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## Article

# The evolution of the UK North-South divide: Should we mind the gap?

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# Third Prize

## Gilles Duranton and Vassilis Monastiriotis

Data on average regional earnings point at a worsening of UK regional inequalities and a rise in the North-South gap. In this paper, we decompose regional inequalities in the UK and apply earnings equations for UK regions over 1982-1997. We find evidence of rapid convergence across regions regarding the determinants of individual wages (i.e., regional fixed-effects, gender gaps and returns to education and experience). Education accounts for most of the discrepancy between aggregate divergence and disaggregated convergence. First, London gained because its workforce became relatively more educated over the period. Second, returns to education increased nationwide, which favoured the most educated regions (i.e., London). Third, returns to education were initially lower in London but they (partially) caught up with the rest of the country. Had returns to education and their distribution across UK regions remained stable over the period, the UK North-South divide would have decreased.



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**Vassilis Monastiriotis** is a research officer currently undertaking his PhD at the Department of Geography and Environment at the London School of Economics. His research focuses mainly on the regional and national economic effects of labour market flexibility, the evolution of wage inequalities between and within regional economies and the impact of human capital on wages, productivity and growth. Other research interests include the size distribution of cities and the investigation of spatial spill-overs in the determination of school performance and criminal behaviour.

# The evolution of the UK North-South divide: Should we mind the gap?

## 1. Introduction

Inequalities across regions in Europe are a matter of great interest to policy makers and politicians as well as members of the general public. Numerous studies have shown that income inequalities across European regions are large and persistent (Quah, 1996; Esteban, 2000). Interestingly, the decomposition of European regional inequalities into a cross-country and a within-country component shows that the former is declining, whereas the latter has risen significantly over the last 15 years (Esteban, 1999; Dunford and Smith, 2000).

This increase in within-country regional inequalities has been particularly strong in the United Kingdom. According to aggregate figures given by the Office for National Statistics, in 1982, average earnings in London and the South East were respectively 121% and 103% of the national average. By 1997, earnings in London and the South East had risen to respectively 137% and 109% of the national average. Broadening the analysis to regional GDP per capita instead of average earnings does not make much difference. Comparable inequalities across UK regions are also found for unemployment, educational attainments and even mortality. This has been identified as the UK "North-South Divide", opposing a prosperous South to an increasingly relatively impoverished North. In this paper we use the UK experience as a case study in order to analyse the forces that are behind the evolution of regional inequalities in a large open economy.

Although it is possible that the UK is a particular case, it is a particularly interesting country to investigate.

Although it is possible that the UK is a particular case, we believe that this is a particularly interesting country to investigate. This trend of rising regional inequalities in the UK suggests indeed significant policy implications. First, the UK has one of the most flexible labour markets in Europe, where the constraints imposed by institutional factors are expected to be weaker, compared to other European economies. Second, the UK is one of the largest EU economies and probably the one that is most deeply integrated in the global economy. Third, this increase of regional inequalities has taken place despite the determination of EU regional policy to narrowing regional differences in economic opportunities and economic outcomes. It goes without saying that further research for other EU economies is of course necessary for more general conclusions to be drawn.

Our starting point is that the aggregate figures quoted above are quite misleading. A more useful comparison would be to use not the average wages of workers across regions, but the wages of specific groups of workers across regions. This makes it possible to distinguish those inequalities which result from workers in the same jobs being paid different rates from inequalities which reflect the different composition of the workforce in different regions. The result is a somewhat different picture of the extent and nature of regional inequalities.

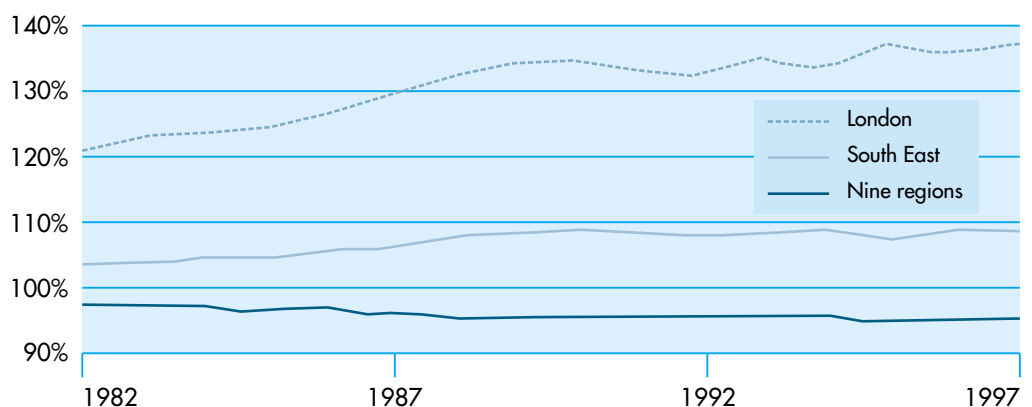
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This essay summarises a longer report on the same subject (Duranton and Monastiriotis, 2000), which is available at <http://cep.lse.ac.uk/~duranton>. We are grateful to Chris Hurst and Gareth Jones for useful comments on this article.

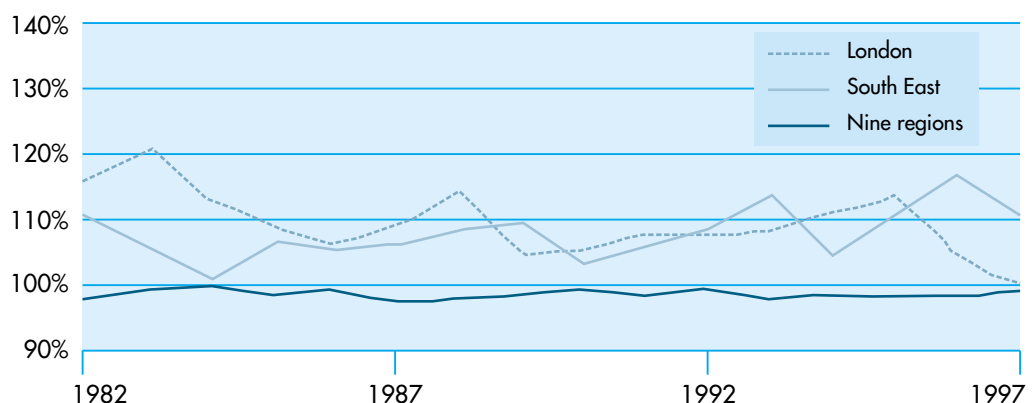
Figure 1 uses the conventional approach: it plots the average relative nominal wage for three regional groupings between 1982 and 1997 (1). Figure 2, by contrast, plots average nominal wages for a specific hypothetical worker, a 25 year-old with secondary education. For this hypothetical case, the contrast between his/her own situation and the aggregate picture is stark. London and the South East are much closer to the national average with London being below the South East at the end of the period. There is also evidence of convergence between the three regions.

The patterns revealed for this particular hypothetical case of Figure 2 is also found for most of the other hypothetical cases. More generally, this research shows that, once the distribution of human capital is controlled for, the *regional returns* (i.e., market value) of all key labour market characteristics (education, experience and sex) and regional fixed-effects converged during the 1980s and 1990s. With the term regional fixed-effects we mean the estimated (average) regional wage that is independent of all key labour market characteristics or, in other words, the wage of a male employee with no education or labour market experience.

**Figure 1.** Average regional earnings in the UK 1982-97 (UK average = 100%)



**Figure 2.** Nominal regional earnings for a 25 year old with 15 years of education, employed full-time (UK average = 100%)



1) Our analysis uses the twelve Standard Statistical Regions (SSRs) of the UK as our spatial units. For presentational reasons, however, Figures 1 and 2 exclude N. Ireland and group the nine regions outside the wider urban agglomeration of London (North, Northwest, Yorkshire, West Midlands, East Midlands, East Anglia, Southwest, Scotland and Wales) into one group, hereafter called "the nine regions".

The main explanations we offer to reconcile the apparent contradictions between Figure 1 and Figure 2 are threefold. First, London had initially lower returns to education. The catch-up in returns to education implied large gains in average wages in London. In other words, disaggregated convergence caused aggregate divergence. Second, during the 1980s and 1990s, a rise in personal inequalities took place in all UK regions (see Machin, 1996 and 1998 for reviews of evidence on this). Rising inequalities between skilled and unskilled, in combination with the uneven spatial distribution of human capital, also contributed to magnify aggregate UK regional inequalities. Third, rising average educational attainment in London and the South East relative to the rest of the country also played a role in explaining the aggravation of regional inequalities.

Before commenting further on these results and their policy implications, we need to examine briefly how they were obtained.

## 2. The method

The two questions we seek to address are the following:

- Do “similar” individuals have the same wage across UK regions?
- How have the differences, if any, evolved in the last 20 years?

**We regress real wages on a set of individual characteristics, including sex, education and labour market experience for each region and each year.**

To answer these questions, we exploit data from the Family Expenditure Survey over the period 1982-1997. We regress individual real wages on a set of individual characteristics, including sex, education and labour market experience, for each region and each year. The reason is that individual characteristics like age, education and sex tend to impact on the wage in systematic ways. For instance, educated workers earn on average more than less educated workers, males earn more than females and experienced workers earn more than workers with no labour market experience. Furthermore, very experienced workers earn less than experienced workers. Workers tend to accumulate skills at the beginning of their career which in many cases become obsolete later on. Over one's life cycle, therefore, wages first increase, then peak before starting to decrease. To deal with these conflicting effects and the resulting non-monotonic pattern in a regression, two different terms related to experience are needed. Hence in addition to labour market experience, we also introduce its square in the regression. Labour market experience captures the accumulation of skills and its square captures its depreciation. Note also that the wages are adjusted by regional prices indices, i.e., they are real and not nominal wages. More details of data definitions and of the model specification are given in the Technical Annex.

To put things simply, this analysis allows us to control for composition effects and it yields five coefficients for each region and each year:

- The gender gap, that is how much being a woman affects one's wage, all else being equal.
- The returns to education, which indicates by how much wages increase for each extra year of schooling.

- The returns to experience, which captures the positive effects on the wage of one year of experience.
- The depreciation of skills, which captures the negative effect on the wage of having stayed longer in the labour market (and, hence, away from education).
- The regional fixed-effect, i.e., the base wage that would be obtained by someone with no experience and minimum education in the region being analysed.

It is difficult in practice to plot the evolution over 16 years of a given variable for all 12 regions in the same Figure and get a clear picture. To analyse our results, three main devices are used: Firstly, we compare the range for the coefficients of each variable at the beginning and the end of the period. This informs us about the evolution of the gap between the region with the highest coefficient and that of the lowest one. A reduction in the range indicates a decrease in disparity between extreme cases. Secondly, we examine the evolution of the coefficient of variation for each variable over the period. This measures the evolution of average relative dispersion across regions. A negative trend indicates a decrease in average disparities for the variable being considered. Finally, we analyse the correlation across regions between the time trend and the initial level for each variable. The simplest way to do this is to draw a simple plot for each variable, where each region is an observation. The time-trend for 1982-97 appears on the vertical axis and the initial level for the variable shows on the horizontal axis. Mean-reversal is observed when the trends for 1982-1997 are inversely correlated with the initial levels, that is, when regions that initially had a high coefficient experienced a relative decline. By contrast, a positive correlation between the intercepts and the trends would indicate divergence. This measure is especially important as it tells us how individual regions have moved within the distribution.

### 3. The results

Before turning to regional differences, it is helpful to look at the evolution of the mean of the coefficients on each variable over the 12 regions (2). The trends are very clear. The main changes that affected the country as a whole are:

- A slight decline in the fixed-effects, i.e., a decline in the wage of a hypothetical uneducated male with no experience.
- A strong decrease of around one fourth in the gender gap.
- A strong increase of around one fifth in the returns to education.
- An increase of around one sixth in the returns to experience.
- An increase in the speed at which skills depreciate (over the life cycle, wages peak about three years earlier in the mid-90s than in the early 80s).

**The most important feature of our results is the tendency of the coefficient on all characteristics to converge across regions.**

These results are very much in line with previous findings regarding the evolution of wage inequalities in the UK. However, despite these marked national trends, regions have behaved differently. If we treat regions as separate units of observation, the most important feature emerging from our results is the tendency for the coefficients on all characteristics to converge across regions.

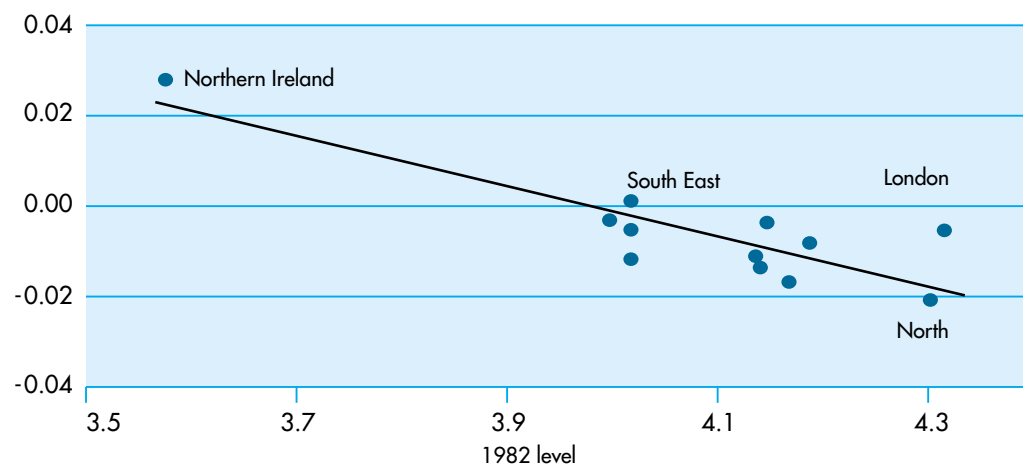
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2) Note that all our variables have followed an upward trend over the study period. However, this trend was stronger for wages and female employment (as a share to total employment) and less so for education and labour market experience.

The range in the real regional fixed-effects at the beginning of the period (average for 1982 and 1983) was very large at 0.90 (from 3.35 in Northern Ireland followed by the North West with 3.77 to 4.25 in London at the other extreme). For the end of the period (average for 1996 and 1997), the range is much smaller at 0.41 (minimum for Northern Ireland at 3.72 and a maximum for London at 4.13). The evolution of the coefficients of variation, which decreased by around one fourth over the period confirms this finding. Figure 3 gives further support to convergence in real regional fixed-effects. The convergence period can be computed at 22 years.

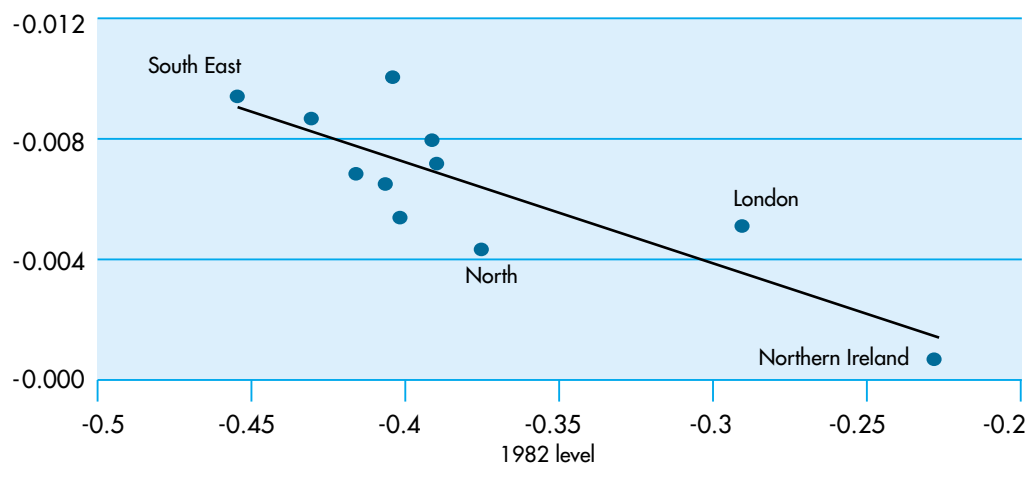
Turning to the gender gap, the initial range was also very large at 19% (from 43% in South East to 26% in Northern Ireland and 24% in London). By the end of the period, the range for the gender gap had fallen to 14% (19% in London and 33% in East Anglia). Further evidence of convergence can be gathered from Figure 4.

**Figure 3.** Regional convergence in the real fixed-effects



Note that analysing nominal wages, i.e., wages not deflated by regional price indices, instead of real wages does not change the results regarding regional fixed effects very much and leaves results for the other variables the same.

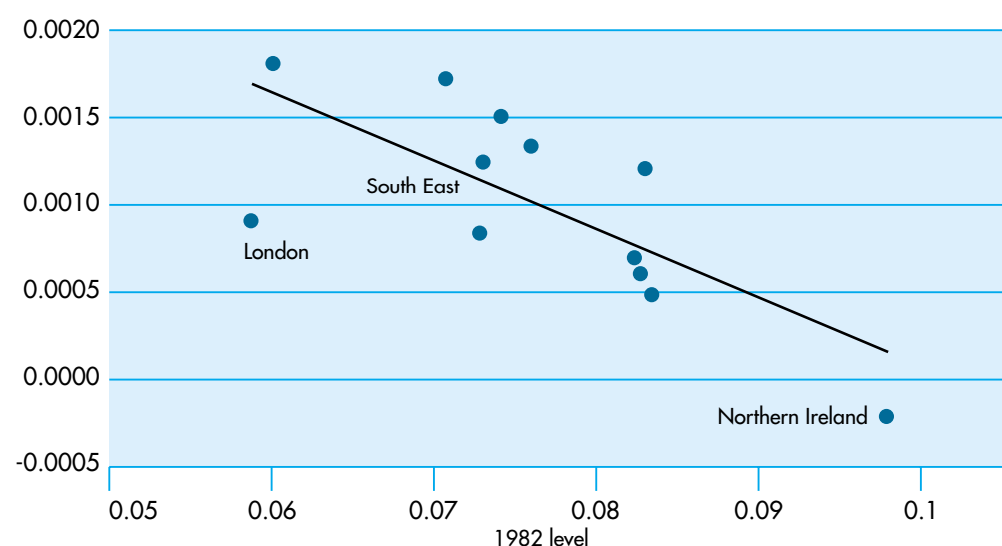
**Figure 4.** Regional convergence in the gender gap



The convergence period is 26 years. Even when the two regions with the lowest gender gaps are ignored, mean-reversal is still found. Regarding the coefficient of variation, there was an increase between 1982 and 1986 and then a sharp decline until 1990 and since then a slight increase. Hence, the evidence about relative dispersion appears to be mixed. But this has a simple explanation since, on average across regions, the gender gap fell very significantly, by 9 points over the period. This decline has been faster than convergence in absolute terms. Consequently, differences in relative terms (as captured by the coefficient of variation) have risen slightly.

For education, the annual returns initially ranged from 6.0% in London to 9.6% in the North West and 10.5% in Northern Ireland. At the end of the period the extremes remained London with 7.4% at the bottom end and Northern Ireland with 10.4% followed by Yorkshire with 10.3% at the top end. Thus the range fell by more than one third from 4.5% to 2.9%. Convergence is also supported by Figure 5. Convergence in this figure, as was the case with the previous ones, is robust to the exclusion of Northern Ireland.

**Figure 5.** Regional convergence in the returns to education

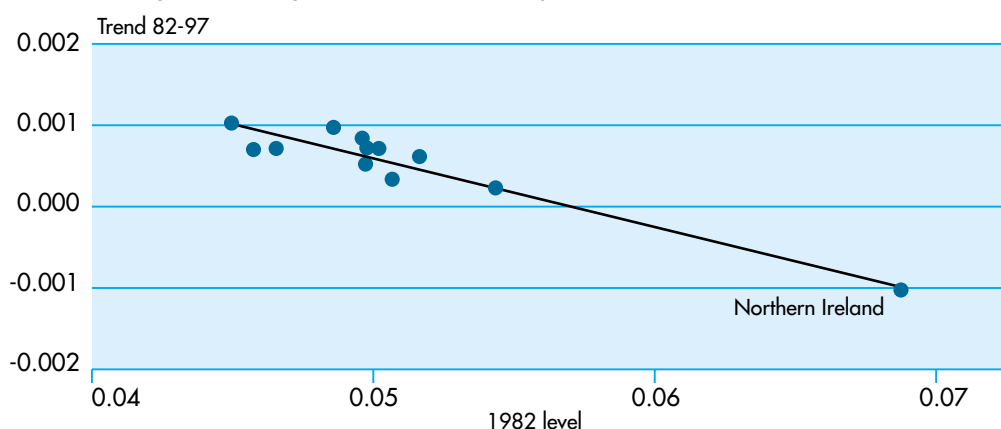


The convergence period, at 35 years, is slower than for the other variables. This is partly due to London, which has persistently lower returns to education and is converging only slowly with the rest of the country. Convergence is also found when looking at the evolution of the coefficients of variation.

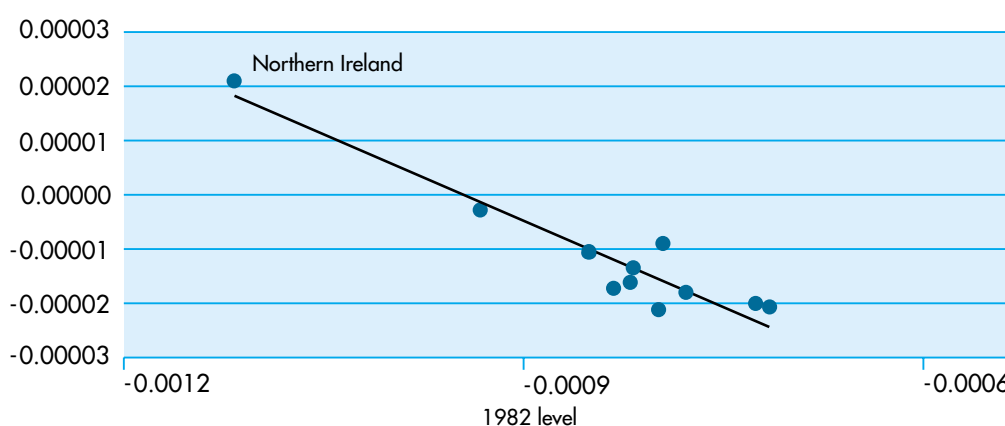
For the returns to experience and its depreciation (i.e., experience and squared experience), convergence is very strong. The lowest returns were initially in the North with 4.8% whereas the highest were in Northern Ireland with 7.9%. By the end of the period, the range had fallen from 3.1% to 1.4% with the extremes being the South West with 5.5% and East Anglia with 6.9%. For both variables, the coefficients of variation nearly halve during the period. Figures 6 and 7 also show remarkable mean-reversal for both variables. The convergence periods are respectively 12 years for experience and 9 years for the depreciation of experience.



**Figure 6.** Regional convergence in the returns to experience



**Figure 7.** Regional convergence in the depreciation of experience



**Convergence in every single dimension stands in sharp contrast with the rising wage gaps observed in the aggregated figures. This can only be resolved by looking at regional structures.**

Overall, the market values of labour market characteristics, alongside regional fixed-effects, have converged across UK regions over 1982-1997. Convergence is very strong for the coefficients on experience and its depreciation. It is also significant, albeit less dramatic, for education, the gender gap and regional fixed-effects. Convergence in every single dimension stands in sharp contrast with the rising wage gaps observed in the aggregated figures. This discrepancy can only be resolved by looking at regional structures.

Note that the analysis employed does not allow us (and is not intended) to draw any conclusions regarding the determinants of the convergence trends identified here. For example, the decline in the gender gap could be possibly attributed to the changing nature of female employment, especially given the observed nation-wide increase in female wages. On the other hand, the possibility that the decline in the gender gap is due to a diffusion of the same social norms throughout the country cannot be excluded on the basis of the information presented here. Likewise, the observed convergence in the returns to education could be due to a more equal cross-regional distribution of skills or due to changes in the patterns of labour migration. Note, however, that the results obtained from our further empirical analysis (see the Technical Annex) do not seem to confirm any of these explanations.

#### 4. A breakdown of the evolution of UK regional inequalities

Regarding regional structures, the first interesting variable to look at is female participation. There has been a large increase in female participation in the UK of around 7 points and this increase has been strongest in regions where the gender gap was initially highest. In the beginning of period, the range for female participation was 9% (26% in the East Midlands and 35% in London). By the end of the period, it was at 6% (34% in East Anglia and 40% in London). For experience the pattern is more complex. Overall, mild structural divergence is observed. The initial range was around two years (19.8 years in London and 21.8 in the North) whereas the final range is about four years (18.3 in London and 22.3 in Wales). For education, divergence is also evident, with London getting relatively more educated than the rest of the country by around 9 months over the period.

Further insights can be gained by decomposing the evolution of regional inequalities. For simplicity, we consider only the evolution of regional inequalities between London and the nine regions between 1982-83 and 1996-97 (Northern Ireland has a behaviour that is different from the rest of the UK whereas the South East is somewhat half way between London and the nine other regions of Great Britain). This decomposition breaks down the aggregate increase in regional inequalities into four components:

1. What can be attributed to changes in national characteristics (e.g., an increase in average education);
2. What can be attributed to changes in the differences in characteristics across regions (e.g., the increase in education being stronger in London);
3. What can be attributed to changes in the estimated model coefficients at the national level (e.g., higher returns to education); and,
4. What can be attributed to changes in the differences in the estimated model coefficients across regions (e.g., a narrowing in cross-regional differences in the returns to education).

**The evolution of fixed-effects, the wage of a male employee of no education or no labour market experience, led to greater regional equalisation.**

The results are presented in Table 1, which is split according to these four components. It must be noted first that the evolution of the nominal fixed-effects led to greater regional equalisation. The decline of the London premium accounted for –32% of the rise in regional inequalities between London and the nine regions (component 4).

In total, the gender variable accounts for 10% of the increase in regional inequalities. This small aggregate effect is the result of conflicting market value (or price) and composition effects. The national increase in female participation implied an increase in regional inequalities due to the lower gender gap in London (component 1). The relatively stronger increase in female participation in the nine regions reinforced this push towards greater inequalities (component 2). The national decline in the gender gap also led to greater inequalities due to the higher female participation rate in London (component 3). However, the stronger relative decline in the gender gap in the nine regions pushed towards equality (component 4).

Regarding experience, the overall effect is one of cross-region equalisation (–25%). Its four components are of different signs. The most important of them is the increase in the experience gap

between London and the nine regions (component 2) where the relative decline in experience in London pushed towards greater equalisation.

**Table 1.** Decomposition of aggregate increase in regional inequalities.

Increase in regional inequalities 1982-1997	
<b>Component 1:</b> part due to changes in national characteristics	-31.6%
Gender	9.7%
Education	-51.0%
Experience	9.7%
<b>Component 2:</b> part due to changes in cross-region differences in characteristics	39.0%
Gender	16.0%
Education	58.8%
Experience	-35.8%
<b>Component 3:</b> part due to changes in the benefit gained from having (or market value of) a particular characteristic at the national level	23.8%
Gender	6.3%
Education	23.9%
Experience	-6.4%
<b>Component 4:</b> part due to changes in cross-region differences in market values of a particular characteristic	68.9%
Fixed-effects	-32.0%
Gender	-21.9%
Education	114.9%
Experience	7.9%
<b>Total</b>	<b>100.0%</b>

If it were not for educational differences, regional inequalities between London and the nine regions would have decreased significantly.

The combined effect of the regional fixed-effects, gender, and experience variables is negative and accounts for -47% of the rise in inequalities. In other words, if it were not for education regional inequalities between London and the nine regions would have decreased significantly. Overall education accounts for 147% of the increase in regional inequalities. However, when the contribution of education is broken down into four components, they do not all go in the same direction. The national rise in educational attainment of the workforce reduced regional inequalities fairly significantly because of lower returns to education in London (-51%, component 1). However the stronger increase in education of the London workforce (component 2) accounts for 59% of the overall increase in inequalities. The national rise in returns to education also favoured London at the expense of the nine regions and accounts for 24% of the rise (component 3). The most important term is however, the part due to the returns to education in London slightly catching-up with those in the rest of the country (component 4). This term alone explains 115% of the increase in regional inequalities.

It is interesting to note that across all variables, the fourth component, which is the part due to the evolution of cross-regional differences in the returns to individual characteristics (i.e., convergence

**The most important cause of the increase in aggregate inequalities is convergence in the returns to labour market characteristics, notably experience and education.**

in this case), accounts for 69% of the rise in inequalities. This highlights the importance of taking a disaggregated approach to regional inequalities. In the UK between 1982 and 1997, the most important cause of the increase in aggregate inequalities is convergence in the returns to labour market characteristics (experience and education). In other words, differences in average wages across regions in 1982 were lower than what differences in characteristics across regions would have predicted. Regional differences in the returns to labour market characteristics in the early 1980s indeed contributed to hiding regional inequalities due to the differences in labour force composition. The decline in these price differences over the 1980s and 1990s, then, contributed to increased differences in average wages.

It is possible to go a little further in the analysis by noting that the evolution of regional prices for goods and housing on the one hand and that of the returns to labour market characteristics on the other are unrelated. There is however, a positive link between the evolution of regional prices and that of the population in UK regions. Over the period, the population of London and the South East increased by 6.5% against 3.3% for the nine regions. There is thus an agglomeration movement of the population towards London and the South East. This agglomeration movement may have been triggered by the initially more favourable sectoral composition of this area (business services, high tech, etc.). This rise in demand for labour attracted more workers, which in turn caused a rise in the demand for other types of workers (personal services, etc.). This may be a case of cumulative and circular causation leading to more agglomeration in the South East of England. This created some stress on regional prices -and in particular land prices - with large increases in London and the South East. These price effects may be so important as to make these two regions unaffordable for the least skilled workers - many of whom end up leaving. This may explain the increasingly uneven distribution of skills observed in the country.

## **5. Potential caveats**

How far are these results a good reflection of regional inequalities in the UK and their evolution? There are many problems that may bias our results. The first important issue is the following. Imagine two workers of the same age, education and sex, working for the same bank as branch managers. The first one works in a very small branch in Scotland whereas the second one manages a large branch in the City of London. Their employer did not assign these two workers randomly although statistically they cannot be distinguished. It is very likely that the London manager has higher abilities than the other one. More generally, people with high unobserved abilities (talent, ambition, motivation, etc) in the UK may tend more often to work in London. This may bias our results.

Note first that such a bias may just reinforce some of our conclusions since it will exaggerate the regional fixed effect in London (i.e., after controlling for their observed characteristics, higher unobserved abilities in London imply a higher basic wage on average). Note also that with respect to the evolution of regional inequalities, this bias does not matter, provided it remains constant over time (static errors cancel each other out when looking at differences over time). Finally we also dealt directly with this problem by running regressions with variables trying to proxy for these unobserved abilities. To do this we used some information in our data regarding occupation and past mobility of our workers. These richer regressions gave similar, if not stronger, results.

A second important problem is that the probabilities of being in full-time employment may differ across regions. For instance in a region facing severe economic difficulties, only the most able may be in full-time employment whereas in prosperous regions, nearly everyone may be at work. This is an important potential source of distortions. Note however, that our analysis controls for key characteristics that influence the probability of finding a job like education and experience so that this bias concerns only unobserved abilities. To deal with this problem, we also used empirical methods that explicitly take into account this kind of issue. They do not significantly change our basic results. If anything, they reinforce them again.

Another two potential problems are the following. First, our conclusions might be to some extent biased due to the omission of significant wage determinants, like sectoral and firm-specific characteristics. However, as explained earlier, such factors were considered as endogenous and, hence, were excluded from the econometric analysis. Further, the robustness of our results across different specifications makes us less worried of any such potential problem. The second issue refers to the quality of the variables used in our analysis. There is increasing literature on the growth effects of human capital suggesting that formal education and labour market experience are possibly less appropriate proxies for skills than are for example on-the-job training, vocational education and the like. Although we are sympathetic to this argument, we cannot ignore the importance of formal education and labour market experience for skills acquisition. Further, data limitations meant that these two measures were the only skill proxies that could be used in our empirical analysis.

## 6. Conclusions and policy implications

**Our results suggest there is no large labour market unfairness across regions. If the objective is to equalise earnings for comparable individuals, then policy intervention may not be warranted.**

Our results suggest that there is no large labour market unfairness across UK regions. When controlling for the composition of the labour force, we find that regional inequalities caused by differences in returns to labour market characteristics have decreased fairly significantly. At the same time, the differences in the composition of the labour force across regions have become more accentuated. If the objective is to equalise earnings for comparable individuals, policy interventions towards regional equalisation may not be warranted.

In any case, this does not mean that regional policy changes cannot lead to efficiency gains, for individual outcomes. In particular, the increasingly uneven distribution of skills across regions can be partially explained by the strong institutional restrictions on the supply of land in London and the South East. It may be tempting to argue for some liberalisation on this side. Further work is needed, however, as a greater concentration of population in London and the South East may have a significant environmental/congestion impact. Furthermore, such reforms are also likely to have distributive effects through potentially large changes in house prices everywhere in the country.

One potential bias in our conclusions should be noted. The analysis presented here refers to only one particular geographical scale: the region. Admittedly, the 1980s and 1990s have also seen a marked pattern of rising inequalities within regions, across UK counties. On the other hand, even at the regional level, what may be true for wages may not be true for other important issues like health or the educational attainment of youngsters. Thus, our findings regarding the labour market need to be replicated for other forms of economic and social inequalities across UK regions.

However, the most pressing issue at this stage is to see whether this type of finding holds for other European countries. Indeed, as in the UK, regional inequalities in most European countries have increased significantly over the last twenty years. Admittedly, the UK economy may be a “special case” in Europe because of its labour market regulation, cyclical behaviour, currency, etc. On the other hand, as many European countries become increasingly integrated in the global economy and - as they seem - follow more closely the Anglo-Saxon paradigm of enhanced labour market flexibility, it is possible that inequalities across regions in Europe have increased through the same sort of mechanism as in the UK. This would warrant a thorough re-examination of European regional policy and its objectives.

**To reduce aggregate disparities, one can only try to make the spatial distribution of skills more even across regions.**

What the UK example shows is a regional equalisation in terms of wages for comparable individuals as well as greater disparities in the distribution of skills across regions. In such a situation, to reduce aggregate disparities, one can only try to make the spatial distribution of skills more even across regions. This may not be such a wise move if the economic prosperity of nations is fostered by the concentration of skilled workers in large metropolitan regions such as London, Paris or the Rhine region. At the same time, the concentration of the most educated in London might be the result of labour market failures in the non-metropolitan parts of the UK with the most educated workers being drawn into London for lack of professional opportunities elsewhere.

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## Technical Annex

The analysis uses the Family Expenditure Survey (FES) and the General Household Survey (GHS), both from the Office for National Statistics (ONS). The FES is a continuous random sample survey of private households in the United Kingdom. It collects information about incomes as well as detailed information on expenditure. When considering only full-time employees, our total sample size varies between 4 357 observations in 1996 and 5 992 in 1992. For most regions and most years, more than 300 observations per year are available. For Northern Ireland however, only 85 observations are available for the typical year. Like the FES, the GHS is an annual national survey. It is a multi-purpose survey, providing information on aspects of housing, employment, education, health and social services, transport, population and social security. It is a continuous survey based on an achieved sample of about 9 000 households. The data is collected by face-to-face interview. It encompasses all English regions, Wales and Scotland but not Northern Ireland.

For both FES and GHS data, the sample that we actually used in our wage equations consists of males and females between 16 and 65 years of age who reported to be in full-time employment. Because of known problems about self-reporting on employment status, we excluded cases that reported less than 30 hours a week. We also excluded cases for people earning hourly wages outside a “reasonable” range (GBP 1- GBP 200 in 1990 UK prices), to avoid extreme cases and apparent data-input mistakes.

Data on regional prices are from Reward Group Ltd (<http://www.reward-group.co.uk>). All other aggregate data used in this paper come from Regional Trends 34 (1998 and 1997 editions) series published by the ONS. Most of it is freely available electronically at <http://www.statistics.gov.uk/>.

The empirical analysis uses standard wage determination equations, regressing individual wages for full-time employees on sex, education, experience and its square. Each regression is run using a full set of regional dummy variables. As far as the estimated coefficients are concerned, this is equivalent to running separate regressions for each region. As individuals cannot be identified and followed over time, a separate cross-section is run for each available year of observation. This allows for each coefficient to vary across regions and across time. Thus for each region-year we obtain a constant (the regional fixed effect), a gender gap and some returns to education and experience. Such a regression can be formally written as follows:

$$(1) \quad LW_i(j,t) = \beta_0(j,t) + \beta_1(j,t)SEX_i + \beta_2(j,t)EDU_i + \beta_3(j,t)EXP_i + \beta_4(j,t)SQEXP_i + \varepsilon_1(j,t)$$

where  $LW_i(j,t)$  is the log of weakly earnings in year  $t$  for full-time employee  $i$  who lives in region  $j$ . We interpret this variable as the nominal wage. The sex variable,  $SEX_i$  is coded 1 for females.  $EDU_i$  is the number of years in full-time continuous education. Labour market experience is not recorded but it can be proxied by potential experience,  $EXP_i$ , calculated as the age minus the age of completion of full time education which is traditionally measured as the number of years in full-time education plus 5. Finally  $SQEXP_i$  is the square of the previous term.



Data on regional prices allow us to calculate  $LRW_i(j,t) = \text{Log}(W_i(t)/PRICE(j,t))$ , the logarithm of the real weekly earnings. Equation (1) can thus be re-written:

$$(2) \quad LRW_i(j,t) = \beta_0^R(j,t) + \beta_1(j,t)SEX_i + \beta_2(j,t)EDU_i + \beta_3(j,t)EXP_i + \beta_4(j,t)SQEXP_i + \varepsilon_1(j,t)$$

where the real regional fixed-effect,  $\beta_0^R(j,t)$ , is equal to the nominal regional fixed-effect minus the log of regional prices:  $\beta_0^R(j,t) \equiv \beta_0(j,t) - LPRICE(j,t)$ . Thus the same analysis can be performed for real wages without any further regression. The coefficients on sex, education and experience are not affected. The real regional fixed effect of a given region-year can be calculated directly as the difference between the corresponding nominal fixed and log regional prices.

The extensions of the analysis attempt to identify and correct for potential caveats. This is done by amending the initial wage equations and adding a number of skill dummies and variables measuring household mobility. We also used the Heckman two-step estimation method to control for potential sample selection bias. These extensions are discussed in more detail in Duranton and Monastiriotis (2000).