

Changing Wage Structures: Trends and Explanations

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Abstract

In this Chapter, I explore changes in the structure of wages that have characterised the UK labour market over the last four decades. I first focus upon documenting the patterns of change and trends in wage structures, and then on explaining why these changes have occurred. The Chapter highlights that there have been different episodes of changes in wage inequalities. In the 1970s, there were reduced inequalities but, in terms of what followed, these narrowings were small in magnitude. The 1980s saw very rapidly rising wage inequalities, with wage gaps widening out at all parts of the wage distribution. In the 1990s, changes were more muted, but wage gaps continued to rise. In the 2000s, a rather different picture emerged, with upper tail inequality continuing to rise, but lower tail inequality stagnating. Turning to explanations, I argue that the standard supply-demand model of the labour market is successful in picking up some, but not all, of these observed changes. The declining impact of labour market institutions, dovetails with this to offer some additional explanatory power.

1. Introduction

Studying changes in the inequality of labour market earnings has been a major focus of economists and other social scientists for a long time, but this research area has experienced a significant resurgence in the recent past as wage structures have altered significantly in many countries. Labour economists, in particular, have invested a lot of time and effort in learning more about trends in wage inequality and in developing and implementing tests of competing explanations of what factors underpin the observed changes (see the surveys of Katz and Autor, 1999, Machin, 2008, and Machin and Van Reenen, 2008).

This Chapter offers a contemporary review of what we have learned from this work in the context of providing an up-to-date picture of what has happened to wage inequality in the UK. I first focus upon documenting the patterns of change and trends in wage structures, and then on explaining why these changes have occurred.

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Turning to explanations, I argue that the standard supply-demand model of the labour market is successful in picking up some, but not all, of these observed changes. A key long run driver has been skill-biased technology change (SBTC), which has been developed further in work that links closely to the polarization phenomenon from the observation that many jobs that have been lost have been through technology substituting for jobs that mainly involve routine tasks (task-biased technical change, TBTC). The impact of labour market institutions dovetails well with these technology based explanations of changing wage structures.

The rest of the Chapter is structured as follows. Section 2 spends some time describing the basic facts in terms of what has happened to wage inequality over the last four decades. Section 3 considers explanations of the observed patterns of change. Section 4 ends with some general observations and concluding remarks.

2. Laying Out the Facts on Changes in UK Wage Inequality

This section lays out the basic facts on changes in UK wage inequality. There are six sub-sections, respectively looking at overall changes in wage inequality, changes in educational wage differentials, patterns of labour market polarization, changes in labour share, decadal differences and how the UK experience compares internationally.

Overall Changes in Wage Inequality Since 1970

Figure 1 displays the evolution of the differential between the ninetieth and the tenth percentile of the earnings distribution (the 90-10 ratio) for full-time men and women since 1970, based upon New Earnings Survey (NES) and Annual Survey of Hours and Earnings (ASHE) data.¹ The Figure reveals what by now has become a well-

¹ The NES data runs up to 1996 and the ASHE data from 1997 to 2009.

known pattern. From the late 1970s onwards the 90-10 ratio significantly increased and inequality is now a lot higher than it used to be. This is the case for men and women, though the increase in the 90-10 ratio for women tends to taper off from the late 1990s.

Figure 2 separately considers the upper and lower halves of the distribution. For men, upper tail wage inequality (measured by the 90-50 wage ratio) rises sharply from the late 1970s and consistently throughout the entire period up until 2009. Male lower tail wage inequality (measured by the 50-10 wage ratio) also shows a significant increase, but with most of its increase concentrated in the 1980s and early to mid 1990s. Following that it flattens out. For women, the story is similar, though there are some subtle differences. Most notable is the halting of the increase in lower tail inequality from the mid-1990s.

Overall, however, what is very clear from Figures 1 and 2 is that wage inequality is significantly higher now than it was some thirty years ago. This is true for men and women, and is the case in both the upper and lower halves of the distribution.

Changes in Educational Wage Differentials

Rising wage inequality has been accompanied by increasing gaps within and between different groups of workers. The wage premium received by graduates as compared to non-graduates is a between-group wage differential that has received considerable attention in the literature. Figure 3 shows the wage gap between graduates and non-graduates from 1980 to 2004. The premium rises sharply from 1.48 in 1980 to 1.60 by 1990 and continues to rise, albeit at a more modest pace, up until 2004. This is in line with the idea, recognised in various places in the literature, that education has become more highly valued in the labour market and that this is one of the key features of rising wage inequality.

Labour Market Polarization

In terms of employment, another key feature of rising labour market inequality has been the polarization of jobs growth (Goos and Manning, 2008). Figure 4 (taken from Mieske, 2009) shows this very clearly, with there being very rapid growth over time in the top two deciles of job quality (as measured by median occupational wages from 1979). Employment actually fell from deciles 2 through 8, showing a hollowing out of the distribution, but there is positive growth for the bottom decile.

Decade by Decade Differences

The results presented to date make it very clear that wage inequalities are now significantly higher than they were forty years ago. However, looking more closely reveals different episodes of changes in wage inequalities. Table 1 looks at decade by decade changes in overall, upper and lower tail wage inequality. It reveals some different evolutions across the four decades covered by the analysis.

The Table shows that the 1970s actually saw reduced inequalities (for women) but, in terms of what followed, these narrowings were relatively small in magnitude. The 1980s were very different. They saw very rapidly rising wage inequalities, with wage gaps widening out at all parts of the wage distribution, for both men and women. The scale of these changes kick-started the now large literature on changes in wage inequality (in the US see Bound and Johnson, 1992, or Katz and Murphy, 1992, and in the UK see Schmitt, 1995, Machin, 1996a, and Nickell and Bell, 1995).

In the 1990s, changes were more muted but wage gaps continued to rise, at approximately half the pace of the 1980s, and still being characterised by rising upper and lower tail inequality. In the 2000s, a rather different picture emerged, with upper tail inequality continuing to rise (albeit at a more modest rate, especially for women), but with lower tail inequality no longer increasing.

The stagnancy of the 50-10 differential in the 2000s based upon the ASHE data requires comment because it has been stated in some places that lower tail inequality has fallen in the current decade. Other data sources suggest there may have been a modest reduction in the 50-10 ratio. In Brewer, Muriel and Wren-Lewis' (2009) analysis of Family Resources Survey, data the 50-10 differential is constant for full-time men and falls by 0.3 percentage points a year (up to 2008) for full-time women. In the ASHE data the 25-10 differential for full-time women falls slightly (by 0.2 percentage points a year). Probably the key observation is that lower tail inequality is no longer rising in the 2000s, and may be falling in its lower regions.

Overall, Table 1 makes it evident that the period where wage inequalities rose significantly and fastest was the 1980s. Considering different parts of the distribution in more detail makes this even clearer. Figure 5 shows real earnings growth at the 10th, 25th, 50th, 75th and 90th percentiles of the distribution by decade. The faster growth at the top that occurred in the 1980s is very clear. The 1990s looks rather like a toned down version of this, but the other decades show a more mixed pattern.

The polarization story also alters when one considers decadal differences. Figure 6 shows polarization from 1979-99 and from 1999-2008 (now expressed in annualised growth rates to permit comparability). Far and away the dominant feature of this Figure is growth at the top end (in the 9th and 10th deciles). The much smaller increases in the growth of low wage jobs seen in the 1980s and 1990s in the lowest decile is, interestingly, no longer observed in the 2000s. However, the J-shape of the employment growth schedule remains the same, despite the lack of growth at the bottom decile, thus preserving the relative pattern seen in the earlier decades.

International Comparison

Many commentators have remarked upon the rapid wage inequality rise in the 1980s arguing that, along with the US where wage inequality also rose very rapidly (and from higher starting levels), the UK labour market was pinpointed as one of the few places that then experienced rising wage inequality. Table 2 picks up on this by showing OECD data on male 90-10 wage ratios in 1970, 1980, 1990, 2000 and 2008 (or the closest year to that) for twelve countries.

Table 2 confirms the 1980s increases in the 90-10 for the UK and US, with relative stability elsewhere. However, when one moves to the 1990s and 2000s the picture is not so clear. In the 1990s wage inequality starts to rise in some countries like Australia, Germany (see Dustmann et al, 2009, for much more detail on this), Korea, the Netherlands and Sweden. In the 2000s rising wage inequality appears to be the norm, even in the Nordic countries where rises are small but there are increases, leaving only France having a stable wage structure over time.

3. Explanations of Changing Wage Structures

In this section I consider explanations of changing wage structures in more detail. I begin by considering the usefulness of a simple supply-demand model of the labour

market in accounting for the observed changes, then move on to discuss possible drivers of these shifts in relative demand and supply that have been considered in the wage inequality literature.

The Orthodox Supply-Demand Model

In the orthodox supply and demand model, wage inequality increases come about because of an increase in the relative for skilled workers. Katz and Murphy (1992) first formalised the issue of changing wage gaps between different workers at different points in the wage distribution in a simple model of relative demand and supply of skills. They specified a production function where output is produced with two labour inputs, skilled and unskilled workers, and where these two sorts of workers are substitutes.

The basic logic of their argument is that the relative wage of the two worker types varies with their relative demand and supply. If demand outstrips supply, the relative wage will increase (and will fall if demand lags behind supply). This is, in essence, Tinbergen's (1974) race between supply and demand. Katz and Murphy argue that the recent patterns of change have seen relative demand for skilled workers outstrip relative supply and so wage gaps between skilled and unskilled workers have increased.

They test this notion through a simple time series model that relates the relative wage of college educated versus high school educated workers to shifts in relative demand and supply. To do so they estimate a relative wage equation of the form:

$$\ln(W_s/W_u)_t = \gamma_0 + \gamma_1 \text{trend} + \gamma_2 \ln(N_s/N_u)_t + v_t \quad (3)$$

where $\ln(W_s/W_u)_t$ is the log of the skilled to unskilled wage, relative supply is measured by the log of the ratio of the number of skilled to unskilled workers $\ln(N_s/N_u)_t$ and v_t is an error term. They proxy relative demand by a trend arguing, for example, that new technologies that drive the relative demand for skilled workers up have been trending up through time. Using US time series data from 1963 to 1987, they found $\hat{\gamma}_2$ to be significantly negative (equal to -.7), showing that relative supply increases depress the relative wage, and a significant trend increase in the college premium of 3.3% per annum ($\hat{\gamma}_1 = .033$).²

Estimates of this model for UK data from 1974 to 2007 (taken from Amior, 2008) are reported in Table 3, together with updated estimates from 1972 to 2010. The model seems to fit the data well in the UK as well. The estimated coefficient on the supply variable is (as predicted) negative and significant and in the range of -.17 to -.22.³ However, the positive coefficient on the trend variable shows that, despite the very sharp increase in the relative supply of graduates, there must have been an even faster growth in relative demand for graduates. Depending on specification, this trend growth was of the order of around 1 % per year over and above the supply changes.

Skill-Biased Technical Change

The estimates of the Katz-Murphy model for the UK make it evident that relative demand has shifted in favour of more educated workers, and that this has been a key

² Autor, Katz and Kearney (2008) present more up to date estimates, from 1963 to 2005, reporting that the same kind of pattern continues into the 1990s and 2000s.

³ For the particular form of the production function used to derive (3) the inverse of this coefficient is the elasticity of substitution between skilled and unskilled workers. The estimates in Table 3 suggest a substitution elasticity of about 5, which is a line with the magnitude of the elasticity of 5.8 reported in Manacorda, Manning and Wadsworth (2006).

feature of rising wage inequality. In the research on rising wage inequality and shifts in relative demand for skills, a strong focus has been placed upon what are the key drivers of change. A lot of the literature has concluded that skill-biased technical change (SBTC) has been the key driver of such change.⁴

Stated in its simplest form, the SBTC hypothesis says that new technologies lead to higher productivity, but only some (more skilled) workers possess the necessary skills to operate them. Therefore in response to introducing these kinds of technologies into their workplace, employers raise demand and/or wages for highly skilled workers who are complements with the new technologies. Lower wages, or lay offs, occur for less skilled workers who do not possess the skills to use the new technologies.

A typical approach adopted to test this (first used in the pioneering paper by Berman, Bound and Griliches, 1994) comes from estimating statistical models relate the skilled wage bill share (to model relative demand shifts that occur through rising relative wages and/or relative employment) to observable measures of technical change. These kinds of models have been estimated in a large number of studies, usually using data on workplaces or industries, to ask whether more technologically advanced workplaces or industries experienced faster skill demand shifts. There is now an abundance of empirical research that suggests that SBTC is an important and international phenomenon. Table 4 shows some selected UK studies showing this, for a range of different technology indicators, time periods and data sources.⁵

It is worth noting that the studies reaching this conclusion for the UK (Machin, 1996b, and Machin and Van Reenen, 1998) use data from the period where wage inequality rose fastest. A natural question to ask, given the decade differences in changing patterns of wage inequality noted in Section 2, is whether such effects still operate. The new analysis described in the first row of Table 4 confirms that they do. Even in the 2000s the industries experiencing faster increases in skill demand are those with higher R&D intensities.

Task-Biased Technical Change

In an important recent paper, Autor, Levy and Murnane (2003) have recast the SBTC hypothesis, especially the impact of computerization, in a fresh light. They argue that the nature of jobs, and the tasks done by workers in their jobs, are key to thinking about the way in which technological changes impact on the wage distribution. They argue that computers raise the demand for jobs where non-routine tasks are required of more skilled and educated workers, but they substitute for jobs with routine tasks done by middle-educated workers (like manufacturing production, or secretarial jobs). Thus routine non-manual tasks may be replaced by computers, whilst some non-routine tasks done by manual workers (like cleaning) are largely unaffected by ICT. This area of work has become known as task-biased technical change (TBTC).

Autor, Levy and Murnane present empirical evidence in favour of the TBTC hypothesis by presenting evidence of non-monotone impacts of computers on the demand for jobs, with there being a strong complementarity between computerization and the demand for non-routine jobs and a strong substitutability with the relative demand for

⁴ For straightforward descriptions of the SBTC hypothesis see Machin (2003, 2004). The assertion that SBTC is the key driver is by no means without controversy. See Card and DiNardo (2002) for a very sceptical position.

⁵ Further international studies are surveyed in a more detailed Table in Machin (2008).

jobs involving routine tasks. Autor and Dorn (2009) have further studied TBTC, showing evidence that there has been an increased demand for service sector jobs in places where larger numbers of routine jobs have been lost to technical change. The argument they offer is that people displaced from jobs with routine tasks are more likely to find employment in the new kinds of service sector jobs available in modern labour markets.

Mieske (2009) has estimated variants of the Autor-Dorn TBTC models for 98 UK counties in the 1990s and 2000s. The key hypothesis she tests is that having more routine task jobs initially causes the hollowing out of middle of the distribution jobs and that this polarization results in an increased demand for low wage service sector jobs. Evidence for this idea is reported in Table 5 (taken from Mieske, 2009). It is indeed the case that there seems to have been faster cross-county growth in the non-graduate service share in places where there were initially more routine tasks that could be substituted for by new technologies. Moreover the finding remains robust both for the 1990s and 2000s, providing some evidence that TBTC matters for the changing nature of the UK labour market.

An Aside on International Trade

In the earlier literature in wage inequality there were (sometimes heated) debates about whether technology or trade matters most for explaining changes in labour market inequality. This is probably because many people's 'first guess' was that it was the opening up to international trade that had caused the labour market position of low skill workers to deteriorate and that this was likely to be a prime mover in raising wage inequality.

Even writing now, little evidence can be marshalled to support this viewpoint. Direct effects of international trade have proven very hard to identify (Desjonquieres et al., 1999). In the skill demand regressions like equation (4) above trade measures rarely correlate well and the explanatory power of technology variables strongly dominates.

Of course, current ongoing research looking at the very rapid increase in trade flows with countries like India and China is likely to result in new evidence on this, but even here it is secondary and indirect effects of trade that form the main focus of interest (e.g. Bloom, Draca and Van Reenen's, 2009, study of trade induced technical change). I shall leave this aside with what has become the usual comment that surely trade will matter for labour market inequality at some point, whilst noting that good evidence supporting this conjecture does not yet exist.

Labour Market Institutions

The final issue I consider in this Chapter is the other possible driver that has received attention in the wage inequality literature, namely the role of labour market institutions. The argument usually posed here is that in places where there has been a change in the strength of labour market institutions this can affect wage inequality. Where institutions have weakened (like union decline, or falling values of real minimum wages), this removes protection for low wage workers, so their relative wages fall, and wage inequality rises. In the case of strengthening institutions (e.g. equal pay legislation) then it is hypothesised that this can curb inequality.

Card and DiNardo (2002) report time series evidence of a strong (negative) connection between US 90-10 log hourly wage gap and the real minimum wage. Evidence in Machin (2010) shows a time series regression of the UK 90-10 log weekly wage differential on union density and a time trend also produces a strong association

between rising inequality and falling unionization. In both cases, however, if one looks at 90-50 regressions, there is a significant upper tail wage inequality impact, which seems odd. Similarly adding the union density to the time series models of relative demand-supply given in Table 3 makes no difference and the estimated coefficient on the union variable is insignificant.

Micro-data estimates do show effects of falling unionization on wage inequality in the UK for the 1980s (see the decompositions in Bell and Pitt, 1998, Gosling and Machin, 1995, and Machin, 1997, which show about 20% of rising UK wage inequality can be attributed to union decline). However, there is no more recent evidence on the issue. It seems sensible to conclude that union decline and minimum wages may matter to explain some part of changes in wage inequality, but that their effect is probably fairly modest.

4. Conclusions

This Chapter has studied changes in the structure of wages in the UK over the last four decades. Wage inequality is significantly higher now than it was in the past. This is the case for upper and lower tail wage inequality. There are decade to decade differences in the patterns of change and it seems clear that the 1980s was the period where wage inequalities seemed to open out at all parts of the distribution. After that the picture has become more complex.

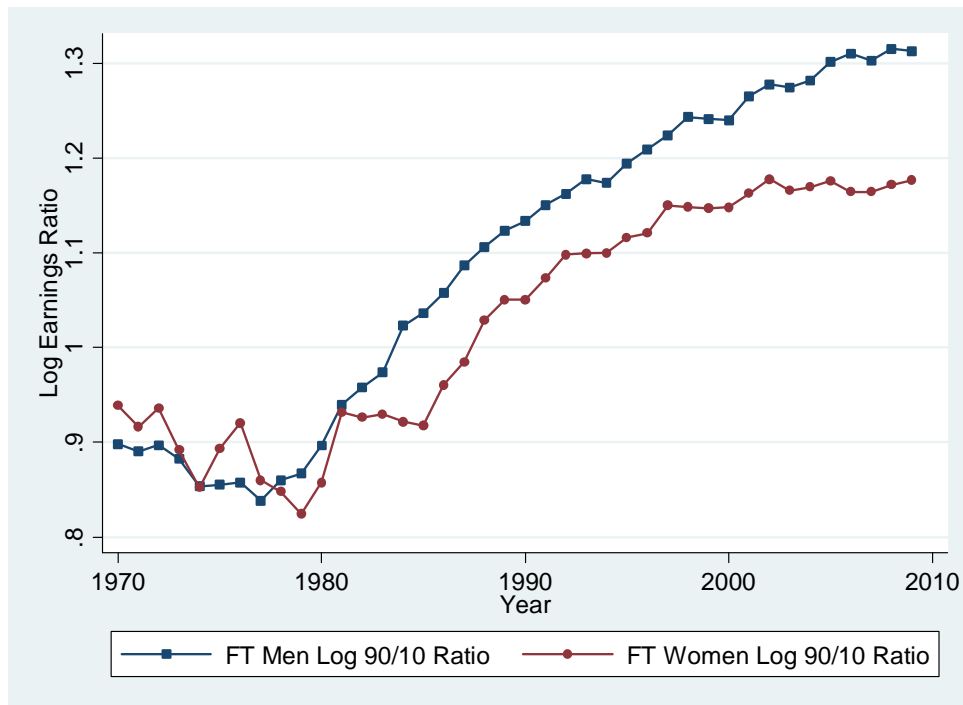
In terms of explanations, it seems reasonable to conclude that the evidence shows the wage distribution has been characterized by long-run growth in the relative demand for skills driven by technology change (rather than trade) and that changes in skill supply and institutional changes have affected the timing of how skill-biased and task-biased technical change impact upon the wage structure in different contexts. The importance of skills, and how education policy links to them, is discussed in the Chapter by Vignoles (2010) and given the role of skill- and task-biased technical change in shaping the evolution of wage inequality, it is evident that this is a key aspect of where labour market inequality is likely to go in the future.

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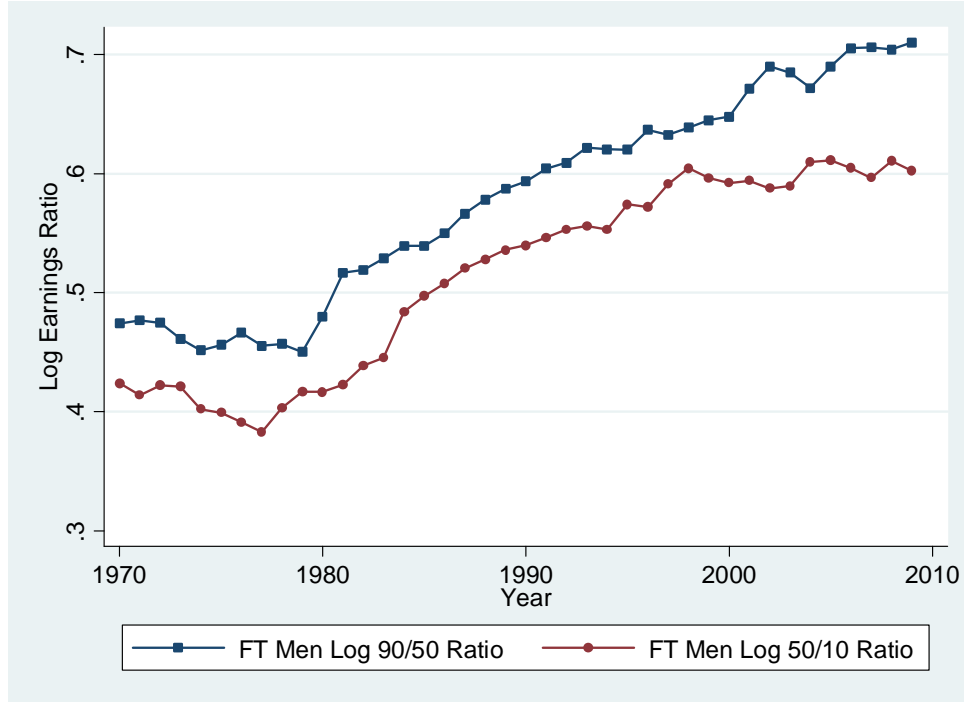
**Figure 1:
90-10 Log Weekly Earnings Ratios,
Full-Time Men and Women, 1970-2009**



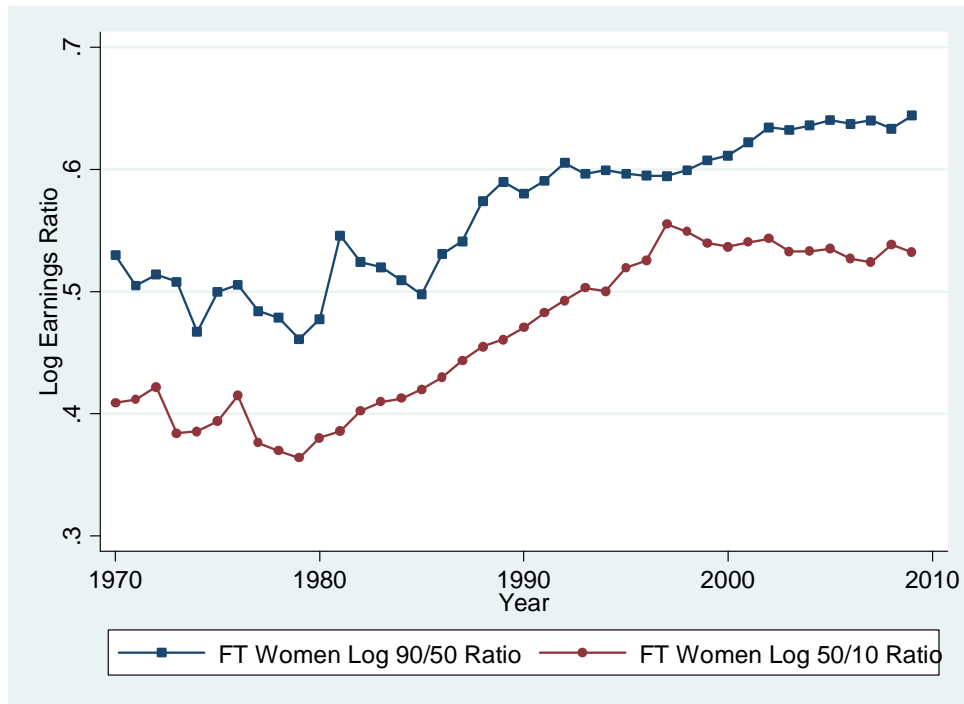
Notes: Source - National Equality Panel Analysis; 1968-1996 New Earnings Survey (NES) and 1997-2009 Annual Survey of Hours and Earnings (ASHE).

Figure 2:
Upper Tail (90-50 Log Earnings Ratio) and Lower Tail (50-10 Log Earnings Ratio)
Inequality, Full-Time Men and Women, 1970-2009

a) Men

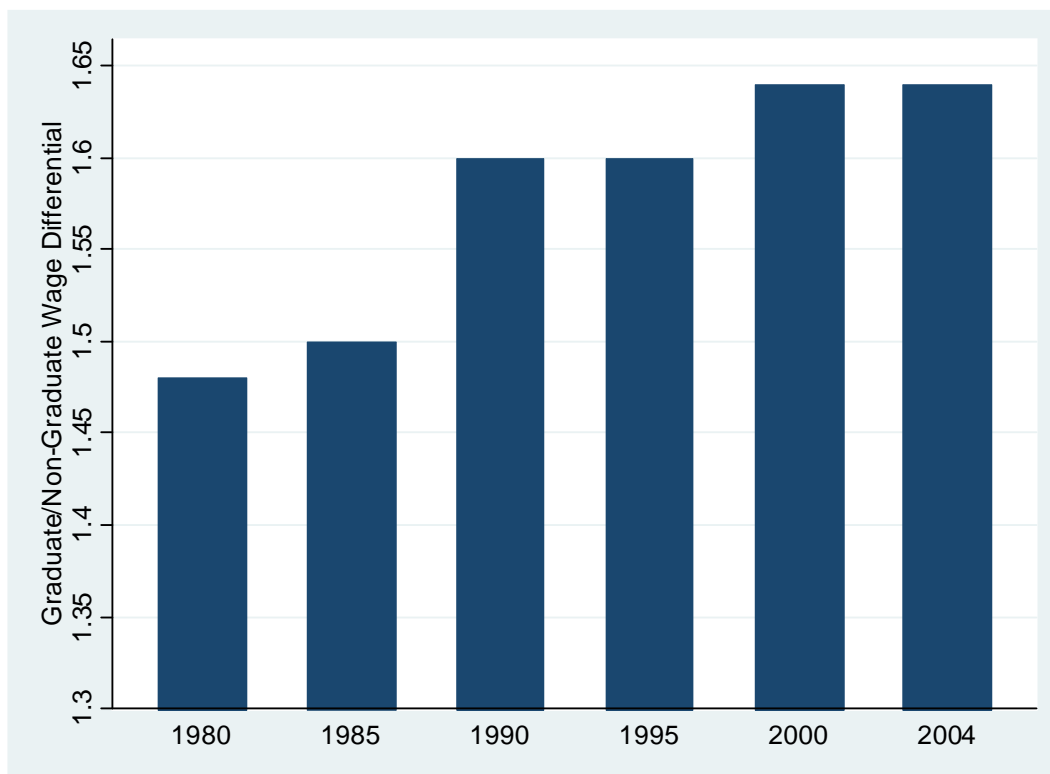


b) Women



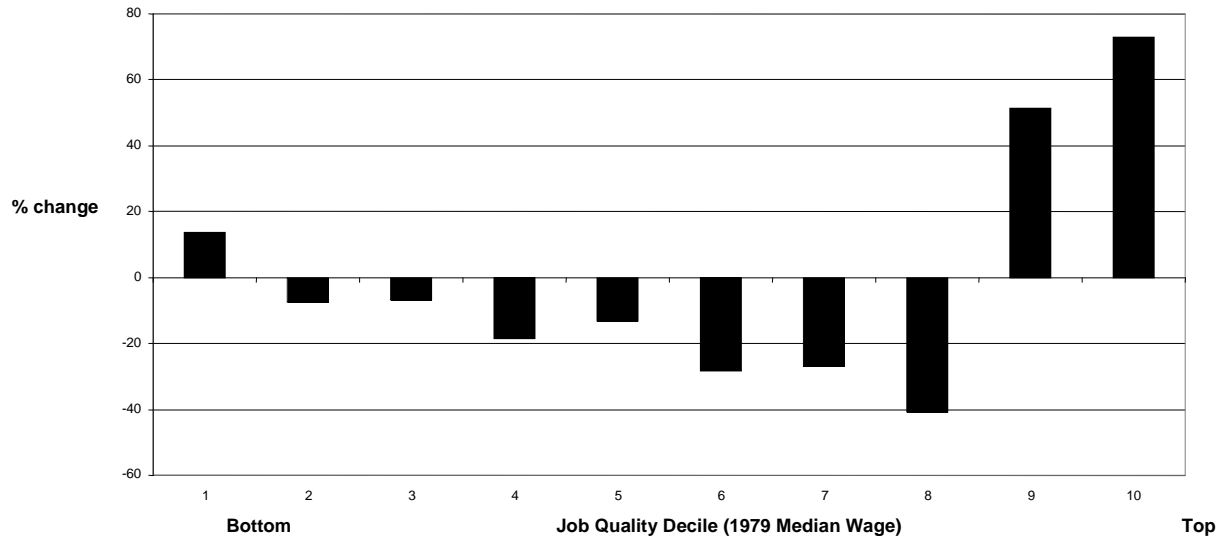
Note: As for Figure 1.

Figure 3:
Graduate/Non-Graduate Earnings Differentials, 1980-2004



Notes: Graduate/non-graduate earnings differentials derived from General Household Survey (GHS) and Labour Force Survey (LFS) data. Updated from Machin and Vignoles (2005). Wages are for full-time workers. The relative wage ratios are derived from coefficient estimates on a graduate dummy variable in semi-log earnings equations controlling for age, age squared and gender (they are the exponent of the coefficient on the graduate dummy).

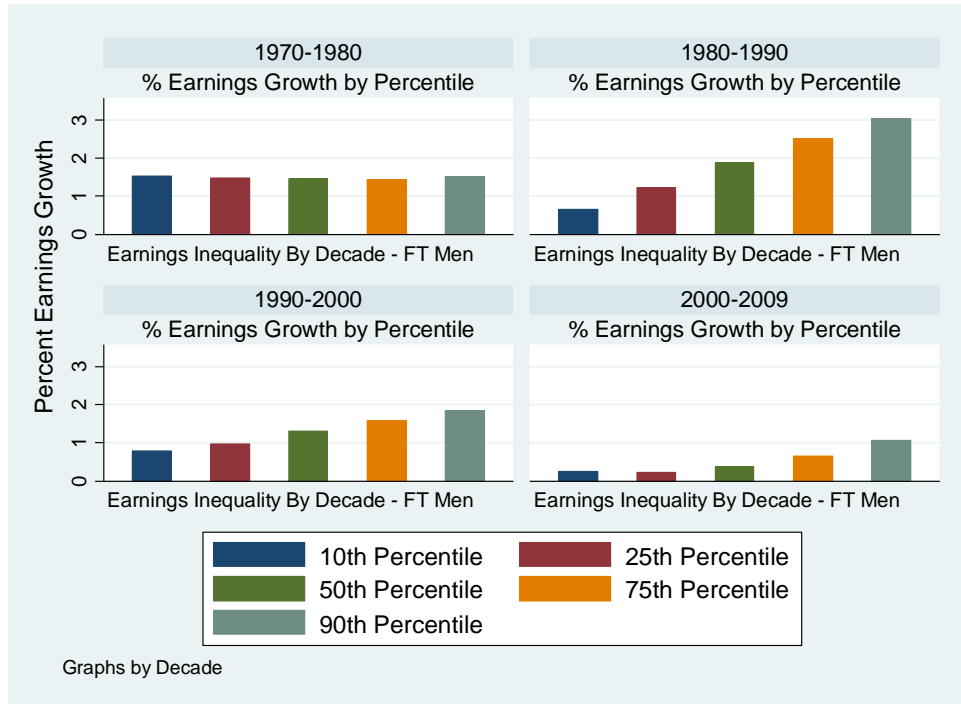
Figure 4:
Polarization of the UK Labour Market, 1979-2008



Notes: Taken from Mieske (2009). Percent changes are for the entire period.

Figure 5:
Real Weekly Earnings Growth At Different Percentiles by Decade

a) Men



b) Women

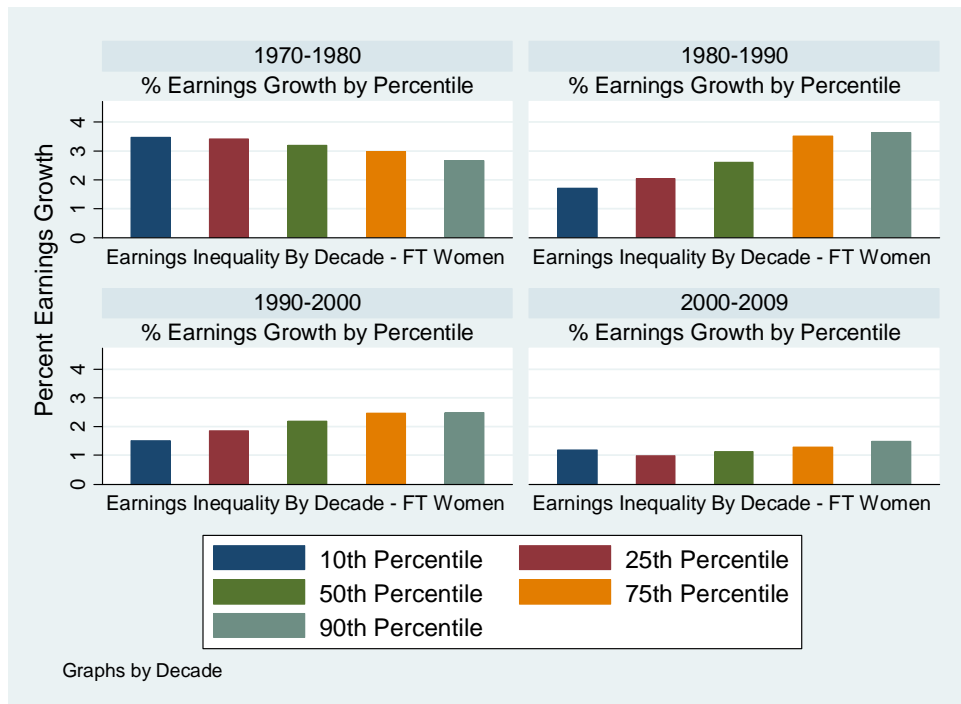
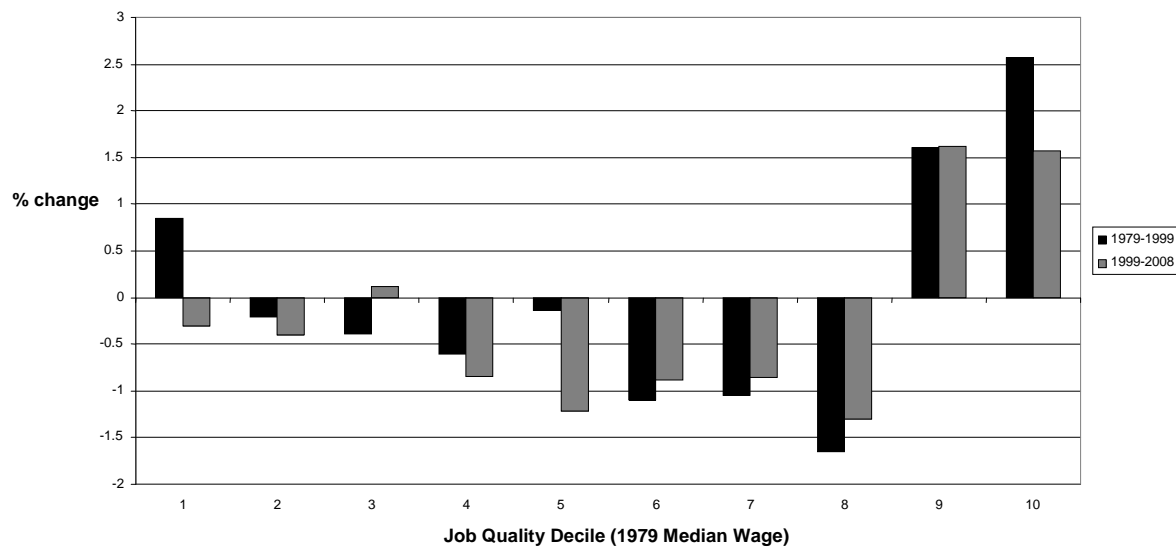


Figure 6:
Polarization in the 2000s Compared to the 1980s and 1990s



Notes: Taken from Mieske (2009). Percent changes are now annualised to permit comparability across the sub-periods.

**Table 1:
Trends in UK Earnings Inequality Indices**

| Trends in UK Full-Time Weekly Earnings Inequality Indices (Annualised Percentage Points) | | | | |
|---|-----------|-----------|-----------|-----------|
| | 1970-1980 | 1980-1990 | 1990-2000 | 2000-2009 |
| Men | | | | |
| 90-10 Ratio | 0.0 | 2.4 | 1.1 | 0.7 |
| 90-50 Ratio | 0.1 | 1.2 | 0.6 | 0.6 |
| 50-10 Ratio | -0.1 | 1.2 | 0.5 | 0.1 |
| 25-10 Ratio | 0.0 | 0.6 | 0.2 | 0.0 |
| Women | | | | |
| 90-10 Ratio | -0.8 | 1.9 | 1.0 | 0.3 |
| 90-50 Ratio | -0.5 | 1.0 | 0.3 | 0.3 |
| 50-10 Ratio | -0.3 | 0.9 | 0.7 | 0.0 |
| 25-10 Ratio | -0.1 | 0.3 | 0.4 | -0.2 |

Notes: Source National Equality Panel Analysis; 1968-1996 New Earnings Survey and 1997-2009 Annual Survey of Hours and Earnings.

Table 2:
Male 90-10 Wage Ratios Across Countries, 1970-2008

| | 1970 | 1980 | 1990 | 2000 | 2008 |
|-------------|------------------|------------------|------|------|------------------|
| Australia | 2.4 ^a | 2.7 | 2.7 | 3.1 | 3.5 |
| Denmark | | 2.1 | 2.2 | 2.5 | 2.7 ^e |
| Finland | - | 2.5 | 2.5 | 2.4 | 2.6 ^e |
| France | 3.7 | 3.3 | 3.3 | 3.0 | 2.9 ^d |
| Germany | - | 2.5 ^b | 2.5 | 2.8 | 2.9 ^d |
| Japan | 2.6 ^a | 2.6 | 2.8 | 2.8 | 2.9 |
| Korea | - | 4.1 ^b | 3.2 | 3.7 | 4.7 |
| Netherlands | - | 2.3 ^b | 2.5 | 2.9 | 2.9 ^d |
| New Zealand | - | 2.2 | 2.5 | 2.7 | 3.1 |
| Sweden | 2.2 ^a | 2.1 | 2.1 | 2.4 | 2.4 ^c |
| UK | 2.7 | 2.7 | 3.3 | 3.4 | 3.7 |
| US | 3.4 | 3.6 | 4.4 | 4.8 | 5.0 |

Notes: Taken from OECD Stat Extracts web site (<http://stats.oecd.org/index.aspx>). Data is from different years to the column header for some countries as denoted by the following superscripts: a – 1975; b – 1984; c – 2004; d - 2005; e – 2007.

Table 3:
Estimates of the Relative Supply and Demand Model For the UK

| Estimates of Relative Wage Equation (Dependent Variable: $\ln(W_s/W_u)_t$) | | | | |
|--|---|-------------------------------------|-------------------------------------|---------------------------------------|
| | Amior (2008) | | | This Chapter |
| | (1) | (2) | (3) | (4) |
| | GHS, LFS earnings, GHS, LFS supply | GHS, LFS earnings, GHS supply | GHS, LFS earnings, LFS supply | GHS, LFS earnings, GHS, LFS supply |
| Coefficients on: | | | | |
| Time trend | .007 (.001) | .008 (.002) | .008 (.003) | .012 (.002) |
| $\ln(\text{Relative Supply}), \ln(N_s/N_u)_t$ | -.168 (.032) | -.174 (.044) | -.200 (.079) | -.220 (.058) |
| R-squared | .48 | .37 | .28 | .50 |
| Sample size | 33 | 30 | 22 | 39 |

Notes: Estimates in (1)-(3) taken from Amior (2008). The earnings sources are General Household Survey (GHS) for 1974-91, Labour Force Survey (LFS) for 1993-07; 1992 is omitted. The combined supply series are GHS for 1974-83 and 1986, LFS for 1984-5 and 1987-2007; the GHS supply series covers 1974-2006 (excluding 1997 and 1999) and the LFS series runs from 1984-2007 (excluding 1986). The preferred sample has 33 observations, and includes all years between 1974 and 2007 (inclusive), with the exception of 1992. Estimates in (4) are my own calculations from 1972-2010 based upon GHS data from 1972 to 1996 spliced to LFS data from 1997 to 2010.

Table 4:
Summary of UK Evidence on SBTC

| Study | Unit of Analysis | Time period | Skill Demand Measure | Technology Measure | Coefficient Estimate on Technology Variable (Standard Error) | Controls |
|------------------------------|--------------------------------|----------------------|---|-----------------------------|--|--|
| This Chapter | 17 manufacturing industries | 2000-08 ^a | Graduate wage bill share | R&D/Value Added (Y) | .176 (.081) | $\Delta \log K_{jt}$, $\Delta \log Y_{jt}$ |
| Machin and Van Reenen (1998) | 15 UK manufacturing industries | 1973-89 | Non production wage bill share | R&D/Value Added (Y) | .026 (.009) | $\Delta \log K_{jt}$, $\Delta \log Y_{jt}$, year dummies |
| Machin (1996b) | 16 UK manufacturing industries | 1982-89 ^a | | R&D/Sales (S) | .065 (.026) | $\Delta \log K_{jt}$, $\Delta \log S_{jt}$, 1 digit industry dummies |
| | 16 UK manufacturing industries | 1980-85 ^a | Non production wage bill share | Innovation Count From 1970s | .092 (.053) | |
| | 398 British workplaces | 1984-90 ^a | Managers , senior technical and professional employment share | Micro computers introduced | .044 (.022) | Dummy for employment decline, 1 digit industry dummies |

Notes: An a subscript notes that models are long differenced (i.e. treated as a single cross section in changes) and so no year dummies need to be included as controls.

Table 5:
Some UK Evidence on Task-Biased Technical Change (Mieske, 2009)

| Changes in the Non-Graduate Service Share of Employment And Initial Share of Jobs With Routine Tasks (Across 98 Counties) | | | | | | |
|---|--------------|-------------|--------------|-------------|--------------|-------------|
| | 1992 to 2008 | | 1992 to 2000 | | 2000 to 2008 | |
| Coefficient on: | | | | | | |
| Initial routine employment share | .038 (.015) | .029 (.016) | .032 (.012) | .030 (.013) | .044 (.024) | .026 (.025) |
| Controls | No | Yes | No | Yes | No | Yes |
| R-squared | .15 | .21 | .22 | .25 | .10 | .20 |
| Sample size | 392 | 392 | 196 | 196 | 196 | 196 |

Notes: Taken from Mieske (2009). Four year differenced models based 98 UK counties. Coefficient estimates reported with standard errors in parentheses. The control variables included are (all in changes): graduate share, working student share, non-graduate migrant share, female employment share, elderly share, inactivity and unemployment.