non-wage income across relatively small spatial units.

Figure 1 shows the regional distribution of earnings. On the horizontal axis are the 11 NUTS1 regions, with the squares indicating average hourly earnings for full-time employees in each of these broad regions. The diamonds represent the comparable figures for the NUTS3 sub-regions that make up each NUTS1 region.

The national average for full-time hourly earnings is £10.83 an hour. At £14.88, average hourly earnings in London exceed that average by 37% and are approximately 60% higher than in the North East, the lowest ranking region.

What is readily apparent from Figure 1 is that the degree of dispersion within regions is comparable with the degree of dispersion across regions. All regions, apart from the North East and Yorkshire and Humberside, include at least one

sub-region in the upper quartile of the distribution (at or above the upper horizontal line) while only London and the East do not have one in the lower quartile (at or below the lower horizontal line).

Earnings variation: the effects of occupational composition and productivity

Regional variation in average earnings can be 'decomposed' into two parts: differences in productivity and hence in the wage rates paid to workers in a given occupation; and differences in the occupational composition of employment.

The issue of occupational composition can be summarised as follows: does a region have low average earnings because it has a high proportion of workers in low skilled occupations or because the workers in any given occupation have low productivity and hence low earnings? We compare actual average earnings in a region with what average earnings would be if the region had its own occupational composition but the same occupational wage rates as the UK as a whole. The evidence shows that around a third of the regional variation in earnings can be explained by occupational composition.

To identify the contribution of productivity differences we construct a measure of average earnings for each area, which is conditional on the occupational composition being the same as that for Britain as a whole – what we call a productivity index. We also construct an index of occupational composition by computing average earnings in each area based on its actual occupational composition but assuming that wage rates are equal to the national average.

These indices are calculated for each of the NUTS3 areas,

and Figure 2 illustrates their averages at the broader NUTS1 level. The height of the bar for each region indicates the percentage by which earnings are above or below the national average. The bars show that only London, the South East and the East have earnings above the national average – in the case of London, 37% above the average.

The blue part of each bar in Figure 2 indicates the proportion of the earnings variation that is due to the region's occupational composition while the purple part indicates the proportion due to productivity differences. It is clear that occupational composition matters a great deal, supporting a near 15% earnings gap between London and the North East. Yet most of the regional variation in earnings across the NUTS3 areas comes from variation in our productivity index rather than the index of occupational composition.

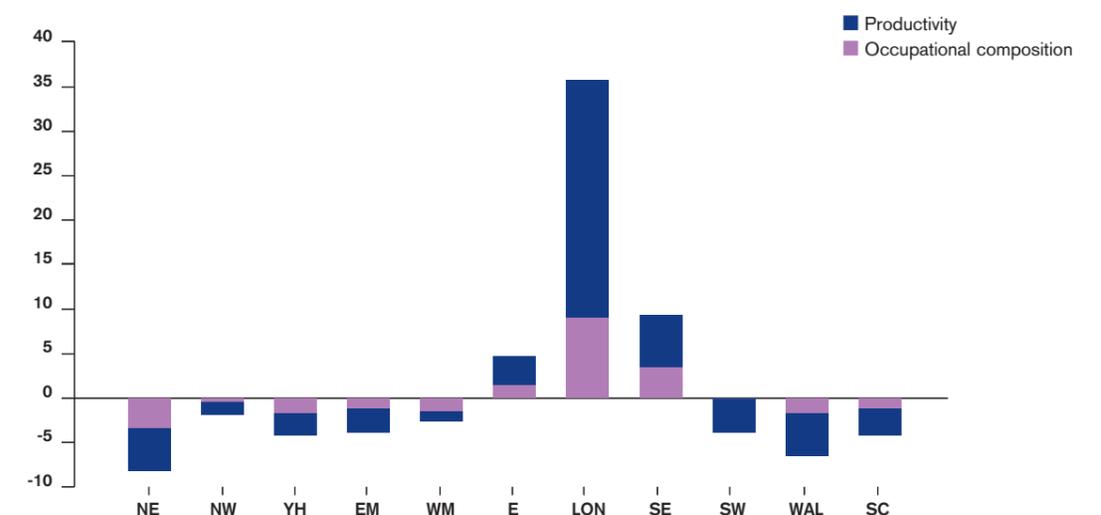
Productivity differences: skill levels and economic mass

We now turn to the question of how much of the regional variation in our productivity index can be explained by economic geography – proximity to economic mass – and how much is due to other factors including regional skill differences.

On the impact of economic mass, our hypothesis is that 'increasing returns' cause productivity to be high in regions that have proximity to cities. US evidence offers some empirical support for such effects – see, for example, Ciccone and Hall (1996), who find that density of activity has a positive effect on productivity. Three main sorts of mechanisms have been put forward to explain the relationship between city size and productivity (see Fujita and Thisse, 2002, for a survey):

Doubling the economic mass to which an area has access will raise its productivity by 3.5%

Figure 2: Occupational composition and productivity



Below average access to cities contributes to the poor performance of the North East, the South West, Wales and Scotland

■ One is technological 'externalities' – firms learn from being located near other firms involved in related activities, so that they innovate and implement new technologies more efficiently.

■ A second is that wide, deep labour markets work more efficiently, by having lower costs of search for both workers and employers and making it much easier to match workers with jobs.

■ The third main mechanism is simply that firms benefit from lower costs of trade and transport if they have good access to both their customers and their suppliers of intermediate goods and services.

It is worth noting that while the first of these mechanisms raises the productivity of a worker of a given type in a given job, the other two do not. Market access effects mean simply that firms seek to locate where they can save on trade and transport costs.

In this research, unlike earlier studies, we assess not only the effects of population size on productivity, but also the distance over which these effects extend. In order to capture the effects of agglomeration, we compute an index of economic mass based on a weighted sum of the population within a given proximity. More specifically, for each of the NUTS3 areas, we estimate the population of working age within each of a series of driving time bands – that is, within 30 minutes, 30-40 minutes, 40-50 minutes, etc. Economic mass is measured as the weighted sum of the population in each time band, where the weights decline with travel time. In other words, population within 30-40 minutes driving time has a larger weight than population within 40-50 minutes.

We then estimate two key parameters. The first is the 'elasticity of productivity' with respect to our measure of economic mass – the extent to which productivity increases as economic mass increases; and the second is the rate of 'spatial decay' – the rate at which the contribution of population to economic mass declines with travel time.

Our estimates point to a fairly steep rate of spatial decay so that moving a given population 30 minutes closer in terms of driving time increases its impact on productivity fourfold. In other words, an extra person within 30-40 minutes driving time has four times the impact on productivity of an extra person within 60-70 minutes driving time.

The estimates of the elasticity of productivity with respect to economic mass centre around 0.05, which implies that doubling the economic mass that an area has access to increases its productivity by 3.5%. This estimate is at the lower end of the range of estimates found by previous research: Rosenthal and Strange (2004) report a consensus view that 'doubling city size seems to increase productivity by an amount that ranges from roughly 3-8%'.

Is this just a London effect?

To what extent are these findings due simply to the coincidence of a large population and high productivity in London and the South East? We take a number of steps to establish the robustness of the findings. These include computing separate estimates for two sub-groups of the sample: a South East 'core' of 60 NUTS3 areas within 180 minutes driving time of central London; and a 'periphery' of 59 NUTS3 areas more than 180 minutes from London.

For both the South East core and the periphery, we find strong evidence that productivity increases with population and that the impact of population declines sharply with proximity as measured by driving times. That said, the responsiveness of productivity to increases in economic mass is somewhat greater in the South East core than in the periphery.

Productivity differences: the impact of education

The second factor driving regional variation in the productivity index is the educational qualifications of the local workforce. In theory, an index of productivity can be constructed at a sufficiently disaggregated level in terms of occupation that each occupational group is homogenous in terms of its educational qualifications. If this were the case, then the impact of education levels on earnings would come only through the occupational composition index and not at all through the productivity index.

In practice, it is not possible to obtain reliable data at such a disaggregated level and jobs within the same occupational group can vary significantly in terms of the associated level of educational qualification. To allow for this, we include the proportion of the economically active population qualified with a specified level of education as explanatory variables.

As might be expected, increasing the proportion of the workforce qualified to at least first degree level while reducing the proportion with sub-degree (GCSE, A-levels, etc.) qualifications raises the productivity index. A 10% increase in the proportion with degree level qualifications or better increases productivity by nearly 1%.

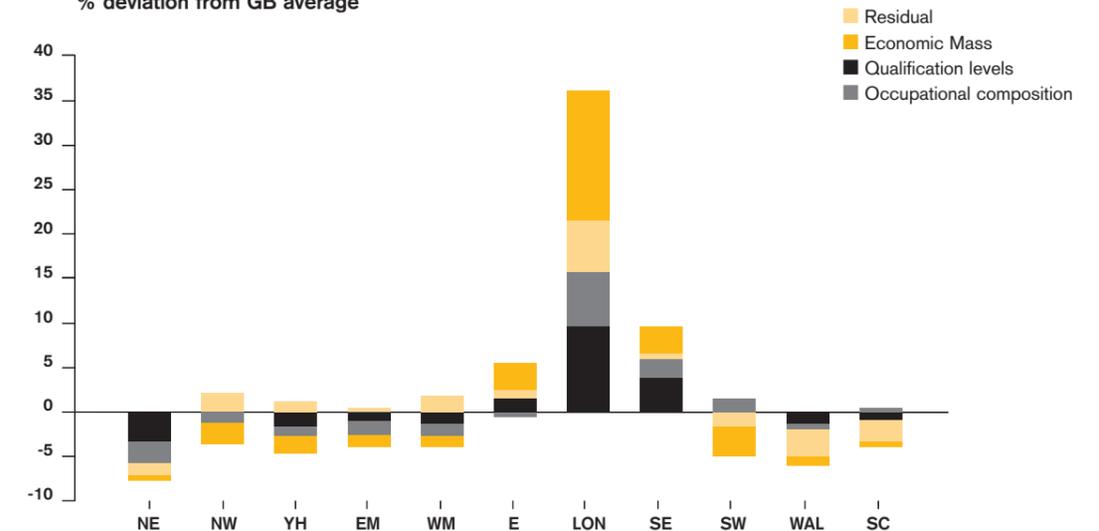
Equally, increasing the proportion of the workforce with no formal educational qualifications relative to the proportion qualified to sub-degree level reduces productivity. A 10% increase in the proportion with no formal qualifications reduces productivity by around 0.7%.

Accounting for regional differences in earnings

We have investigated three causes of regional variations in earnings: occupational composition; productivity differences due to agglomeration; and productivity differences due to education. The relative importance of each of these factors – and the residual that is unexplained by these

Wales' overall 3% productivity loss from below average access ranges from plus 0.5% in Cardiff to minus 9% in Powys

Figure 3: Decomposition of earnings differentials % deviation from GB average



factors – is illustrated in Figure 3. As with previous figures, we just illustrate the averages for each of the NUTS1 regions, although the measures are calculated for each NUTS3 area.

As in Figure 2, the overall height of the bar shows the percentage by which average earnings differ from the national average, and the black part of each bar shows the contribution of occupational composition to this difference. In Figure 3, the contribution of productivity differences is further decomposed into the contribution of differences in qualification levels; differences in economic mass; and the unexplained residual.

What can we conclude from this analysis? First, it is clear that a robust and quantitatively important determinant of variations in productivity between NUTS3 areas is the proximity of each area to economic mass – the presence of a large population of working age within 80 minutes or less driving time.

Below average access to economic mass contributes to the poor performance of the North East, South West, Wales and Scotland, and reinforces the strong performance of East Midlands, London and the South East. The effects are quite large – around 9% of the difference in earnings between London and Wales as a whole is attributable to differences in these scale effects.

At first sight, the magnitude of the productivity effects of greater proximity to cities may appear modest. But there are large variations in access to economic mass across the NUTS3 areas and the effects are much larger for some NUTS3 areas than between entire NUTS1 regions. Thus, while London as a whole has a 6% gain from its access to

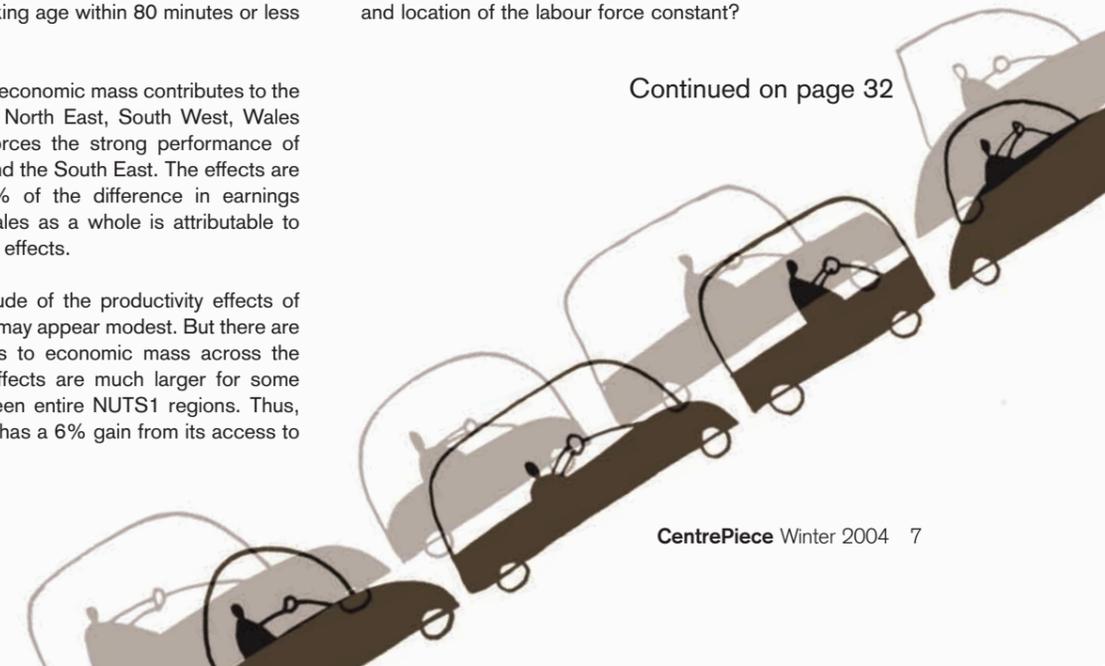
economic mass and Wales a 3% loss, this ranges from plus 0.5% in Cardiff to minus 9% in Powys.

Moreover, closer examination of the contribution of economic mass to explaining regional variations in productivity suggests that it is particularly important in areas in the lower half of the productivity distribution. More than two-thirds of the productivity variation between these areas is due to variation in their access to cities.

The productivity gains from cutting journey times

A final indicator of the quantitative importance of the effects of economic mass comes from considering the following thought experiment designed to assess the likely productivity gains from improvements in transport infrastructure. Suppose that all journey times were cut by 10%. How much would productivity increase, holding the qualifications and location of the labour force constant?

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The productivity gain would be nearly twice as large for places where access to cities increases the most

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Answers to this question are given in Table 1. They show that a 10% reduction in average journey times throughout Britain would raise productivity by 1.12% and by nearly twice as much for places where access to cities is increased the most.

Table 1: Percentage productivity gain from a 10% reduction in all driving times

	Average	Minimum	Maximum
GB average	1.12		
North East	0.81	0.53	1.04
North West	1.10	0.88	1.44
Yorks-Humberside	1.25	1.07	1.45
East Midlands	1.33	0.69	1.66
West Midlands	1.30	0.88	1.73
East	1.35	0.32	2.22
London	0.90	0.73	1.08
South East	1.31	0.99	1.66
South West	1.08	0.31	1.62
Wales	1.09	0.48	1.57
Scotland	0.80	0.00	1.55

It should be noted that these numbers represent the 'induced' productivity gain and are additional to any effects that would be included in a standard cost-benefit analysis of a transport improvement, such as direct cost and time savings. We have not experimented with reducing travel time on particular routes or in particular regions, but the results of the nationwide experiment are generated for each NUTS3 sub-region.

The table reports the average results for each NUTS1 region and the minimum and maximum values in each of these areas. In very low-density areas, speeding up transport has essentially no induced productivity effect, hence the low minimum values for Scotland and the South West. The highest value is for Peterborough, which would enjoy a 2.22% productivity increase, gaining from improved access to both the London area and the Midlands.

This article summarises 'Spatial Determinants of Productivity: Analysis for the Regions of Great Britain' by Patricia Rice and Anthony J Venables, CEP Discussion Paper No. 642 (<http://cep.lse.ac.uk/pubs/download/dp0642.pdf>). The paper was written as part of the Evidence Based Policy Fund project 'Regional Inequalities in the UK: Productivity, Earnings and Skills'.

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