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**Job Polarisation in the UK:  
An Assessment Using Longitudinal Data**

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## Editor's Foreword

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## **Abstract**

This paper provides an assessment of Goos and Manning's (2007) polarised or 'hour-glass' labour market thesis, which they claim has been caused by a period of routinisation where labour engaged in routine task occupations has been replaced by computer capital. It uses data taken from two waves of the National Child Development Study (NCDS) to study changes in labour market outcomes between 1981 and 2004 for a single cohort.

While this dataset does demonstrate changes in employment consistent with routinisation, it is not clear that a polarising labour market is the inevitable conclusion. Looking at wage distributions for this cohort shows that the largest number of jobs continue to be in the middle of the wage spectrum. This paper questions the implicit assumption made by Goos and Manning (and subsequent authors) that initial wages provide a consistent proxy for job quality over the time period, and argues that the wage structure of occupations may have altered significantly over time.



## 1 Introduction

There is a growing literature on job market polarisation as a consequence of technological progress, for which the contribution of Goos and Manning (2007) is a theoretical starting point. They argue – in line with Autor, Levy and Murnane (2003) – that technological progress lowers the price of capital, which is substitutable for labour performing routine tasks. As such jobs are found to occupy the middle of the wage spectrum (and indeed, the middle of any spectrum capturing job quality), employment in middling jobs will decline. Furthermore, as jobs at the top and (to a lesser extent) the bottom end may be complementary with technological progress, employment in good and bad jobs (or ‘lovely’ and ‘lousy’ jobs) will have increased. Thus, the job market becomes polarised, with more people employed at the extremes, and far fewer in the middle.

This paper provides an assessment of Goos and Manning’s work and the concept of the polarised or ‘hour-glass’ labour market. It uses data taken from two waves of the National Child Development Study (NCDS) to study patterns in changing employment and labour market outcomes over the period 1981 to 2004 for a single cohort that has been in the labour force during this period of change.

The main proposition of this paper is that while the dataset used here does demonstrate changes in employment of the sort consistent with routinisation, it is not clear that a polarising labour market is the inevitable conclusion. The key observation driving this claim is that wage distributions do not appear to have changed dramatically over the time period for this cohort. The largest number of jobs continues to be in the middle of the wage spectrum. It would be incorrect to immediately extend this conclusion to the entire labour force. However, in seeking to explain this specific case, this paper questions the implicit assumption made by Goos and Manning (and used subsequently in equivalent work for the United States, see Autor, Katz and Kearney (2006)) that initial wages provide a consistent proxy for job quality over time. It is more likely that the relative position of different occupations has shifted over time. This methodological concern extends to the entire labour force, and raises questions for further investigation about the extent that labour markets have polarised.

This paper is arranged as follows. A summary of the routinisation hypothesis and the polarisation literature is presented in section two. Section three presents the data and the issues that need to be confronted in the present analysis. Sections four

and five present the statistical analysis, first of changes in the occupational structure of the labour market, and second of wage distributions. Section six concludes the findings of the paper and discusses the next steps for this work. It is not a trivial issue that, unlike the original Goos and Manning work, this data is longitudinal. This was initially chosen in order to look at mobility and possible segmentation in a polarising labour market. A discussion is presented of the implications of this approach.

## **2      Routinisation and Job Market Polarisation**

This section outlines the approach and conclusions of Goos and Manning (2007). As noted in the introduction, they employ the theory of Autor, Levy and Murnane (2003) and argue that computer capital can best replace human capital engaged in routine tasks. The definition of a routine task is one that can be described by a series of clear instructions (and as such may be similarly executed by a computer or programmable machine). Employment in jobs characterised by routine tasks will fall when there is technical progress, which lowers the price of computer capital.

Non-routine task-based jobs fall into two categories: skilled professional and managerial jobs, which are complementary to technical progress, and unskilled manual tasks or services (e.g. cleaning). The latter is not generally directly affected by technical change, but the impact of technology on other parts of the labour market is likely to lead to a rise of employment in these jobs.

Goos and Manning (2007) use the categorisation of task in Autor, Levy and Murnane (ALM) to show that jobs typified mostly by non-routine cognitive and non-routine interactive tasks are at the high end of the wage distribution, jobs typified mostly by non-routine manual tasks are at the low end of the wage distribution, and jobs typified mostly by routine cognitive and routine manual tasks appear in the middle. This is demonstrated in their Table 1, which divides the wage spectrum in 1983 into thirds and shows the proportion of workers who have above average Dictionary of Occupational Titles (DOT) scores for their occupation, in each of the five task types (the three non-routine tasks and the two routine tasks). For example, 17 per cent of the bottom third have above average scores for non-routine cognitive tasks, compared to 88 per cent for the top third, while 49 per cent of the bottom third has above average scores in non-routine manual, compared to 31 per cent of the top third. For routine cognitive and manual tasks, the middle third had a higher percentage



with above average scores than both the top and the bottom segments (63 per cent and 58 per cent respectively, compared to 37 per cent and 28 per cent for the lower third and 43 per cent and 35 per cent for the higher third).

An implication of technical change when routine and non-routine jobs are not uniformly distributed over the wage distribution is that the labour market becomes polarised with increasing employment in high-paying and low-paying jobs. Goos and Manning look at changes in employment for occupations of varying quality, proxied by initial median wage (in 1979), and find there has been employment growth in wage deciles at both ends of the pay spectrum, and declines in the middle deciles. A quadratic regression of changes in employment on initial wages shows a negative linear term and a positive squared term, implying a U-shaped relationship. This relationship is consistent across several datasets, using several measures of employment growth, and remains consistent when limiting the data to just males or just females.

To support this, as an attempt to deal with the issue that using median wages for each occupation necessarily ignores the dispersion of wages within each job, they also follow a second methodology, which they attribute to Juhn, Murphy and Pierce (1993). With this approach, each job is assumed to employ a fixed share of labour from each percentile of the initial wage distribution, where these shares are based on the wage distribution in 1976. Changes in employment for each job then filter through to all percentiles of the new (derived) wage distribution. Similar predictions are found to the first methodology, as the predicted employment changes are positive for the top and the bottom percentiles, and negative for the middle.

This present paper is not the first paper to question the polarisation effect. Fauth and Brinkley (2006) suggest that labour markets have been fairly stable between 1995 and 2005, and argue that polarisation may instead have been more of a feature of the 1980s. For men there was some growth in employment for jobs earning above 180 per cent of the median, mixed changes in employment for low paid jobs (median wage and below) and small declines in the middle categories. For women, there is approximately a positive relationship between wage group and employment share growth – most notable, there are declines in employment share for low earning jobs.

Further, as Anderson (2009) points out, the hourglass economy theory is a direct challenge to those who support the notion of skill-based technical change and

up-skilling. Anderson's paper finds the hourglass economy theory more consistent with evidence on employment changes using a one-digit SOC2000 classification of occupations, compared to the up-skilling view. However, her paper also presents additional issues for the hourglass theory as an explanation of the labour market experience of middle or intermediate workers. First, the group of occupations considered in the paper as intermediate (based on level three skills) have maintained a similar share of employment between 1984 and 2004. Second, this group appears to cover a range of occupations from the middle to the upper end of the wage spectrum, so there may be a divergence between jobs that are conceptually intermediate and those which are actually in the middle of the wage spectrum.

As in Anderson (2009), this paper argues that middling jobs still form a large part of the UK occupational structure. This paper goes further as it not only presents data that suggests that employment in the middle of the wage spectrum has remained constant, but also argues that the methodology used in previous papers to argue differently is faulty. The critique in this paper focuses on the implicit assumption in Goos and Manning's work that the quality of individual jobs has remained approximately constant over time, so that it is appropriate to use initial wages as a proxy for job quality over the entire period being studied. This point may seem obvious, but it is an assumption used without question or discussion in a number of studies to demonstrate polarisation.

Although a debatable assumption, this paper will similarly use average wages as a proxy for job quality<sup>1</sup>. However, it will argue that the wage structure of occupations has altered significantly over the past thirty years. This may have occurred for a number of reasons, but the routinisation hypothesis may itself offer one explanation. Routinisation affects the nature of the work relationship as well as the relative demand for different occupations. For example, a skilled manual job may be replaced by advances made in computer-aided design and manufacture. The benefits to a firm of fostering a long-term relationship with such workers will decline as such replacements are made. Thus, as well as a fall in demand for such a job, the quality of that job (in terms of both pay and working conditions) may also decrease, even if the actual processes of the job remain near-identical. There may be supply-side effects

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<sup>1</sup>There are many other measures of job quality, such as security and status. Moreover, there are several dimensions, which are likely to be negatively correlated with wages (for example, risk of injury or the unpleasantness of tasks, which are generally compensated for with wages).

also: as the relative rewards to routine task based jobs decreases, displaced workers may supply their labour elsewhere. Increased supply will exert a downward pressure on wages for some jobs. The overall effect of these factors is a wage structure of occupations that is markedly different this decade than it was thirty years ago. It seems unlikely that initial wages will act as a good predictor of the relative position of jobs in this structure at the end of the period.

### **3 Data Description and Initial Issues**

The data used in this paper is taken from the National Child Development Study (NCDS). The members of the NCDS study were all born in a single week in March 1958. Data has been collected on these members in a series of waves. The most useful waves for assessing labour market trends are the fourth and seventh waves, taken in 1981 and 2004-5 respectively. The fourth wave is the first one taken after the school leaving age (respondents were aged 23) and records early labour market experience. The seventh wave was completed in 2004-5 (respondents were aged 46-47), and has the most recent data on wages, employment and education. This latest wave records, where possible, the previous ten labour market activities (including periods of employment, unemployment, self-employment and non-participation for a number of reasons such as sickness or study).

As noted in the introduction, the fact that the data set used here is not cross-sectional creates a number of issues for the analysis and these will be noted throughout the paper. At the same time, there are several other reasons why this data is useful. In particular, aside from the harder-to-access New Earnings Survey, it is the only dataset that provides detailed occupational and wage data in the UK going as far back as 1981. The approach in this paper is to use this data to demonstrate certain key issues with existing approaches to polarisation. Care is taken to ensure that conclusions, where made, are not extended to the entire population when they can only be shown for a single cohort.

One of the principal reasons for using this longitudinal dataset is to look at how individual employment outcomes have shifted during a period where technological advance has impacted on the structure of the labour market. Systems of job and work classification have evolved between the two waves, which presents a problem for recording occupational transitions accurately. In the next section, data is

presented on changes in occupational structure. Changes in employment of socio-economic groups (SEG) are used to provide a crude approximation of the trends Goos and Manning highlighted. Both waves of the dataset give social class and SEG – however, these definitions are quite broad and may cover a wide range of occupations. As the goal is to see which jobs routinisation has affected, and where these jobs appear in the wage spectrum, the picture presented may be imprecise.

To supplement this, the paper looks more closely at jobs. As noted above, the classification of occupations is not constant over the two waves. The 1981 wave uses the CODOT system of job title classification, which has been superseded three times (CO80, SOC90, SOC2000), while the 2004 wave uses the most recent classification. The SOC2000 coding system of occupations has four levels of disaggregation starting from major group (9 categories) to unit group. CODOT codes have been converted into SOC2000 codes using the descriptions of each code. The conversion is not always perfect – in some cases a category in SOC2000 could apply to several categories under CODOT (and vice versa). However, many more groups have a reasonably reliable definition. Changes in occupations and occupational group under this method will also be presented.

#### **4 Occupational Structure**

Table 1 shows the change in the employment shares of different socio-economic groups between 1981 and 2004. They are ranked according to the 1981 mean wage – thus, Table 1 is a crude attempt to replicate the first approach of Goos and Manning. It includes only those in the set who were classified in a SEG in both 1981 and 2004 – those inactive or unemployed at one of these dates are not included, leaving 4898 matched observations.

Table 1 gives support to the routinisation hypothesis – the groups which have decreased in employment match much more closely to the idea of a routine task based job, particularly the junior non-manual category (predominantly comprising clerical and sales jobs) and the semi-skilled and unskilled manual categories. However, other patterns may be somewhat more inconsistent. For example, skilled manual work has fallen in employment share over the time period, in line with other manual jobs, but such work was relatively well paid – on average only employers and managers in large organisations earned more in 1981. Similarly, junior non-manual workers appear

near the bottom of the earning spectrum, but have decreased in employment share by nearly 50 per cent.

**Table 1: Employment shares; matched data**

SEG group	Description	Mean weekly gross wage, 1981	Employment shares, 1981	Employment shares, 2004	% increase in employment shares
1	employers and managers – large establishments	100.0	1.1%	11.0%	935%
9	skilled manual	98.8	14.5%	7.4%	-49%
8	foremen & supervisors	97.7	5.0%	6.5%	29%
4	professional: employees	94.2	3.2%	4.3%	32%
2	employers and managers – small establishments	88.3	4.5%	9.7%	117%
5	intermediate non-manual	84.0	22.7%	29.1%	29%
11	unskilled manual	82.5	2.7%	2.1%	-22%
10	semi-skilled manual	81.6	10.2%	7.1%	-31%
15	agricultural workers	78.9	1.3%	0.4%	-68%
6	junior non-manual	76.1	29.2%	15.9%	-46%
13	farmers: employers & managers	66.5	0.2%	0.2%	25%
7	personal service	65.4	5.5%	6.4%	17%

Source: NCDS, author's calculations.

Notes: Dataset has variables for gross pay and length of pay period. Weekly wage is calculated as the gross pay variable divided by the length of pay period in weeks e.g. if pay period is a fortnight, gross pay is divided by 2. The sample is restricted to those who are employees and who work over 30 hours per week. Wages have been converted to an index (wage of SEG group 1 = 100).

Obviously, as the dataset follows a group of individuals over their working career, the increase in employment in good jobs is partially the result of career advancement, rather than entirely the result of a change in the occupational structure of the labour market. At age 23, it would not be expected that many individuals would fall into the category of employers or managers. Similarly, the fall in employment of some categories may be due to promotion – manual workers advancing to foreman or supervisor status, for example. However, not all transitions can be explained as such. A large proportion of manual workers have transitioned into non-manual intermediate occupations – it seems more unlikely that such a transition is the result of career advancement and promotion<sup>2</sup>.

Table 2 presents a similar story. The difference between Table 1 and Table 2 is that those counted in Table 2 report SEG for one or more of the two waves, whereas

those in Table 1 are strictly matched data. There are 5660 observations for the 1981 wave and 7273 observations for the 2004 wave for the purposes of Table 2. There does not appear to be any significant difference in the trends within each SEG, compared to Table 1, although the magnitude of the growth rates has changed.

**Table 2: Employment shares; all data**

SEG group	Description	Mean weekly gross wage, 1981	Employment shares, 1981	Employment shares, 2004	% increase in employment shares
1	employers and managers – large establishments	100.0	1.2%	12.0%	883%
9	skilled manual	98.8	18.1%	7.9%	-57%
8	foremen & supervisors	97.7	5.3%	6.6%	26%
4	professional: employees	94.2	2.8%	5.1%	78%
2	employers and managers – small establishments	88.3	4.3%	6.5%	52%
5	intermediate non-manual	84.0	20.4%	31.2%	53%
11	unskilled manual	82.5	3.4%	2.0%	-40%
10	semi-skilled manual	81.6	11.7%	6.6%	-44%
15	agricultural workers	78.9	1.3%	0.6%	-56%
6	junior non-manual	76.1	26.1%	15.0%	-43%
13	farmers: employers & managers	66.5	0.1%	0.3%	95%
7	personal service	65.4	5.2%	6.3%	21%

Source: NCDS, author's calculations.

Note: Wages have been converted to an index (wage of SEG group 1 = 100).

The SEG categories are quite broad, and do not allow an accurate picture of the changing occupational structure. Using a greater number of occupational groups would provide more detail. The dataset is limited in that, as mentioned before, the system of job title classifications across the two waves are not compatible. A manual conversion of the codes between the two systems was undertaken which, whilst imperfect, may allow a closer look at the data and patterns of occupational structure transformation<sup>3</sup>. The current SOC2000 code has a four level classification system: major group (first digit), sub-major group (second digit), minor group (third digit) and unit group (fourth digit). Using descriptions of the jobs under this system and the old CODOT system, the jobs were matched to the closest equivalent category (or categories in some cases).

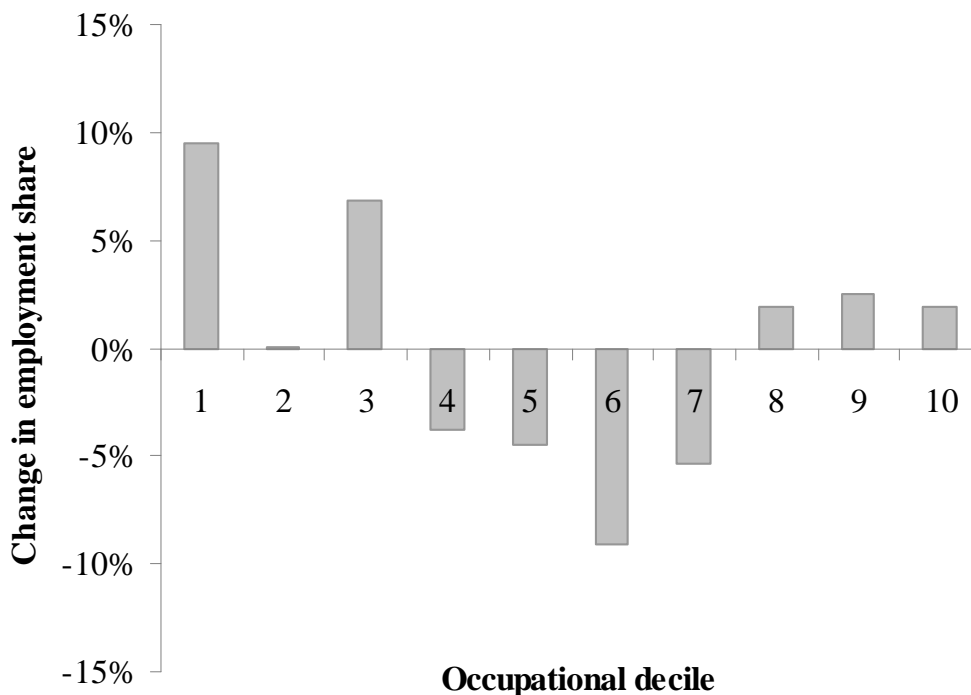
<sup>2</sup> The full transition matrix is presented as an Appendix (Table A1)

<sup>3</sup> Available upon request, from the author

In many cases, there was a single matching four-digit SOC code for a single CODOT job category (for example CODOT 610: ‘Building Inspectors’ and SOC2000 3212: ‘Building inspectors’). In some cases, several SOC2000 categories could be applied to one CODOT code. For example, CODOT 7220: ‘Cleaners, window cleaners, chimney sweeps, road sweepers’ corresponds to SOC2000 9231: ‘Window cleaners’, SOC2000 9232: ‘Road sweepers’ and SOC2000 9233: ‘Cleaners, domestics’. Similarly CODOT 930: ‘Property and estate managers’ matches to both SOC2000 1231: ‘Property, housing and land managers’ and SOC2000: 3544 ‘Estate agents, auctioneers’.

This conversion was used to derive a major group, sub-major group, minor group and unit group SOC 2000 equivalent for all CODOT definitions, where there is no disagreement. For example, in the above case of CODOT 7220, there is a consistent equivalent major group (9), sub-major group (92) and minor group (923), but not a consistent unit group. However, in the cases of CODOT 930, there is no consistent equivalent at any level, so all workers classified in 1981 as ‘Property and estate managers’ are excluded from the sample. Total exclusions on this basis account for 8.82 per cent of the sample at the major group level, and 12.43 per cent at the minor group level.

**Figure 1: Change in employment by occupation group**



The focus is on minor groups, which gives 70 job categories. These occupational categories have been ranked by mean wage of the occupation based on 1981 wages and divided into ten groups, each with approximately 10 per cent of total employment, with group one having the highest paying occupations and group 10 the lowest paying occupations. With one exception, all occupations fall into one group. This lumpiness means that group sizes vary from 9.24 per cent to 11.07 per cent. The one occupation which was split was Administrative Occupations: Records, which has an employment share of 18.9 per cent in 1981. The group is split over three deciles, the middle of which had exactly 10 per cent of employment and contained only workers from this occupation. This replicates the methodology and results of Goos and Manning (see their Figure 1), with employment increases in the highest and lowest paid occupations, and employment falls in the middling occupations.

Looking at the individual minor groups (presented in Appendix Table A2), those categories with the largest employment falls would be considered routine (the largest falls are for groups such as elementary administration occupations, administrative occupations: records, elementary process plant operatives, administrative occupations: communications and elementary agricultural trades) whilst the largest gains are for non-routine categories (the largest increases are for functional managers, production managers, health associate professionals and healthcare and other personal service). As with the SEG-based method, there is a drop in employment for some jobs with high earnings and low earnings, as well as those in the middle of the spectrum. However, as Figure 1 shows, the overall balance of these variations is in line with Goos and Manning – that is, there are more increases in employment for jobs at the top and the bottom of the wage spectrum than there are decreases.

## **5 Wage Distributions**

The evidence presented in the above section provides support for the routinisation hypothesis. However, the issue that is most important when discussing a polarising labour market is not changes in employment of different occupations, but the resulting change in wage distributions. The key proposition of this paper is that while routinisation has led to a fall in the employment share of several types of occupation, it may not necessarily have caused a polarisation of jobs. In this section, it is argued



that the structure of wages for occupations has not remained constant over the time period. First, as demands for different occupations change, it seems likely that the relative earnings of these occupations will also change. Second, as certain occupations grow, some of them will inevitably employ those from the old middle-income occupations in decline. To the extent that wages are not solely determined by occupation, but by individual skills and productivity, this may mean that expanding occupations have a great deal more variance in the wages earned by those performing them. Thus, there is not an automatic conclusion that the disappearance of middling jobs (based on starting wages) means that the job market is polarising; rather, it could be the case that some of the jobs that are expanding in employment may have moved nearer the middle of the new wage spectrum.

It seems that the only work which has looked at the wage structure assumption is Mieske (2009), who calculates wage growth rates for each initial decile between 1979 and 2008 using Labour Force Survey and New Earnings Survey data, presented here in Table 3. However, her calculation is geared towards arguing that the low wage service occupations have not moved up the quality distribution, as her focus is on this segment of the labour market. These calculations do not show a stable wage structure of occupations across the entire distribution. For example, the fifth decile (based on 1979 wages) has grown much faster than the surrounding occupations, and the bottom two deciles have grown faster than the third and fourth in the past decade. Furthermore, these broad groups are likely to conceal a lot of additional changes within the individual occupations. The extent that the wage structure of occupations within the NCDS members has changed can be seen in Appendix Table 3, which ranks each minor group on the basis of the mean 1981 wage and then provides its rank in 2004. Only 34 of the 70 job categories move less than 10 ranks between 1981 and 2004, with the mean change in rank being 15.46.

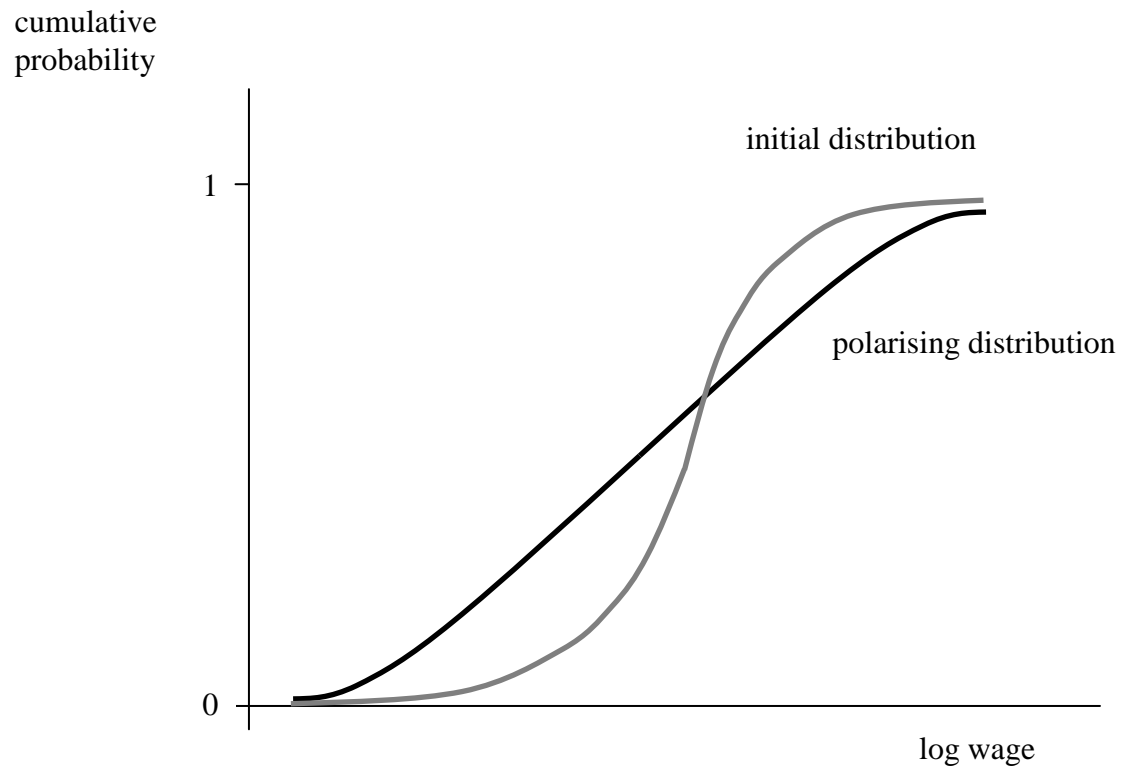
Of course, career progression effects will certainly be captured here – for example, in occupations like legal professionals, where expected wages profiles may be quite steep – and such issues cannot just be ignored. For a large number of the occupations however, this data indicates the potential methodological concern within Goos and Manning’s work. It would be useful to recreate this latter approach using NES data.

**Table 3: Wage growth rates**

Decile	Average Annualised % Change in Real Hourly Wages		
	1979-1989	1989-1999	1999-2008
<b>1</b>	1.98	0.50	1.75
<b>2</b>	1.95	0.47	1.75
<b>3</b>	2.41	0.39	0.98
<b>4</b>	2.20	0.89	1.01
<b>5</b>	3.47	0.80	1.80
<b>6</b>	2.08	0.11	2.07
<b>7</b>	2.79	0.91	1.36
<b>8</b>	2.80	1.11	1.14
<b>9</b>	3.83	0.87	2.03
<b>10</b>	3.67	0.50	2.43

Source: Mieske (2009) based on NES and LFS data.

**Figure 2: Effect of polarisation on wage distributions**

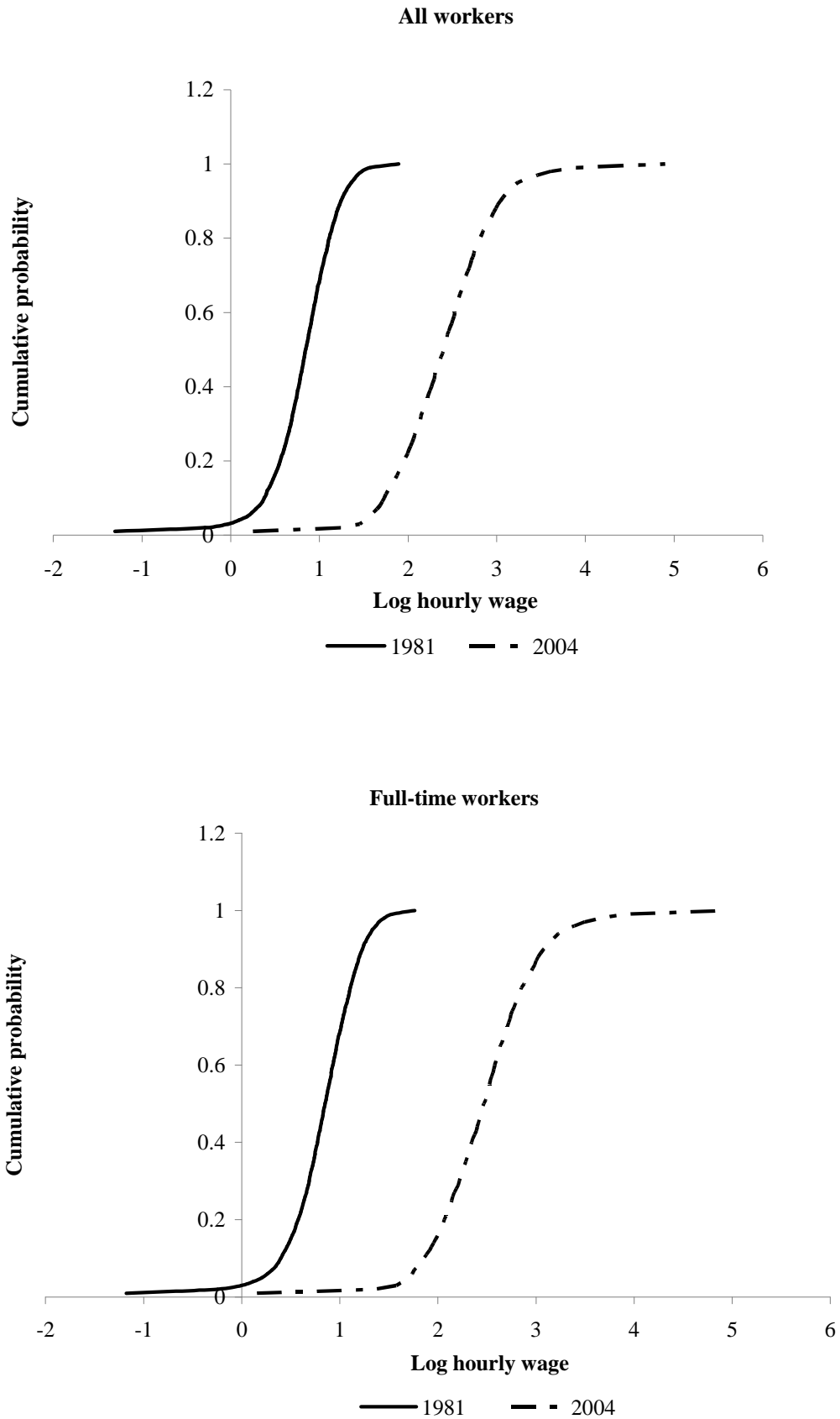


Changing occupational wage structures and employment shares combined imply a more complicated picture for the composition of the workforce than is currently accepted. The remainder of this section looks at the resulting wage distributions after a period of polarisation as a way to better describe the overall consequences. A polarising workforce has a greater number of individuals earning low and high wages, and a decreasing number of individuals earning middling wages. Consider an initial wage distribution, represented in Figure 2 as a cumulative distribution function – a function which shows the probability that the log wage is less than a certain point, and as such is bounded between zero and one. If employment increases in the lowest paying jobs, the bottom section of the distribution function steepens. The lowest deciles of workers covers a smaller range of wages as there are more workers earning the lowest wages. A similar steepening would be seen at the top of the distribution as employment increases in well-paid jobs. At the same time, falling employment in the intermediate jobs flattens the distribution function in the middle, as the range of wages covering the middle deciles increases with lower employment in the middle. The end result is shown in Figure 2.

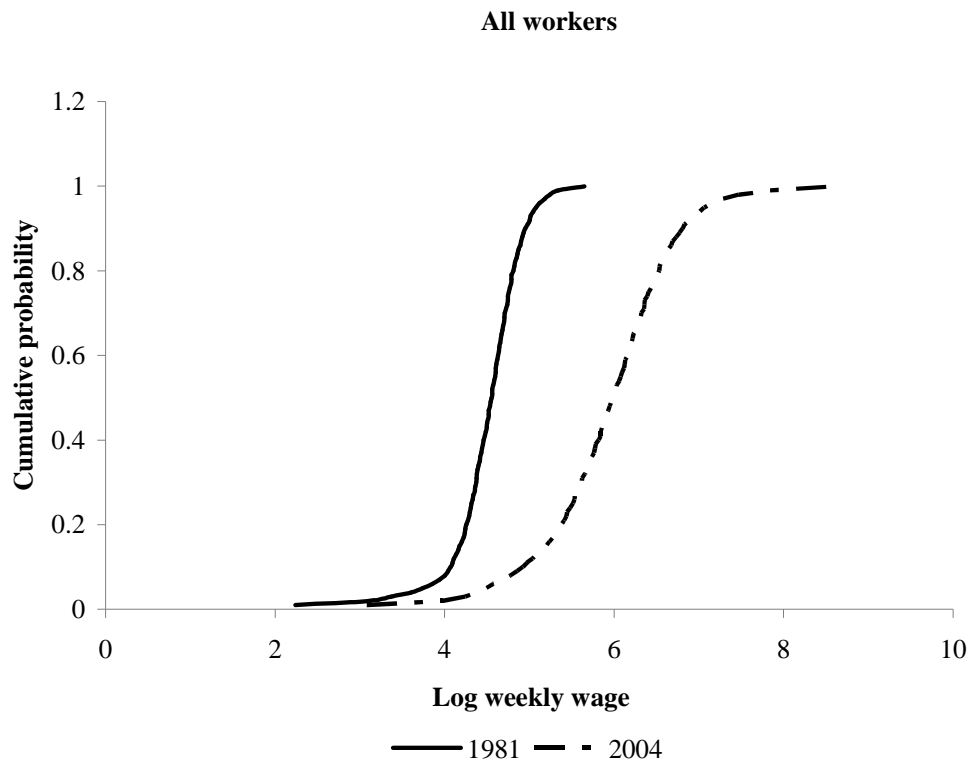
Using the NCDS datasets from both 1981 and 2004, hourly and weekly log wage distributions are derived, shown in Figures 3 and 4. The hourly wage data is extensive in the first wave and is derived from the variables for gross pay, length of pay period and hours worked per week. In the 2004 wave, hourly wage data is mainly given for those who are not classified as full-time employed (30 hours per week or more). Of the 5523 full-time workers, 3709 of them do not report hours of work in the dataset. Wage distributions for hourly wages are presented with all available data and just those in full-time employment (not including self-employment).

The lack of hours of work data in the later wave limits the sample size for the hourly wage distribution sample, and may bias it towards the likely lower hourly wages of part-time workers. Looking at weekly wages increases the sample size; however, looking at changes in this distribution over time is less informative, as the proportion of workers in part-time work or self-employment may have varied. To correct partially for this, weekly wage distributions are presented for just those in full-time employment, as well as for all the available data as a comparison.

**Figure 3: Log hourly wage distributions, 1981 and 2004**



**Figure 4: Log weekly wage distribution, 1981 and 2004**



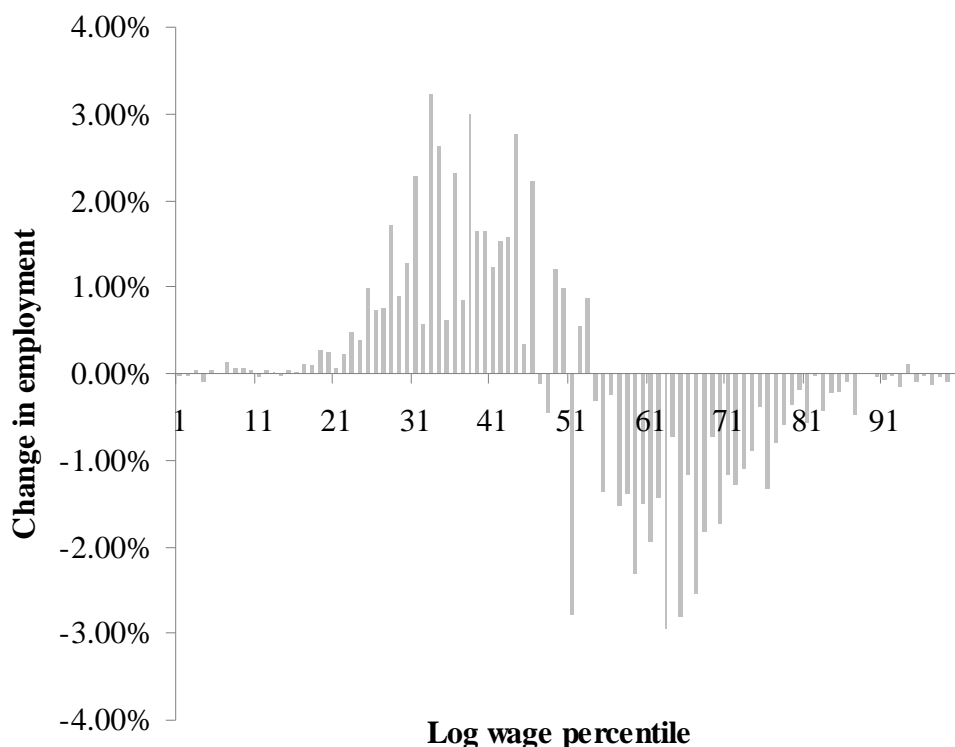
Again, because this is a longitudinal dataset, the effects of promotion and career advancement on wages are likely to be included in the calculated wage distribution – it is not claimed that these distributions reflect an unbiased estimator of the total UK wage distribution in 1981 and 2004. That said, polarisation should affect the whole labour market, so even if the two derived distributions are biased (in favour of low paying jobs in 1981, and in favour of higher paying jobs in 2004), it would say something quite unexpected and stark about the experience of successive generations if the effect of polarisation was not at least partially observable for this one age group.

It is not obvious from looking at these distributions that the middle of the wage spectrum has declined and that the top and bottom of the spectrum has grown – the shape of the distributions looks roughly the same. There has clearly been an increase in the variance of wages, but this seems to have affected the entire distribution. Further work on this subject will present a more robust econometric analysis of these changing wage distributions – the purpose of this present paper is to highlight a problematic issue in existing work. For the time being, a descriptive method is presented to assess the change in the wage structure represented by these distributions more quantitatively, similar to that used by Fauth and Brinkley (2006). Both in 1981 and 2004, employment is split into 100 divisions, each comprising one per cent of the wage range<sup>4</sup>, and changes in employment rates are looked at in each of these divisions over the time period. For example, if the wage range in 1981 was (in log terms) between £3 per week and £5 per week, and in 2004 it was between £4 per week and £10 per week then each division covers £0.02 in 1981 and £0.06 per week in 2004. The tenth wage percentile group in 1981 is all those earning between £3.18 and £3.20, whilst in 2004 it is all those earning between £4.54 and £4.60. For each of the 100 wage percentile groups in each year, an employment rate can be found. The change in each group between 1981 and 2004 is shown in Figure 5. This measure captures the change in slope across the wage distribution, and accounts for the different distribution of wages earned over time.

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<sup>4</sup>A number of obvious outliers, which occupied around 20% of the initial wage range, have been removed from the sample. For weekly full time wages, 16 observations for 2004 and 10 for 1981 were removed.

Figure 5: Change in employment by wage percentile, 1981 to 2004



The most striking thing about Figure 5 is that there has been very little change in employment for the highest paid and lowest paid jobs (defined by these wage percentiles), as a proportion of total jobs. The largest changes all occur in the middle of the wage spectrum, with increases in employment for jobs with wages that fall between 30 per cent and 50 per cent of the highest wage, and decreases in employment for jobs with wages that fall between 50 per cent and 80 per cent of the highest wage. Note that these are absolute changes in the employment share of jobs in each division, so a change from 1.2 per cent to 1.8 per cent is recorded as 0.6 per cent, not 50 per cent. As a result, it would be expected that the changes in the middle to appear larger, as the total employment rate in these divisions starts higher. However, we would also expect them to be uniformly negative if polarisation were taking place.

The story that Figure 5 tells is that the share of employment in the best paid and worst paid jobs has remained roughly constant over the time period, although given both Goos and Manning’s findings and those in section 4 and Appendix Table A3, it seems likely that the actual jobs which fit these descriptions have changed. Meanwhile, the middle section has remained similar in terms of total employment, but has skewed somewhat towards relatively lower paid work. Remembering that each division is derived relative to the total wage range, one explanation for this shape is

relatively higher wage inequality increases in the top half of the distribution when compared to the lower half. Such an explanation is consistent with routinisation (see Autor, Katz and Kearney (2006), which uses the routinisation hypothesis to explain divergence between upper wage inequality and lower wage inequality since the early 1990s), but because of changing wage structures does not lead to polarisation. Distinguishing between the effects of polarisation and other factors which may affect the shape of wage distributions, such as skills and experience, will be an important part of further analysis.

## **6 Conclusion**

This paper has used a dataset comprising two waves of the National Child Development Study to show that, similar to the seminal paper of Goos and Manning (2007) on job market polarisation, the labour market for this cohort has changed over the past 30 years with employment falling in jobs typified by routine tasks and increasing in jobs typified by non-routine tasks. It has also shown, consistent with their results, that based on the initial wages, these jobs have tended to fall near the middle of the wage spectrum. However, it has presented evidence on the changing wage structure of jobs, and has argued that the position of most jobs within the wage spectrum has changed between 1981 and 2004. This suggests that their conclusion that the decrease in employment of middling jobs measured by initial wages implies polarisation is potentially questionable. This paper supports this by deriving and presenting wage distributions (which, ultimately, are most important when considering changing labour market outcomes) and found little evidence that employment in the middle of the spectrum (again, for this cohort) has declined significantly.

It was noted at the beginning, and reiterated at stages throughout, that this analysis differs from Goos and Manning in that the dataset used is longitudinal. The benefit of such a dataset is that it creates the opportunity to follow the labour market outcomes of individuals over a period of time when occupational structure is changing. It would not be expected that any biases that may exist in wages or occupational choices from looking at a single cohort would be enough to disguise the effects of polarisation entirely; however, the generality of this analysis should be verified. The most important point is that the methodological criticism which may



explain why the single cohort wage distributions here do not exhibit any particular indication of polarisation could equally be applied to previous work, which has considered the entire population. An important next step is to replicate some of this analysis using cross-sectional data, for which the New Earning Survey is likely to be the most useful source.

One area that requires further investigation is whether the experience of new entrants to the labour market as it transforms is different to those already in the labour market. Specifically, new entrants may be increasingly polarised and predominantly enter at the ends of the job quality spectrum, whereas those in the middle of the spectrum are able to retain the remaining middling jobs. Again, replication of the analysis with a dataset such as the New Earnings Survey is likely to prove insightful here. With this in mind, it is worth noting that even with the dataset used in this paper, patterns of employment increase and decrease by occupation are consistent with the idea of routinisation. That is, employment in middle earning routine task occupations has declined significantly in this single cohort dataset, in line with the overall pattern in Goos and Manning's analysis. This paper has offered an explanation as to why this has not manifested in a polarising wage distribution.

If the conclusions of this paper prove robust, more work is needed to consider why. The following explanations should be considered:

1. Some displaced middle spectrum workers move into growing non-routine occupations at the top end. This may depress wages in some well-paid jobs, relative to others, creating a new set of middle to upper-middle occupations.
2. Some routine task-based occupations were initially well paid, and have moved down the wage distribution towards the middle with routinisation.
3. Some low-paid non-routine jobs have benefited from a complementarity with computerisation and have experienced rising marginal productivity and ultimately higher wages.
4. Displaced middle spectrum workers may move into previously lower-end jobs. If these workers are more productive, these jobs may begin to receive higher wages.

A starting point for this is to reconsider the theoretical model of Autor, Katz and Kearney (2006), which they use to explain the trends found in their work (and which mirrors, for the US, those found by Goos and Manning). Explanations 1 and 2, in particular, are not allowed within their model. The model could be extended to consider the predicted effect of wage distributions – it currently focuses on inequality.

The analysis of wage distributions in this paper has been predominantly descriptive. Future work should explain with more precision the changes that have taken place within wage distributions. The approach of Firpo, Fortin and Lemieux (2007), which decomposes changes in quantiles into composition and coefficient effects (in a similar manner to a Blinder-Oaxaca decomposition) is an appealing method for assessing what can account for changing wage distributions. Polarisation, in the form of increased employment of non-routine occupations can, with this method, be separated from other effects that alter wage distributions over time (for example, distribution of education or wage premia to certain qualifications).

The ultimate aim of this work is to consider mobility and the segmentation of labour markets. If further work reveals more evidence of polarisation, for example that polarisation has affected younger generations more so than those in the labour market near the beginning of the computerisation era, then it may be interesting to look at issues of mobility for these workers relative to older workers. It would also be important, were that the case, to be able to explain why younger workers are more polarised in the first place, why routinisation has had different effects on different cohorts, and ultimately what this may mean for future generations.

Alternatively, as argued here, labour markets may not be polarising as much as suggested elsewhere in the literature. The fact that routinisation has taken place has implications for studying mobility – as the occupational structure of the labour market changes, displaced labour moves towards new jobs. Existing segmentation may limit this mobility. Furthermore, the idea that there are new types of jobs occupying the middle of the wage/job quality spectrum raises the question of where the workers in these jobs have come from – whether they previously worked in the old middling jobs, and have maintained their position in the wage distribution, or whether they comprise individuals who worked in well-paid (badly-paid) occupations that have declined (improved) in wage and/or job quality, and now occupy the middle of the spectrum. There is also a possible gender dimension to this structural transformation that is worth evaluating, given the types of jobs that have declined (for example, male-dominated manual work) and the increasing labour market participation of women over this time period. Further work looking at wage and occupational mobility jointly may be able to provide some answers to these questions.

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## Appendix

**Table A1 – SEG transition matrix, 1981 to 2004 (% of people working in each SEG in 2004, given initial SEG in 1981)**

		SEG, 2004											
		1	2	4	5	6	7	8	9	10	11	13	15
SEG, 1981	1	<b>23.1%</b>	15.4%	3.8%	40.4%	7.7%	1.9%	3.8%	0.0%	1.9%	1.9%	0.0%	0.0%
	2	15.9%	<b>22.7%</b>	2.7%	27.3%	9.1%	5.5%	3.6%	5.9%	6.4%	0.5%	0.0%	0.5%
	4	23.4%	13.9%	<b>32.3%</b>	24.7%	1.9%	0.6%	1.9%	0.0%	1.3%	0.0%	0.0%	0.0%
	5	15.7%	7.9%	4.2%	<b>50.2%</b>	11.8%	5.6%	1.6%	0.7%	1.4%	0.5%	0.1%	0.3%
	6	9.0%	8.7%	3.3%	31.3%	<b>30.5%</b>	8.0%	1.8%	1.5%	4.8%	1.2%	0.0%	0.0%
	7	7.5%	7.1%	3.4%	22.0%	16.4%	<b>24.3%</b>	4.9%	0.7%	8.2%	4.1%	0.0%	1.5%
	8	11.8%	14.7%	4.1%	13.1%	5.7%	2.4%	<b>20.8%</b>	19.2%	6.9%	0.8%	0.4%	0.0%
	9	7.3%	10.0%	3.4%	15.2%	5.2%	2.0%	17.3%	<b>26.9%</b>	10.3%	2.3%	0.1%	0.1%
	10	7.8%	8.0%	1.6%	14.7%	14.1%	6.2%	10.0%	9.4%	<b>21.5%</b>	6.4%	0.0%	0.4%
	11	7.7%	6.9%	1.5%	17.7%	9.2%	4.6%	10.8%	19.2%	13.1%	<b>9.2%</b>	0.0%	0.0%
	13	0.0%	12.5%	0.0%	12.5%	0.0%	0.0%	0.0%	12.5%	0.0%	0.0%	<b>50.0%</b>	12.5%
	15	1.6%	14.3%	4.8%	7.9%	7.9%	1.6%	12.7%	14.3%	12.7%	4.8%	4.8%	<b>12.7%</b>

Note:

SEG	Description
1	employers and managers – large establishments
2	employers and managers – small establishments
4	professionals: employees
5	intermediate non-manual
6	junior non-manual
7	personal service
8	foremen & supervisors
9	skilled manual
10	semi-skilled manual
11	unskilled manual
13	farmers: employers & managers
15	agricultural workers

**Table A2 – Derived SOC2000 minor groups employment changes**

Description	1981		2004		Change in employment rate
	Mean wage	Employment rate	Mean wage	Employment rate	
Sports and fitness occupations	1.973	0.18%	0.460	0.23%	0.05%
Functional managers	1.455	0.15%	3.678	4.14%	3.99%
Information and communication technology professionals	1.374	1.06%	1.222	0.94%	-0.12%
Teaching professionals	1.347	2.80%	1.032	6.86%	4.06%
Engineering professionals	1.323	1.03%	1.065	1.65%	0.62%
Printing trades	1.281	0.53%	0.910	0.44%	-0.09%
Draughtspersons and building inspectors	1.270	0.77%	1.007	0.34%	-0.43%
Artistic and literary occupations	1.256	0.18%	1.102	0.57%	0.39%
Sales and related associate professionals	1.251	1.77%	1.013	1.79%	0.02%
Corporate managers and senior officials	1.248	0.12%	1.013	0.09%	-0.03%
Science professionals	1.243	0.77%	1.115	0.60%	-0.16%
Building trades	1.227	0.21%	0.684	1.05%	0.84%
Administrative occupations: government and related organisations	1.223	0.35%	0.683	0.73%	0.37%
Public service and other associate professionals	1.221	0.44%	0.947	1.60%	1.16%
Electrical trades	1.209	2.98%	1.074	2.38%	-0.60%
Protective service occupations	1.200	3.45%	1.198	1.81%	-1.64%
Construction trades	1.184	3.22%	0.784	4.37%	1.15%
Business and finance associate professionals	1.165	0.62%	1.066	1.97%	1.35%
Metal machining, fitting and instrument making trades	1.163	1.03%	0.951	1.78%	0.74%
Librarians and related professionals	1.146	0.15%	0.686	0.25%	0.10%
Science and engineering technicians	1.134	1.15%	0.845	0.52%	-0.64%
Business and statistical professionals	1.113	0.80%	3.215	1.62%	0.82%
Production managers	1.106	0.53%	1.179	4.41%	3.88%
Plant and machine operatives	1.097	2.21%	0.698	1.12%	-1.09%
Health professionals	1.096	0.32%	1.767	1.30%	0.97%
Therapists	1.087	0.24%	1.793	0.82%	0.58%
Financial institution and office managers	1.080	0.91%	0.954	1.67%	0.76%
Metal forming, welding and related trades	1.078	1.27%	0.863	0.64%	-0.63%
Elementary administration occupations	1.070	3.28%	0.639	1.16%	-2.12%
Construction operatives	1.050	0.68%	0.994	0.36%	-0.32%
Mobile machine drivers and operatives	1.036	1.24%	0.800	0.69%	-0.55%
Architects, town planners, surveyors	1.024	0.32%	1.306	0.73%	0.40%
Media associate professionals	1.015	0.15%	0.580	0.57%	0.42%

<b>Childcare and related personal services</b>	1.006	0.47%	0.488	1.16%	0.68%
<b>Process operatives</b>	1.004	2.60%	0.652	1.44%	-1.16%
<b>Vehicle trades</b>	1.002	1.68%	0.745	0.91%	-0.78%
<b>Sales related occupations</b>	1.000	0.65%	0.829	0.23%	-0.42%
<b>Managers in distribution, storage and retailing</b>	0.995	0.62%	0.825	2.88%	2.26%
<b>Elementary goods storage occupations</b>	0.971	2.51%	0.593	1.17%	-1.34%
<b>Design associate professionals</b>	0.968	0.15%	0.752	0.57%	0.42%
<b>Administrative occupations: records</b>	0.967	18.89%	0.640	1.63%	-17.26%
<b>Skilled trades nec</b>	0.954	0.18%	0.729	0.50%	0.32%
<b>Secretarial and related occupations</b>	0.933	7.29%	0.739	3.89%	-3.40%
<b>Elementary construction occupations</b>	0.931	1.21%	0.646	0.50%	-0.71%
<b>Health associate professionals</b>	0.929	0.62%	0.877	4.14%	3.52%
<b>Transport drivers and operatives</b>	0.923	3.13%	0.643	3.52%	0.39%
<b>Managers and proprietors in other service industries</b>	0.902	2.48%	0.864	2.95%	0.47%
<b>Elementary process plant occupations</b>	0.892	2.45%	0.666	0.68%	-1.77%
<b>Elementary security occupations</b>	0.889	0.35%	0.515	1.00%	0.64%
<b>Healthcare and related personal services</b>	0.882	0.71%	0.562	4.27%	3.56%
<b>Food preparation trades</b>	0.864	1.92%	0.504	0.94%	-0.98%
<b>Assemblers and routine operatives</b>	0.864	2.80%	0.653	1.49%	-1.31%
<b>Textiles and garments trades</b>	0.858	0.59%	0.816	0.30%	-0.29%
<b>Agricultural trades</b>	0.854	0.32%	0.511	1.40%	1.08%
<b>Administrative occupations: finance</b>	0.847	0.06%	-	0.00%	-0.06%
<b>Administrative occupations: communications</b>	0.838	1.42%	0.497	0.25%	-1.17%
<b>Transport associate professionals</b>	0.835	0.27%	1.404	0.25%	-0.02%
<b>Leisure and travel service occupations</b>	0.818	0.41%	1.074	0.37%	-0.04%
<b>Elementary cleaning occupations</b>	0.817	1.42%	0.434	2.54%	1.12%
<b>Elementary sales occupations</b>	0.797	0.30%	0.439	0.37%	0.08%
<b>Legal professionals</b>	0.780	0.38%	1.835	1.00%	0.61%
<b>Elementary agricultural occupations</b>	0.777	0.91%	0.303	0.25%	-0.67%
<b>Managers and proprietors in hospitality and leisure services</b>	0.742	0.77%	0.927	1.60%	0.83%
<b>Protective service officers</b>	0.739	0.06%	1.236	0.34%	0.28%
<b>Sales assistants and retail cashiers</b>	0.711	4.49%	0.448	3.71%	-0.77%
<b>Elementary personal services occupations</b>	0.661	2.15%	0.397	1.48%	-0.68%
<b>Housekeeping occupations</b>	0.633	0.12%	0.513	0.55%	0.43%
<b>Hairdressers and related occupations</b>	0.623	0.68%	0.420	0.39%	-0.29%
<b>Public service professionals</b>	0.455	0.03%	1.552	0.71%	0.68%
<b>Social work professionals</b>	-	0.00%	0.691	1.44%	1.44%

**Table A3 – Changing wage rank of SOC2000 minor groups**

Description	1981		2004	
	Rank	Wage / mean wage	Rank	Wage / mean wage
<b>Sports and fitness occupations</b>	1	1.973	63	0.460
<b>Functional managers</b>	2	1.455	1	3.678
<b>Information and communication technology professionals</b>	3	1.374	10	1.222
<b>Teaching professionals</b>	4	1.347	19	1.032
<b>Engineering professionals</b>	5	1.323	18	1.065
<b>Printing trades</b>	6	1.281	28	0.910
<b>Draughtspersons and building inspectors</b>	7	1.270	22	1.007
<b>Artistic and literary occupations</b>	8	1.256	14	1.102
<b>Sales and related associate professionals</b>	9	1.251	21	1.013
<b>Corporate managers and senior officials</b>	10	1.248	20	1.013
<b>Science professionals</b>	11	1.243	13	1.115
<b>Building trades</b>	12	1.227	45	0.684
<b>Administrative occupations: government and related organisations</b>	13	1.223	46	0.683
<b>Public service and other associate professionals</b>	14	1.221	26	0.947
<b>Electrical trades</b>	15	1.209	16	1.074
<b>Protective service occupations</b>	16	1.200	11	1.198
<b>Construction trades</b>	17	1.184	37	0.784
<b>Business and finance associate professionals</b>	18	1.165	17	1.066
<b>Metal machining, fitting and instrument making trades</b>	19	1.163	25	0.951
<b>Librarians and related professionals</b>	20	1.146	44	0.686
<b>Science and engineering technicians</b>	21	1.134	32	0.845
<b>Business and statistical professionals</b>	22	1.113	2	3.215
<b>Production managers</b>	23	1.106	12	1.179
<b>Plant and machine operatives</b>	24	1.097	42	0.698
<b>Health professionals</b>	25	1.096	5	1.767
<b>Therapists</b>	26	1.087	4	1.793
<b>Financial institution and office managers</b>	27	1.080	24	0.954
<b>Metal forming, welding and related trades</b>	28	1.078	31	0.863
<b>Elementary administration occupations</b>	29	1.070	53	0.639
<b>Construction operatives</b>	30	1.050	23	0.994

<b>Mobile machine drivers and operatives</b>	31	1.036	36	0.800
<b>Architects, town planners, surveyors</b>	32	1.024	8	1.306
<b>Media associate professionals</b>	33	1.015	55	0.580
<b>Childcare and related personal services</b>	34	1.006	62	0.488
<b>Process operatives</b>	35	1.004	49	0.652
<b>Vehicle trades</b>	36	1.002	39	0.745
<b>Sales related occupations</b>	37	1.000	33	0.829
<b>Managers in distribution, storage and retailing</b>	38	0.995	34	0.825
<b>Elementary goods storage occupations</b>	39	0.971	54	0.593
<b>Design associate professionals</b>	40	0.968	38	0.752
<b>Administrative occupations: records</b>	41	0.967	52	0.640
<b>Skilled trades nec</b>	42	0.954	41	0.729
<b>Secretarial and related occupations</b>	43	0.933	40	0.739
<b>Elementary construction occupations</b>	44	0.931	50	0.646
<b>Health associate professionals</b>	45	0.929	29	0.877
<b>Transport drivers and operatives</b>	46	0.923	51	0.643
<b>Managers and proprietors in other service industries</b>	47	0.902	30	0.864
<b>Elementary process plant occupations</b>	48	0.892	47	0.666
<b>Elementary security occupations</b>	49	0.889	57	0.515
<b>Healthcare and related personal services</b>	50	0.882	56	0.562
<b>Food preparation trades</b>	51	0.864	60	0.504
<b>Assemblers and routine operatives</b>	52	0.864	48	0.653
<b>Textiles and garments trades</b>	53	0.858	35	0.816
<b>Agricultural trades</b>	54	0.854	59	0.511
<b>Administrative occupations: finance</b>	55	0.847	-	-
<b>Administrative occupations: communications</b>	56	0.838	61	0.497
<b>Transport associate professionals</b>	57	0.835	7	1.404
<b>Leisure and travel service occupations</b>	58	0.818	15	1.074
<b>Elementary cleaning occupations</b>	59	0.817	66	0.434
<b>Elementary sales occupations</b>	60	0.797	65	0.439
<b>Legal professionals</b>	61	0.780	3	1.835
<b>Elementary agricultural occupations</b>	62	0.777	69	0.303
<b>Managers and proprietors in hospitality and leisure services</b>	63	0.742	27	0.927
<b>Protective service officers</b>	64	0.739	9	1.236
<b>Sales assistants and retail cashiers</b>	65	0.711	64	0.448
<b>Elementary personal services occupations</b>	66	0.661	68	0.397
<b>Housekeeping occupations</b>	67	0.633	58	0.513
<b>Hairdressers and related occupations</b>	68	0.623	67	0.420
<b>Public service professionals</b>	69	0.455	6	1.552
<b>Social work professionals</b>	-		43	0.691



## **Annexe**

### **Introduction**

In the main paper, it was argued that polarisation of the job market leading to an hourglass economy may be a lot less observable than others have suggested (see Goos and Manning 2007, 2009, and Autor, Katz and Kearney, 2006). Those authors demonstrate how employment has increased in jobs at the low-end and upper-end of the employment spectrum and decreased in jobs in the middle of the spectrum, where the position on this spectrum is given by initial median wages of each occupation.

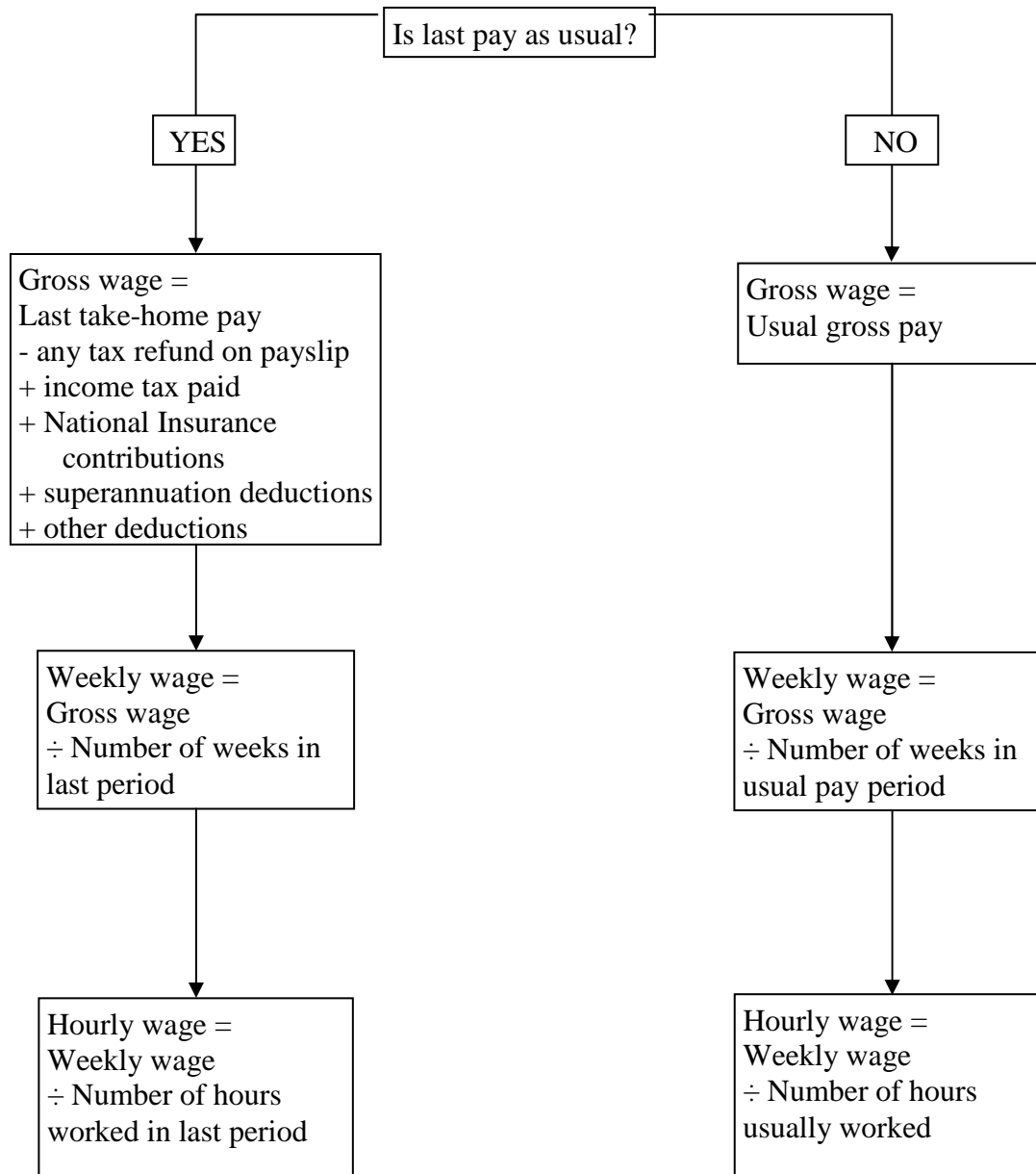
Contrary to that, this paper argues that the wage structure of occupations has changed markedly over the past thirty years, so that jobs are not necessarily in the same place on the wage spectrum over time. Wage distributions were presented from a longitudinal study (the National Child Development Survey, NCDS) to show that there was not a significant increase in employment of high wage and low wage jobs. In the conclusion, it was stated that there is a possibility that as the dataset is longitudinal, while useful for looking at how individuals move during a period of structural change, it may also bias the derived wage distributions (downwards in the 1981 wave and upwards in the 2004 wave). It was argued that it would be unexpected for this choice of dataset to conceal entirely the effect described, as the same patterns of growth in non-routine occupations was found, but that supplementing this with further data from cross-sectional studies would be useful. In this annexe, wage distributions are presented derived from a cross-sectional study, the Family Expenditure Survey (FES), to assess their similarities with those derived in the main paper.

### **Data**

The FES has collected data since 1957. It was designed to record household expenditure and income, and collects responses throughout the year to capture seasonal variations. The main purpose of the survey was to provide the weights for the United Kingdom Retail Price Index (RPI). It is a relatively small survey – the final survey, taken 2000/1, contained over 6600 households (each household could have multiple respondents). This is significantly larger than the NCDS dataset however. The FES data on income follows roughly the same methodology over time, and

captures net and gross pay, tax, deductions, usual pay, and hours of work. It was superseded in 2001 by the Expenditure and Food Survey.

**Figure A1: FES wage methodology**



In terms of consistency of methodology and completeness of data, the Family Expenditure Survey (FES) is the most useful for constructing hourly wage distributions over the past thirty years. As noted above, the survey is a lot smaller than some of the larger samples, however, it provides information of last net pay, tax, national insurance, tax refunds, superannuation and other contributions, usual gross pay (where different from the last pay), hours worked, overtime worked, usual hours

(where different to last pay period), and length of pay period (last pay and usual). Other cross-sectional datasets do not provide this same level of detail over the same length of time (the General Household Survey and the Labour Force Survey both fall into this category). Given the structure of questions in the FES Income Schedule interview, the methodology shown in Figure A1 was adopted. Table A4 summarises the variables used for these calculations from the 1981, 1990 and 2000/1 surveys.

**Table A4: Summary of variables**

Calculation variable	1981	1987/1990	2000/1
<b>Is last pay as usual?</b>	A254 (Yes = 1, No = 0)	INA254 (Yes =1, No = 2)	INA254 (Yes =1, No = 2)
<b>Last take-home pay</b>	T303	XPAYAMT	PAYAMT
<b>Any tax refund on payslip</b>	T304	XTXREFAM	TAXREFAM
<b>Income tax paid</b>	T305	XTAX	TAX
<b>National Insurance contributions</b>	T306	XNINO	NINO
<b>Superannuation deductions</b>	T318	XDDSUPAM	PENDAMT
<b>Other deductions</b>	T308	-	-
<b>Usual gross pay</b>	T315	XUGROPAY	USGROPAY
<b>Number of weeks in last period</b>	A213 (1 week = 1, 2 weeks = 2, 4 weeks = 4, 365/84 weeks = 5)	PERC409 (1 week = 1, 2 weeks = 2, 3 weeks = 3, 4 weeks = 4, 365/84 weeks = 5)	PERC409 (1 week = 1, 2 weeks = 2, 3 weeks = 3, 4 weeks = 4, 365/84 weeks = 5, 365/42 weeks = 7, 365/28 weeks = 13, 365/14 week = 26, 365/7 weeks = 52)
<b>Number of weeks in usual pay period</b>	A213 (1 week = 1, 2 weeks = 2, 4 weeks = 4, 365/84 weeks = 5)	PERC428 (1 week = 1, 2 weeks = 2, 3 weeks = 3, 4 weeks = 4, 365/84 weeks = 5)	PERC428 (1 week = 1, 2 weeks = 2, 3 weeks = 3, 4 weeks = 4, 365/84 weeks = 5, 365/42 weeks = 7, 365/28 weeks = 13, 365/14 week = 26, 365/7 weeks = 52)
<b>Number of hours worked in last period</b>	A216+A218	INA220+INA244	USUHR+POTHR
<b>Number of hours usually worked</b>	A220	INA220+INA244	TOTUS1
<b>Sample size</b>	7,637	7,116	6,322

The one issue found with the 1981 data is the fact that wages appeared to be presented to three decimal places (so £10 was recorded as 10000). There was documentation to say that this had happened in the past, but nothing within the documentation of the 1981 survey. As two decimal places made little sense, as it would imply weekly wages greater than those in 2000, I will continue to assume this is correct unless shown otherwise.

### Occupational structure

Table A5 looks at the changing employment shares of different occupational groups between 1987 and 2001, using the FES data on employment and social economic group. 1987 is used as the initial year because this was the first year the FES reported SEGs.

**Table A5: Changing employment shares, FES**

<b>SEG group description</b>	<b>Mean hourly gross wage, 1987</b>	<b>Employment shares, 1987</b>	<b>Employment shares, 2001</b>	<b>% increase in employment shares</b>
<b>employers and managers – large establishments</b>	100.00	7.82%	10.68%	36.6%
<b>professional: employees</b>	95.02	4.73%	5.22%	10.5%
<b>intermediate non-manual</b>	73.10	11.09%	13.83%	24.7%
<b>employers and managers – small establishments</b>	67.49	5.21%	6.94%	33.3%
<b>foremen &amp; supervisors</b>	59.06	9.61%	7.18%	-25.3%
<b>skilled manual</b>	51.05	14.77%	10.10%	-31.6%
<b>junior non-manual</b>	46.81	22.24%	21.62%	-2.8%
<b>farmers: employers &amp; managers</b>	43.21	0.31%	0.11%	-64.7%
<b>semi-skilled manual</b>	40.24	10.62%	11.17%	5.3%
<b>agricultural workers</b>	37.16	1.28%	0.77%	-39.6%
<b>unskilled manual</b>	34.60	6.27%	5.22%	-16.7%
<b>personal service</b>	31.97	6.06%	6.82%	12.5%

Source: FES, author's calculations.

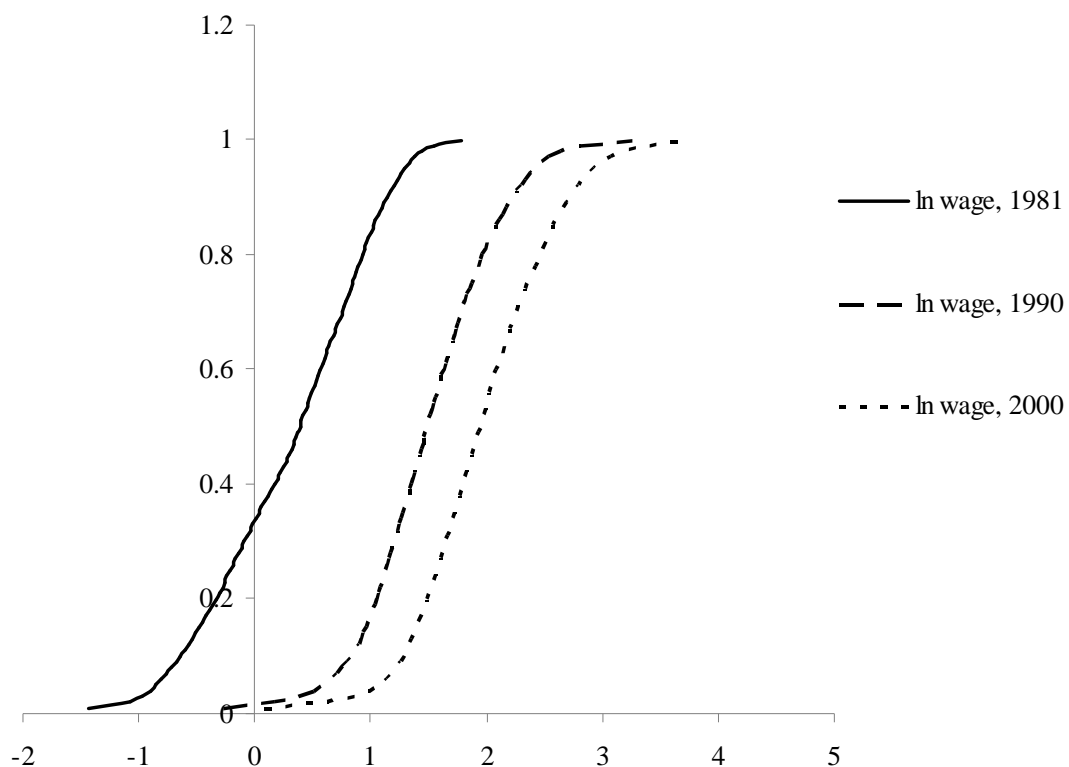
Note: Mean hourly gross wage in 1987 indexed to 100 for employers and managers in large establishments.

Table A5 shows similar patterns to the main paper, and are in line with routinisation. Manual jobs and clerical jobs have fallen in employment share, while high skill professional and managerial jobs, and low skill service jobs have grown. The only major difference is for foremen and supervisors, but this can be explained by the relative sizes of the two effects (decline in manual work and career progression) in a longitudinal and a cross-sectional sample. The size of the changes is less pronounced than in most cases, which is almost certainly related to career progression, especially for management and supervisory positions. The FES does not have data on occupations beyond the broad socio-economic groups, so it is not possible to recreate Figure 1 from the main paper.

### **Wage distributions**

Using these data, the distributions shown in Figure A2 were derived. As with the NCDS distributions, there does not appear to be a significant flattening of the distribution curve, as would be expected if the job market were polarising into low paid and high paid jobs.

**Figure A2: Hourly wage distributions from Family Expenditure Survey**



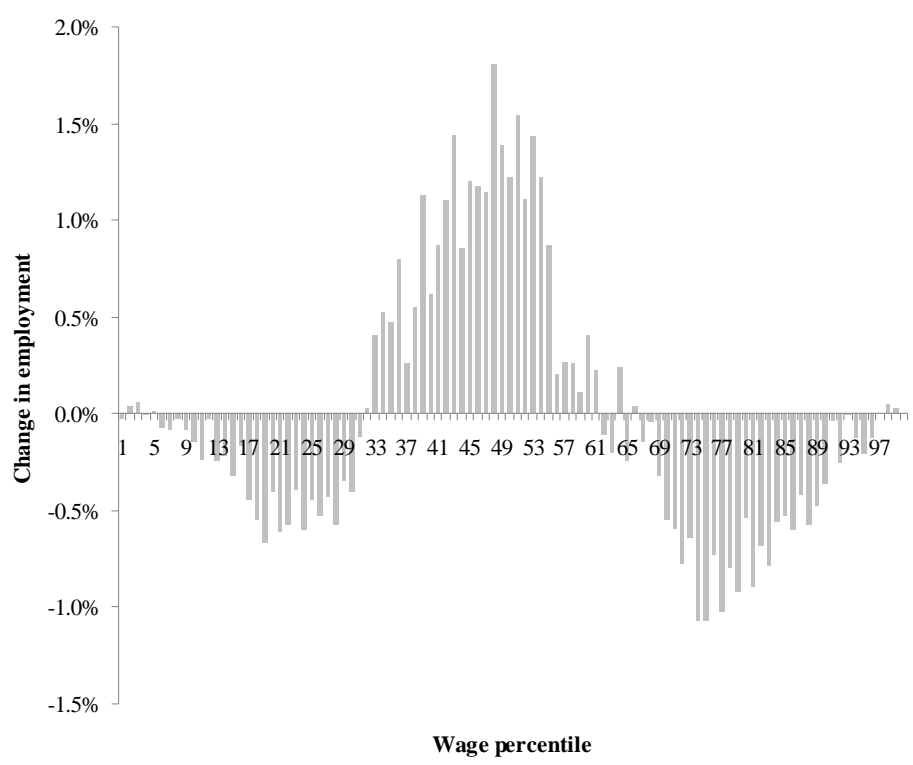
It is useful to be able to quantify the changes in the distribution. As in the main paper, the wage range in each distribution is divided into 100, to see how employment in each of these divisions has increased or decreased over time. The change in each group between 1981 and 2000 is shown in Figure A3a. This measure captures the change in slope across the wage distribution, and accounts for the different range of wages earned over time. Figure A3b and Figure A3c show the interim changes (1981 to 1990 and 1990 to 2000).

Figure 3 shows two important results from this survey. Firstly, employment increased in middle of the wage spectrum jobs between 1981 and 2000, and decreased for low paying and high paying occupations (all defined by these wage percentiles). Secondly, the majority of this change occurred between 1981 and 1990. There is no clear pattern of change between 1990 and 2000, particularly in the middle (with some wage percentiles increasing in employment and others decreasing). The bottom 25 wage percentiles generally decreased – this may, in part, be accounted for by the introduction of the minimum wage (coupled with some non-compliance). The upper 20 wage percentiles generally increased in employment. This suggests the possibility of some increase in employment for the most well-paid jobs.

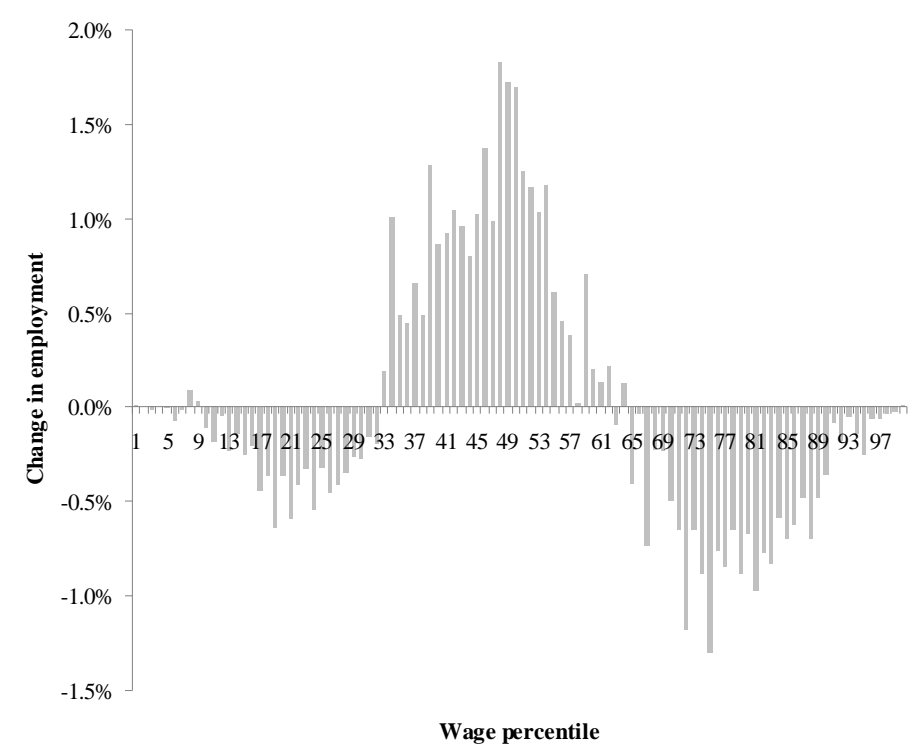
## **Conclusion**

It is no more obvious from using this cross-sectional dataset that the wage distribution over the past twenty years has exhibited any polarisation. The wage percentile diagrams are one convenient way of describing the changes in the distribution. They are imprecise, however, as there are several different factors which can explain changes in the shape, and only one relates to the hollowing-out of the economy as a result of routinisation. Other factors, such as changes in the distribution of skills and education and the returns to these factors also alter the shape. Furthermore, routinisation may play a role in explaining changes to all of these factors. The next stage is to move beyond the motivating descriptive statistics presented here and in the main paper, and evaluate the changing wage distributions with a more rigorous quantitative methodology.

**Figure A3a: Change in employment by wage percentile, 1981 to 2000**



**Figure A3b: Change in employment by wage percentile, 1981 to 1990**



**Figure A3c: Change in employment by wage percentile, 1990 to 2000**

