

# Accounting for Changes in Income Inequality: Decomposition Analyses for the UK, 1978–2008\*

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## Abstract

We analyse income inequality in the UK from 1978 to 2009 in order to understand why income inequality rose very rapidly from 1978 to 1991 but then remained broadly unchanged. We find that inequality in earnings among employees has risen fairly steadily since 1978, but other factors that caused income inequality to rise before 1991 have since gone into reverse. Inequality in investment and pension income has fallen since 1991, as has inequality between those with and without employment. Furthermore, certain household types – notably the elderly and those with young children – which had relatively low incomes in the period to 1991 have seen their incomes converge with others.

## I. Introduction

It is widely known that income inequality in the UK is much higher than it was 40 years ago (Hills *et al.*, 2010; Belfield *et al.*, 2014). Between the late 1960s and the present day, income inequality in the UK has risen from that of a relatively average developed country, with a Gini coefficient of 0.23, to being among the most unequal countries in the OECD, with a Gini coefficient over 0.3 (see Figure 1; OECD, 2011).<sup>1</sup> However, the rise over this

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<sup>1</sup>We refer throughout to the UK, but our data exclude Northern Ireland.

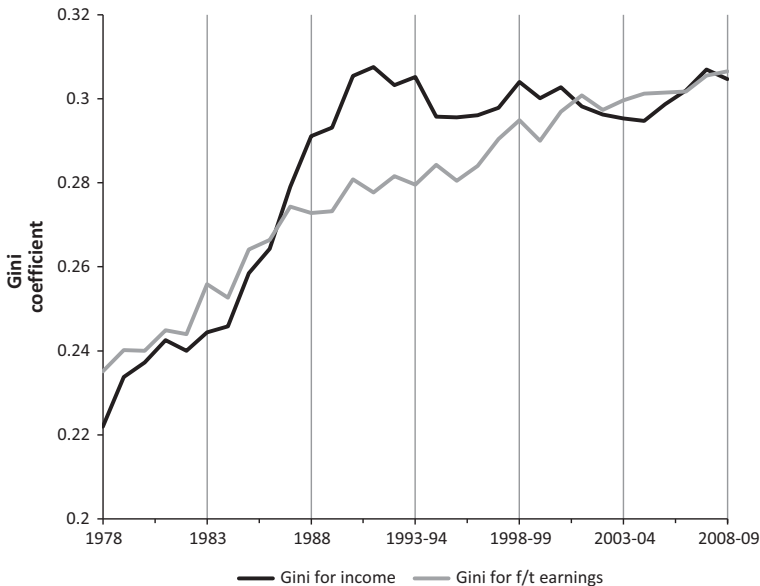


Figure 1. Household income inequality in Great Britain: the Gini coefficient, 1978 to 2008–09

*Note:* The income concept is disposable household income, before housing costs have been deducted.

*Source:* Authors' calculations using the sample described below from Family Expenditure Survey and Family Resources Survey, various years, as described in Appendix D. The bottom and top 1% of both distributions have been trimmed. Only full-time employees are included in the measure of earnings inequality.

period has not been even. Instead, on many measures income inequality rose very quickly during the 1980s, and has changed little since 1991. This is more puzzling given the fact that wage and earnings inequality rose fairly steadily over the period, at least until 2000 (Machin and van Reenen, 2007; Blundell and Etheridge, 2010).

This article investigates these recent changes in inequality in household disposable income, which have remained relatively understudied compared with inequality in earnings or wages. We address the question ‘why did income inequality in the UK rise very rapidly from 1978 to 1991 but then remain flat thereafter?’, and we seek to distinguish between two broad hypotheses: was it the case that those factors which drove the rise in income inequality between 1978 and 1991 were specific to that period? Or was it that the factors behind the pre-1991 rise in inequality have continued, but have been offset by new factors pulling inequality downwards?<sup>2</sup>

To answer these questions, we construct annual, cross-sectional microdata with consistent measures of income and household characteristics spanning 1978–2008/09, and we use three complementary techniques, with each giving a different insight into the underlying forces driving changes in inequality. Our first decomposition, following Shorrocks (1982), identifies the contribution played by different income *sources* (such as earnings from employment, investment income, and cash benefits paid by the state). Our second decomposition uses the regression-based methods in Fields (2003) and Yun (2006) to identify

<sup>2</sup> We use 2008/09 as our final year as we wish to focus our analysis on long-term trends, rather than the impact of a very sharp contraction. For information on the impact of the great recession on inequality, see for example, Jenkins *et al.* (2012) and DWP (2014a).

the contribution of *household characteristics* (such as age, education, and sex). Finally, following Shorrocks (1984), we implement a decomposition that allows us to identify more clearly the role played by sub-groups defined by specific household characteristics.

Our approach is consistent with Cowell and Fiorio (2011), who argue that additional insights are gained by using an *a priori* decomposition approach (which includes our decompositions by income source and by subgroup) alongside an ‘explanatory models’ approach (which includes our regression-based decompositions). Moreover, decomposing changes in income inequality by both income source and household characteristics increases the range of influences that we can detect. One drawback is that we cannot use a single measure of inequality throughout. However, we also show that the time profile of income inequality in the UK is very similar across a range of measures. More importantly, much of our analysis is in terms of inequality ‘shares’ – the share of total inequality explained by different income sources, or by different household characteristics – measures that are valid for any inequality measure that is symmetric, continuous and equal to zero iff all incomes are equal (Shorrocks, 1982).

We show that a number of factors that pushed up income inequality in the 1980s (as shown in, for example, Jenkins, 1995) have disappeared or reversed their influence since then, including income from investments and private pensions. This is consistent with Atkinson’s (1997) argument that movements in income inequality are better thought of as a sequence of ‘episodes’ than in terms of ‘trends’. However, while some of the factors pushing up income inequality in the 1980s have disappeared, others have continued, with employment and self-employment income becoming consistently more unequally distributed among the economically active. Indeed, and unlike those studies of US income inequality (which we discuss in detail in our concluding section), we find that female earnings in the UK continued to push up income inequality in both the 1990s and 2000s, despite rising female employment. Instead, the factors pushing down income inequality in the UK since 1991 are a fall in the number of unemployed, an increase in the redistributive impact of employment taxes, and a rise in the relative incomes of pensioners and households with children under five. As all of our methods allow us to decompose changes between any pair of years, the results presented in this paper also allow an understanding of what factors contributed to the changes in inequality over any sub-period from 1979 to 2008–09.

Our work can be seen, in part, as updating and extending Jenkins (1995), who decomposed changes in household disposable income inequality in the UK between 1971 and 1986. Jenkins found that changes in inequality during this period were the result of a multiplicity of factors, some temporary and others part of ongoing trends. For example, changes in wage inequality were central throughout but weakened over time, with rising unemployment important in the early 80s and a rise in self-employment income influential later on.<sup>3</sup> While other studies have also decomposed changes in the UK income inequality in 1980s, no similarly detailed decomposition exists for later periods. Subsequent UK studies have considered particular aspects of the changes in the income distribution since the early 1990s. For example, Brewer and Wren-Lewis (2011) assessed the causes of changes in the level of household incomes in the UK, and Clark and Leicester (2004), Adam and

<sup>3</sup> p. 79 of Brewer *et al.* (2009), an earlier version of this work, gives a detailed comparison of our results for 1971–86 with those in Jenkins (1995).

Browne (2010), Bargain (2012) and Hills *et al.* (2014) each analyse the effect of changes in personal tax and benefit policy on income inequality in the UK. Other studies of income inequality include those focusing on the rising importance of the top 1% (Brewer, Sibieta and Wren-Lewis, 2009; Atkinson and Voitchovsky, 2011), the extent to which inequality in earnings is transmitted into inequality in household income and consumption (Blundell and Etheridge, 2010) and the relationship between income and consumption inequality (Goodman and Oldfield, 2004; Brewer and O'Dea, 2012). More recently, OECD (2011) looks at a number of factors that may be driving household income inequality trends across OECD countries. It shows that, although most OECD countries have experienced increases in income inequality since 1990, a few countries, including the UK, have seen stability or slight falls. The OECD carry out decompositions which hint at potential causes of this divergence (finding, for example, that the role of capital income appears to have declined in the UK, something confirmed in our analysis, while it rose elsewhere), but the cross-country nature of the report prevents a more in depth analysis of the UK. Rather, more studies exist which try to understand inequality in household incomes in the US, including some using decomposition methods: see, for example, Reed and Cancian (2001), Gottschalk and Danziger (2005), Burkhauser *et al.* (2011) and Larrimore (2014). We discuss their findings more, and how they relate to what we learn about the UK, in our concluding section.

The rest of the paper is structured as follows. Section II gives details of the methodology of the three decomposition techniques. In section III, we describe our empirical implementation and the underlying data sets. The results of the income decompositions are then analysed in section IV. Section V draws together the results to answer our key questions, and considers implications for future work.

## II. Methodology

Within the literature on inequality, there exist a large number of decomposition methodologies, each with their own advantages and limitations. Cowell and Fiorio (2011) provide a review of such decompositions, categorising methodologies into 'a priori approaches' and 'regression models'. A priori approaches derive decompositions based on theoretical axioms, and include the factor and subgroup decompositions derived by Shorrocks (1982, 1984) and the Shapley-value decomposition (Chantreuil and Trannoy, 2013). Regression models, on the other hand, seek to estimate counterfactuals using an econometric model, and by imposing additional structure can get closer to deriving 'causal' impacts (see, e.g. Bourguignon, Ferreira and Lustig, 2004; Herault and Azpitarte, 2014).

Cowell and Fiorio (2011) also argue that additional insights are gained by using *a priori* decompositions alongside regression-based 'explanatory models' decompositions, and our approach is consistent with this. We use three different decompositions to analyse the changes in inequality in UK household disposable income, breaking the changes down by income source, by subgroup and using a multivariate regression-based approach. We use these three different decomposition methods, rather than focusing on one, because each provides us with a different insight into what drives inequality. For example, the decomposition by subgroup provides us with a measure of inequality between different groups, but it cannot tell us which of two different variables contributed the most to total inequality if the two variables are correlated. This is an advantage of the multivariate regression-based

decomposition, since all the variables are included simultaneously. On the other hand, decomposing inequality by subgroups can give us a better understanding of why inequality between groups changed.

The methodologies used here have a number of advantages that are suited to our context. First, avoiding a more complex structural model allow us to easily consider a large number of income sources and variables, as well as undertake the analysis for over forty years of data. Second, our decomposition statistics have the nice property of being additive over time – i.e. the contribution of a factor to the change in inequality between  $t_1$  and  $t_3$  is equal to the sum of the contribution of that factor to the change in inequality between  $t_1$  and  $t_2$  and the contribution of that factor to the change in inequality between  $t_2$  and  $t_3$ . So, for instance, if the absolute contribution of self-employment income to income inequality rose by 15 between 1978 and 1981, one way we can split this rise is into a rise of 4 between 1978 and 1981 and a rise of 9 between 1981 and 1991. This allows us to produce annual decompositions – given in Appendix C – so that we can identify more precisely when changes occurred as well as test the robustness of our results to the particular years chosen. Finally, two of the decomposition techniques that we use have been applied by others in analysis of earlier periods in the UK (Mookherjee and Shorrocks, 1982; Jenkins, 1995), and hence using the same techniques allows for greater comparability.

For each decomposition, our unit of analysis is an individual adult, though income is measured at the household level; this is equivalent to using households as the observational unit but weighted by household size.

### By income source

We follow Shorrocks (1982) to decompose income inequality into the contributions made by different sources of income.<sup>4</sup> In this decomposition, the *component inequality weight* of source  $k$ ,  $s_k(Y)$ , is the covariance of this income source with total income, scaled by the total variance of income, i.e.

$$s_k(Y) = \text{cov}[Y^k, Y] / \sigma^2(Y) \quad (1)$$

These shares are applicable to all inequality measures that use all observations in a given distribution, and we can trivially define the absolute contribution of source  $k$  to a particular inequality measure  $I$  as  $S_k = s_k I$ .<sup>5</sup> Then, if we define  $s'_k$  to be the share of source  $k$  in a future year, and  $I'$  to be the level of inequality in this future year, then we can decompose the change in inequality as:

$$I' - I = \sum_k (s'_k I' - s_k I) \quad (2)$$

Shorrocks (1982) shows that we can decompose this further if we use half the coefficient of variation squared,  $I_2 = (1/n) \sum_i [(Y_i/\mu)^2 - 1]/2 = \sigma^2/2\mu^2$ , as our inequality measure. In this case, the absolute share of source  $k$  in total inequality is  $S_k = \frac{\text{COV}(Y^k, Y)}{2\mu^2}$ , the sum of a

<sup>4</sup> These calculations can be performed using the Stata package *ineqfac* (Jenkins (1999b)).

<sup>5</sup> In particular, Shorrocks (1982) shows that these shares are applicable to any inequality measure that is symmetric, continuous and equal to zero if and only if all incomes are equal – in practice, this applies to almost all commonly used measures, but not decile ratios like the 90/10 ratio.

term that contains only the inequality of the particular source,  $S_k^A = \frac{\sigma^2(Y^k)}{4\mu^2}$ , and another part which includes the correlation with other income sources,  $S_k^B = \frac{\sigma^2(Y^k) + 2\text{COV}(Y^k, Y - Y^k)}{4\mu^2}$ . We therefore, use the  $I_2$  measure of inequality when reporting absolute contributions, although the inequality shares calculated remain applicable to many inequality measures, including the Gini coefficient. [Correction added on 18 March 2016, after first online publication: The symbol ' $\sigma$ ' has been changed to ' $\sigma^2$ ' and the term ' $S_k^A$ ' has been modified to ' $S_k^B$ ' in the second occurrence.].

### Multivariate regression-based

We use the method set out in Fields (2003) to produce a regression-based decomposition.<sup>6</sup> The technique involves estimating an income generating equation of the form

$$y_i = \sum_{c=0}^{c=N} \beta_c X_{ci} + \epsilon_i \quad (3)$$

where  $y_i = \ln(Y_i)$ ,  $Y_i$  is an individual's income,  $(X_{ci})_{c \in [0, N]}$  a set of observed variables that influence this variable and  $\epsilon_i$  the residual term. The coefficients  $\beta_c$  are estimated by OLS regression at the adult level; given the coefficients, we can calculate the estimated residual for each observation. [Correction added on 18 March 2016, after first online publication: The symbol ' $\delta_i$ ' has been changed to ' $\epsilon_i$ ' in equation 3 and in the above paragraph.].

The decomposition technique is identical to that in Shorrocks (1982) once one treats each  $\beta_c X_{ci}$  and the residual like an income source in the Shorrocks sense. We can then define the relative characteristic inequality weight as

$$s_c(y) = \text{cov}[\hat{\beta}_c X_{ci}, y] / \hat{\sigma}^2(y) \quad (4)$$

In our case, the variables  $X$  are sets of indicator variables representing the different subgroups that we consider, and we add the shares of the indicator variables together to form the total share explained by that characteristic.<sup>7</sup> The decomposition will also calculate the share given by the residual term.

Using the shares calculated in equation (4), we can then express the contribution of the  $c$ th characteristic in the change in any suitable inequality measure,  $I$ , between time  $t$  and  $t'$  as

$$s'_c I' - s_c I \quad (5)$$

As with the income source decomposition, these shares are invariant to the inequality measure used. However, Yun (2006) shows that if we use the variance of logs of incomes as an inequality measure, we can decompose these changes further.<sup>8</sup> He constructs an auxiliary distribution of income, where  $y_i^* = \sum_c \beta'_c X_{ci} + e_i$ , i.e. the distribution of income if the coefficients changed but not the individual characteristics or residuals. He then shows that

$$I' - I = \sum_{c=1}^{c=N} (s'_c I' - s_c^* I^*) + \sum_{c=1}^{c=N} (s_c^* I^* - s_c I) \quad (6)$$

<sup>6</sup> These calculations can be performed using the Stata package *ineqrbd*, written by Fiorio and Jenkins (2007).

<sup>7</sup> Cowell and Fiorio (2011) then show that there is a direct correspondence between this sum and the between-effect found using the subgroup analysis, and one can be used to measure the robustness of the other.

<sup>8</sup> It should be noted that the variance of logs measure cannot be guaranteed to satisfy the Pigou–Dalton principle of transfers, unlike most other indices.

where the first set of terms are known as ‘price effects’ and the second known as ‘quantity effects’. A price effect is the part of an inequality change explained by a change in the influence of a particular characteristic on income (e.g. a rise in the education price effect is due to education becoming a more important determinant of an individual’s income). The quantity effect is due to a change in the distribution of a characteristic among the population (e.g. a rise in the education quantity effect might be due to education becoming less equally distributed among the population). We therefore use this inequality measure when discussing absolute contributions of household characteristics to inequality changes.

### By subgroup

Our third decomposition partitions the population into non-overlapping subgroups. By using inequality measures that are part of the generalized entropy family, it is possible to express total inequality as the sum of the inequalities within each group and the inequality that exists between the groups, or:

$$I_{\text{Total}} = I_{\text{Between}} + I_{\text{Within}}$$

Here  $I_{\text{Between}}$  stands for between group inequality, which is the inequality that would arise were each person to receive the mean income of the subgroup to which s/he belonged, and  $I_{\text{Within}}$  stands for within group inequality, which is the weighted sum of inequality within each group, with the weights depending (in general) on the income share and population shares of each group.

We can then similarly decompose changes in total inequality into three components: (i) a change in the relative income of the subgroups, which changes the inequality between subgroups; (ii) a change in the inequality within some or all of the subgroups; (iii) a change in the population shares within the different groups. The last of these components in turn affects inequality in two ways: first, the change in weights given to different groups will affect the total  $I_{\text{Within}}$  term, assuming the subgroups whose populations have changed have different levels of inequality; second, the changing weights of the groups will change the measure of inequality between them.

We use methods from Mookherjee and Shorrocks (1982) and Jenkins (1995), taking advantage of the additive decomposability of the mean log deviation (MLD), where  $I_0 = (1/n)\sum_i \ln(\mu/Y_i)$ . This can then be decomposed into between and within components, i.e.

$$I_0 = \sum_g v_g I_{0g} + \sum_g v_g \ln(1/\lambda_g) \quad (7)$$

where  $\lambda_g = \mu_g/\mu$  and  $v_g = n_g/n$  with  $\mu_g$  the mean income of subgroup  $g$  and  $n_g$  its size ( $\mu$  and  $n$  are the mean and size of the whole population).<sup>9</sup> The first set of terms in equation (7) represents the part of total inequality that is made up of inequality within the subgroups, and the second set inequality resulting from differences in the mean income of subgroups. As the MLD is the index for which subgroup-indices are population-share weighted, Mookherjee and Shorrocks (1982) show that changes can be decomposed as:

$$\Delta I_0 \approx \sum_g \bar{v}_g \Delta I_{0g} + \sum_g \bar{I}_{0g} \Delta v_g + \Delta_g [\bar{\lambda}_g - \overline{\ln(\lambda_g)}] \Delta v_g + \sum_g (\bar{\theta}_g - \bar{v}_g) \Delta \ln(\mu_g) \quad (8)$$

<sup>9</sup> These calculations can be performed using the Stata package *ineqdeco*, written by Jenkins (1999a).

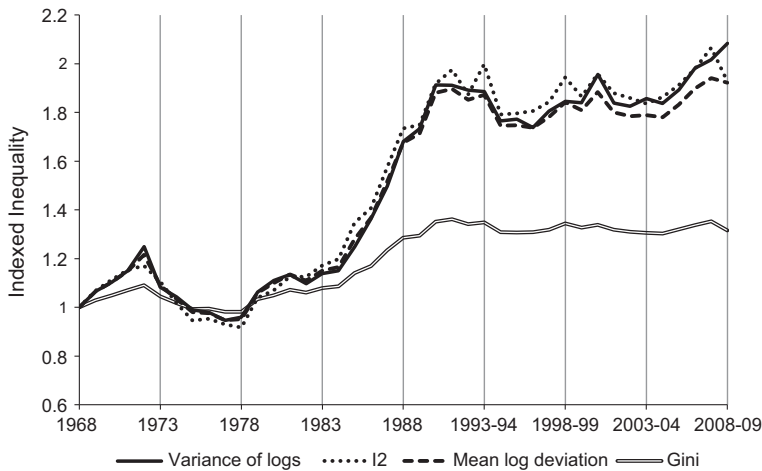


Figure 2. Alternative income inequality measures: 1968 to 2008–09

*Note:* All measures have been scaled so that they take a value of 1 in 1968.

*Source:* Authors' calculations using Family Expenditure Survey and Family Resources Survey, various years, as described in Appendix D.

where a bar over a variable indicates an average of base and current period values. Changes are thus decomposed into, from left to right in equation (8), 'pure' changes in inequality within groups, changes due to changing numbers in the different groups (the second and third terms), and changes due to shifting relative incomes between groups.

### Robustness to choice of inequality measures

The majority of our analysis uses the results of Shorrocks (1982) together with the extension proposed in Fields (2003), and these provide inequality 'shares' (the share of total inequality explained by different income sources, or by different household characteristics) that are valid for any inequality measure that is symmetric, continuous and equal to zero iff all incomes are equal. We are able to say more, however, by specifying particular measures: the decomposition by income source considers half the coefficient of variation squared, the regression based decomposition uses the variance of logs, and the subgroup decomposition is based on the mean log deviation.

These measures vary in their sensitivity to changes in different parts of the income distribution, with the first being relatively sensitive to high incomes, and the latter two more sensitive to changes in the lower part of the distribution. Figure 2 therefore shows changes over time in the three inequality measures that we use, along with the Gini coefficient. Each is scaled such that it takes a value of 1 in 1968. The broad trends we study (a large rise in inequality from 1978 to 1991, followed by relative stability) are apparent for each measure.<sup>10</sup>

Furthermore, we can consider the robustness of the regression-based decomposition (which does require a specific inequality measure to split changes into 'price' and 'quantity'

<sup>10</sup> The similarity in trends between the measures may be due in part to our decision to remove the top and bottom 1% of households. We do this mostly to remove the impact of censoring, but it also reduces the differences between inequality measures that are sensitive to the shape at the very top or bottom.



effects) by comparing the substantive conclusions with those from the subgroup decomposition, which uses a different inequality measure.

### III. Empirical implementation

Our analysis is performed on annual cross-sectional household surveys covering Great Britain from (calendar) 1978 to (financial) 2008–09. We detail these, and how we construct our final data set for analysis, in Appendix A, but we would highlight six points here. First, in common with almost all research on income inequality in the UK, our measure of income is a measure of ‘weekly net disposable equivalent household income’, in which incomes, usually measured over a short period of time, are measured net of taxes and benefits, summed across all individuals living in the same household, and then equivalised to take into account the size and composition of households (we use the modified OECD equivalence scale). Second, we then trim the top and bottom 1% of households in each year; in doing so, we remove all of the very high and very low income households whose reported incomes are adjusted by government statisticians before the micro data are made available. Third, although we have a measure of pretax earnings at the individual level, we have a measure of the tax paid on employment income only at the household level; we assume that the each adult’s share of household net earnings is given by their share of pretax earnings. Fourth, we classify income from state benefits according to the type of household that receives the income. Fifth, no allowance is made for the implicit income that accrues to owner-occupiers or those with below-market-rent social housing. Sixth, our measures of inequality are taken among *individuals*, though income is assumed to be shared equally across the household; this is equivalent to analysing income inequality at the household level but weighting each household by the number of inhabitants.

We have not used longitudinal data as the main source of household panel data in the UK (the British Household Panel Study) began in 1991, thereby preventing any assessment of what was different in the pre- and post-1991 periods (see, though Jenkins and van Kerm (2011), who analyse the incomes changes from 1991 to 2005).

Decomposing a *change* in inequality involves choosing two years to compare (e.g. ‘change in inequality from 1978 to 1979’, or ‘change in inequality from 1970 to 1980’). As Jenkins (1995) emphasises, the conclusions a researcher draws about inequality trends can be driven in part by the years they choose to compare. Our approach is to split this into two sub-periods in 1991. Our choice of 1991 is driven by the time path of income inequality in the UK, shown in Figure 2. Income inequality reached a relative low in 1978, independent of the inequality measure used, and then grew, until reaching a local maximum around 1991. Since 1991, inequality has experienced a number of small rises and falls and, although there is some variation in the size and timing of these changes according to the inequality measure, in 2008–09, each index has a similar value to that it took in 1991.<sup>11</sup> But, as all of our methods allow us to decompose changes between any pair of years, the results presented in this paper also allow an understanding of what factors contributed to changes in inequality over any sub-period from 1979 to 2008–09.

<sup>11</sup> The Figure uses several common measures, each scaled so that they have a value of 1 in 1968. Having done this, we note that it is not meaningful to compare the size of changes across indices, as some are bounded and some not.

## IV. Results

This section presents our main results. We consider first the decomposition by income source and then the decompositions by characteristic.

In each of these two parts, we first highlight the factors influencing the large rise in inequality between 1978 and 1991; this allows us to compare our results with those of earlier studies, but more importantly provides us with a baseline that helps us to interpret the results from the decomposition of the factors influencing the much smaller changes in income inequality in our second period, from 1991 to 2008–09. We use the bootstrap to construct confidence intervals for the main quantities of interest. These are given in full in Appendix D, and, in the tables below, results are put in *italics* when zero lies within a 95% confidence interval.

### Decomposition by income source

We begin by decomposing changes in household income inequality into the contribution of the different sources of household income, using equation (1). Figure 3 displays the

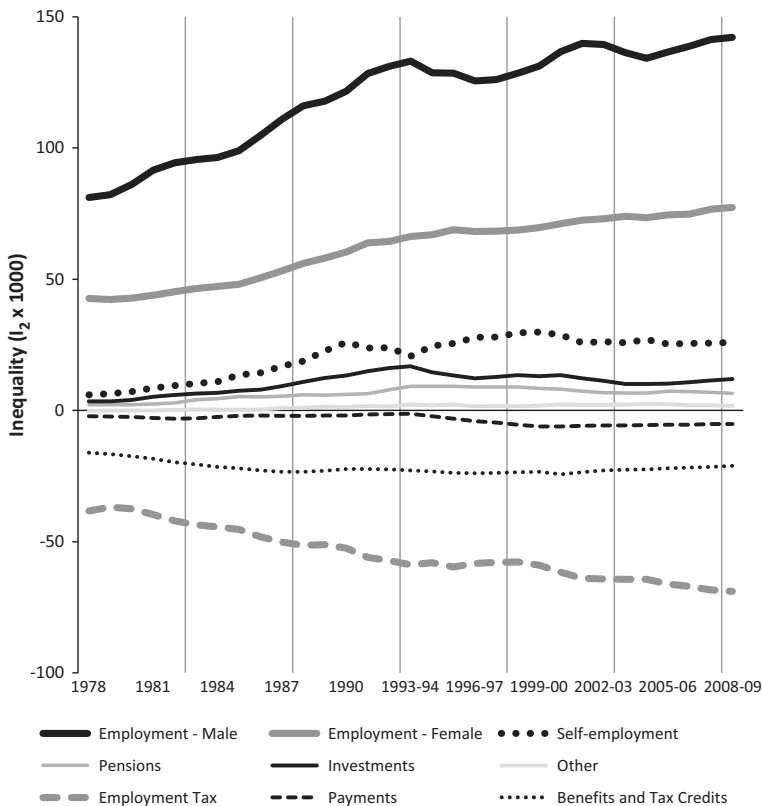


Figure 3. Absolute shares of each income source in inequality ( $I_2 \times 1,000$ )

*Note:* The inequality measure used is 1,000 times half the coefficient of variation squared,  $I_2$ .

*Source:* Authors' calculations using Family Expenditure Survey and Family Resources Survey, various years, as described in Appendix D.

contribution of each income source to total income inequality (as measured by  $1,000 \times I_2$ , where  $I_2$  is half the squared coefficient of variation).

Tables 1 and 2 present the decomposition in more detail. Table 1 reports the share of each income source in average income,  $s_k$ , the share of each income source in total income inequality, and the percentage of households that receive some income from each source. As described in section II, these shares can be applied to almost any inequality measure. Table 2 then shows the changes in the absolute contribution of each income source to income inequality in each of our periods,  $s'_k I' - s_k I$ , the share of this change in the total change,  $(s'_k I' - s_k I)/(I' - I)$ , and the inequality of each particular income source when considered separately. In this case, we use the coefficient of variation squared, as this allows us to go one step further in the decomposition.

In our discussion of the results, we use the term ‘relative contribution to inequality’ to describe a source’s share in total income inequality, and ‘absolute contribution to inequality’ to mean the share multiplied by the level of total income inequality. When inequality rises, it is therefore possible for an income source to increase its absolute contribution to total inequality while its relative contribution falls.

### *1978 to 1991*

Employment income was the largest contributing source to the rise in total income inequality between 1978 and 1991 (from Figure 3 and the second panel of Table 2). Overall, the net employment income from both men and women (this is combined contribution of male gross employment income, female gross employment income and employment taxes) accounts for 66% of the total rise in income inequality from 1978 to 1991, a finding that is consistent with the large rise in earnings inequality over the period (Blundell and Etheridge, 2010). Moreover, it also captures an increase in inequality between those with and without employment income, and the increase in the number of households not receiving income from male employment, which rose from 29% to 43% over the period (see the third panel of Table 1). The exact breakdown of this change is explored in the next section when we decompose inequality by employment status.

Three other income sources also played a substantial role in the rise in income inequality (see the second panel of Table 2): self-employment income, investment income and income from pensions. Together they explain 38% of the total rise from 1978 to 1991. Consistent with Jenkins (1995), we find these non-employment income sources exerted a particularly strong force on income inequality in the 1984–88 period (see Table C1).

Table 1 tells us that the rise in the contribution of self-employment income to total income inequality in the period 1978–91 is partly explained by its increasing share of total income, rising from 5% in 1978 to 8% in 1991 and going alongside a large rise in the number of households receiving some self-employment income, from 19% in 1978 to 24% in 1991. Indeed, the third panel of Table 2 tells us that considered separately, self-employment income become more equally distributed during this period. This large rise in the role of self-employment income is consistent with Goodman and Webb (1994) and Jenkins (1995); Meager, Court and Moralee (1996) partly explain the rise as the result of low-skilled unemployed workers becoming self-employed due to an inability to obtain full-time employment.

TABLE 1  
Shares of mean income and income inequality by income source

Year	Gross employment			Self-		Benefits received by							
	Male	Female	Tax	employment	Pensions	Investments	Deductions	Households	Tax	Other	Credits	Other	
Share of mean income (%)	1978	78	26	-29	5	3	2	7	7	4	4	1	
	1991	61	28	-24	8	5	6	6	7	4	4	2	
	2008-09	56	33	-23	8	6	4	6	8	4	2	3	
Share of income inequality (%)	1978	102	55	-47	7	3	4	-9	-12	0	0	0	
	1991	83	39	-36	11	5	11	-6	-5	-2	1	1	
	2008-09	84	46	-41	14	4	7	-4	-4	-2	-2	1	
Share of households with	1978	71	50	77	19	12	57	53	14	11	17	17	
non-zero source income (%)	1991	57	50	66	24	19	73	45	17	14	24	24	
	2008-09	55	51	67	14	18	67	44	17	14	28	28	

Notes: Negative values mean the income source is on average a negative contributor to mean income or income inequality. Shares of income inequality are calculated based on Shorrocks (1982) – see equation (1). Tax credits were only introduced in 2000 and so no values are displayed in earlier years. Source: Authors' calculations using Family Expenditure Survey and Family Resources Survey, various years, as described in Appendix D.

TABLE 2  
Changes in inequality ( $I_2$ ) decomposed by income source

Year	Gross employment				Benefits received by							
	Total	Male	Female	Tax	employment	Pensions	Investments	Deductions	Pensioners	Households with children	Tax credits	Other
Change in absolute contribution to income inequality ( $I_2 \times 1,000$ )												
1978 to 1991	88	59	22	-23	12	6	15	1	0	-4	-2	2
1991 to 2008-09	4	4	13	-9	6	-1	-6	-4	2	4	0	0
Share of change, %												
1978 to 1991	100	67	25	-27	14	7	17	1	0	-4	-3	2
1991 to 2008-09	100	108	302	-212	145	-35	-151	-99	38	89	-4	-5
Inequality of income source ( $I_2 \times 1,000$ )												
1978	78	421	1,169	428	8,507	8,433	6,539	293	3,212	1,930	5,349	16,218
1991	166	814	1,314	772	6,150	5,393	4,591	104	2,782	2,069	4,474	13,833
2008-09	171	1,037	1,320	907	7,472	4,864	8,022	720	3,043	2,163	5,528	9,070

*Note:* Changes in absolute contributions of sources are calculated based on Shorrocks (1982) – see equation (2). Tax credits were only introduced in 2000 and so no values are displayed for earlier years.

*Source:* Authors' calculations using Family Expenditure Survey and Family Resources Survey, various years, as described in Appendix D.

The contribution of investment income to inequality also substantially increased in the first period. In 1991, investment income explained 11% of total inequality, the peak in this series (as can be seen in the second panel of Table 1). The temporary nature of this rise suggests it may be explained by the spike in the nominal interest rate over this period, and the increasing investment income inequality during the 1980s may reflect tax changes that increased the net income received by savers. However, since the inequality of the income source itself decreased over the period, and the share of households receiving it increased, the rise in its contribution most likely reflects a greater number of (presumably richer) households receiving income from investments. Similarly, the absolute contribution to inequality of (private) pension income rose steadily from 1978 to 1991. Table 1 shows that this occurred alongside a rise in the number of households receiving income from pensions (from 12% to 19%), a rise in its share of total income from 3% to 5% and a reduction in the inequality of the income source itself.

One income source that acted to reduce the inequality was the benefits given to non-pensioners. The size of the direct effect of benefit income for non-pensioners on inequality was roughly the same in 1978 and 1991, so this mitigating effect has come about through a greater negative correlation with other income sources over the period, and this most likely reflects the lower relative prebenefit income of benefit recipients in 1991 compared with 1978, rather than any change in the benefit regime. Indeed, Clark and Leicester (2004) argue that changes in the benefit regime during this period may have reduced the potential equalising effect of the benefit system.

Overall therefore, income from employment provided the largest single contribution to the rise in inequality between 1978 and 1991, but self-employment, investment and pension income also played considerable roles. We now turn to consider the role played by the various income sources in explaining income inequality since 1991.

### *1991 to 2008–09*

Using the inequality measure of half the coefficient of variation squared, income inequality in 2008–09 was very similar to the level in 1991, having risen by only 3%. However, this disguises a divergence in the absolute contributions of several income sources. In particular, the first panel of Table 2 tells us that, were the contributions of other income sources to income inequality to have remained constant, the changing distribution of employment and self-employment income would have led to an overall rise in inequality of 9%. This larger rise in inequality was prevented by a fall in the absolute contributions of investment income, pension income and deductions.

If we look in detail, Table 2 shows that employment income became less equally distributed between 1991 and 2008–09, but by less so than in the previous 13 years. Furthermore, most of this rise was due to female employment income (see the first panel of Table 2), which is markedly different from the previous period. This rise in inequality in income from female employment was from women in couples, which increased total income inequality further due to its positive correlation with income from male employment.<sup>12</sup> From Table D3, we can see that this positive contribution to inequality of female employment

<sup>12</sup>The decomposition into ‘men/women in couples’ and ‘single women/men’ is not reported in the main tables because the definition of couples changed in 1990, making the data inconsistent over the longer period.

income occurred both in the 1990s and 2000s. The impact of the rise of gross employment income inequality was, however, mitigated by employment taxes, which offset more than half of the rise in gross employment income inequality. This dampening impact of the tax system is substantially greater than in the previous period, when employment taxes offset less than third of the impact of higher gross employment income on overall income inequality.

Perhaps, the largest difference between the post-1991 period and 1978–91 is the negative absolute contribution of investment and pension income to income inequality over the latter period. In the case of investment income, this has gone alongside a fall in its share in total income (1<sup>st</sup> panel of Table 1); this may be associated with the general decline in nominal interest rates since 1991. Pension income, on the other hand, has increased its share in total income, but it has become more equally distributed (2nd panel of Table 2) and less correlated with other income sources. This may be the result of the fall in investment income, as well as the fact that the receipt of private pension income spread into the middle of the income distribution during the 1990s.

Table 2 suggests that changes to benefits received by households with children have acted to increase overall income inequality between 1995–96 and 2008–09. This appears to contradict previous findings that the benefit changes introduced by the Labour government over the period 1997–2010 were generally progressive and decreased inequality, particularly among families with children (see, e.g. Adam and Browne, 2010). One explanation for this is that the inequality-reducing effect of policy changes to the benefit regime have been cancelled out by the reduction in the quantity of benefits distributed that occurred as a result of rises in employment and earnings: in other words, although changes to the structure of the benefit system considered in isolation would have reduced inequality, the large fall in the number of workless families meant the benefit system became less effective at reducing inequality.

Two other income sources appear to have contributed sizably to falls in income inequality over the period: ‘deductions’ and tax credits. The term ‘deductions’ refers to items subtracted from net income, such as local taxation (regular income tax and national insurance are subtracted earlier, when calculating net earnings or net income from investments). This income source increased its equalizing effect substantially between 1991 and 2000–01 (Table C1), partly as a result of these deductions becoming larger as a share of income, and partly due to a stronger negative correlation with total income. The latter of these effects reflects the replacement of the community charge (commonly known as the ‘poll tax’) with council tax in 1993: the community charge was levied at a flat rate, but council tax rates vary according to the value of residents’ accommodation, likely to be correlated with their income. The first of these effects then reflects the large above-inflation increases in council tax, particularly at the end of the 1990s. Tax credits, which were introduced in 2000–01, have steadily reduced inequality since then by a similar amount to deductions.

Overall, therefore, the two periods are similar in that both saw a substantial rise in the inequality of income from employment and self-employment. But there are two major differences. First, the increases in employment and self-employment income inequality were much smaller between 1991 and 2008–09 than between 1978 and 1991, partly due to a greater mitigating impact of employment taxes. Second, investment and pension income reversed their impact on income inequality (increasing it in the first period, and reducing

it in the second), and local tax changes and increases in tax credits worked to reduce inequality between 1991 and 2008–09. Together, these two differences account for a large amount of the difference in trends in income inequality over the two periods.

### **Decomposition by individual and household characteristics**

We now decompose inequality by two household characteristics (region, household type) three characteristics of each household's highest earner (age, education (measured by age at which left full-time education), employment status), and the presence and characteristics of any partner of the highest earner. This allows us to see both how inequalities in these variables are related to income inequality, and also which sub-groups of the population are affected most by changes in income inequality. For each of these categories, indicator variables are created according to which subgroup of the population the individual belongs in (details of the exact subgroups used can be found in Appendix B).<sup>13</sup>

We use two different decomposition methodologies to answer these questions. First, we use the regression-based methodology developed by Fields (2003) to analyze the effects of all of our characteristics simultaneously. This gives us an overall view of which characteristics are most important in explaining inequality changes. We then split the population into subgroups based on these characteristics and use the decomposition methodology of Shorrocks (1984). In this way, we can analyse the role of each individual subgroup in any change; for example, if the regression based decomposition showed region to be an important explanatory variable in a particular change, we can then consider how much of this effect was the result of London becoming relatively richer.<sup>14</sup>

Using the regression-based methodology, Table 3, shows the estimated share of each characteristic in total inequality, a set of statistics which are true for a wide range of inequality measures (defined in equation (4)). We then focus on the variance of logs, as this measure allows us to decompose inequality changes further, and show the absolute contributions of each characteristic to inequality in Figure 4, and, in Figure 5, the contribution of the 'residual', the part of inequality unexplained by the characteristics in the regression (since our observed variables still leave a reasonable portion of heterogeneity in household incomes unexplained, and the log-linear model used is clearly an approximation, we find – as is common (see, e.g. Cowell and Fiorio, 2011) – that this term accounts for a large amount of total income inequality).

Table 4 displays the changes in the variance of logs in each of our periods of analysis, following equation (5). Changes are decomposed into the 'price' (P) and 'quantity' (Q) effects of each characteristic.

<sup>13</sup> We also tried including two additional variables for those individuals in work – their occupation and the industry in which they worked. However, since these variables are only given for those employed or self-employed, there is no way to exactly decompose the amount of inequality explained by employment and the amount explained by occupation/industry. Moreover, we do not have consistent series of either variable – see the Appendix D for more information. We, therefore, do not include these two variables in the results presented in this paper, but these results are available on request

<sup>14</sup> As there are such a large number of decompositions, we do not show tables or figures relating to these decompositions here; these are available on request.



TABLE 3  
*Shares of characteristics in income inequality (%)*

Year	Residual	Region	Household type	Age		Education		Employment status	
				Male	Female	Male	Female	Male	Female
1978	50	1	14	2	3	3	3	11	13
1991	53	2	10	1	3	5	5	15	6
2008–09	66	1	4	3	1	4	4	8	9

*Notes:* Shares of income inequality are based on Fields (2003) – see equation (4). Data on education begins in 1978 and therefore is counted as zero in years prior to then.

*Source:* Authors' calculations using Family Expenditure Survey and Family Resources Survey, various years, as described in Appendix D.

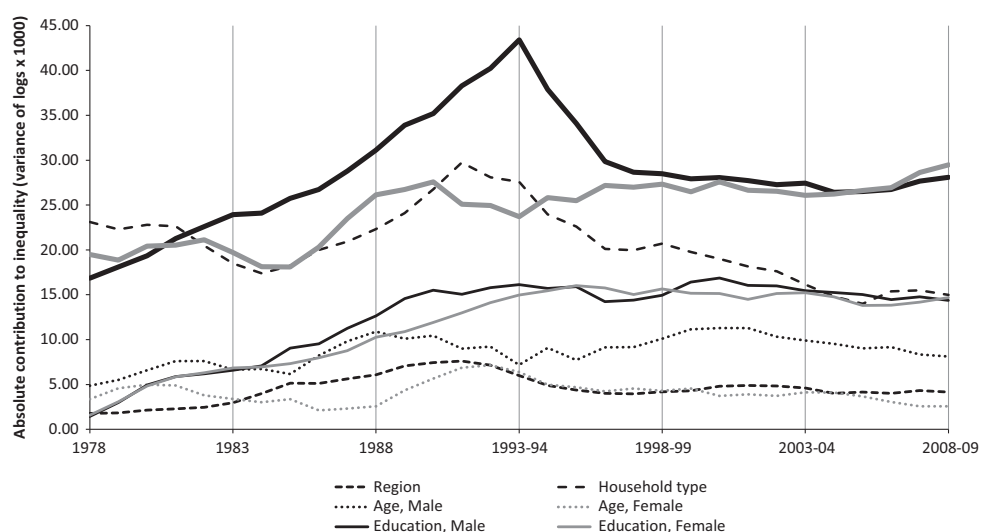


Figure 4. Income inequality (variance of logs) decomposed through multivariate regression-based decomposition

*Notes:* Absolute contribution to income inequality is based on Fields (2003) – they are the shares calculated using equation (4) multiplied by income inequality, which is measured as 1,000 times the variance of logs.

*Source:* Authors' calculations using Family Expenditure Survey and Family Resources Survey, various years, as described in Appendix D.

### 1978 to 1991

The employment status of men is, in general, the most important of our explanatory variables in the decomposition (see Table 3), and it is also the variable that explains the greatest share of the rise in income inequality during the period 1978–91. During this period, there was both a large price effect and a large quantity effect (Table 4): men's employment status became more correlated with income, and the distribution of employment changed in a way as to increase inequality. Both effects are consistent with the subgroup decomposition by men's employment status (not shown here). The subgroup decomposition suggests that the quantity effect was mainly a result of the rise in the number of unemployed or inactive in the 1978–84 period, which increased inequality due to the relatively low income

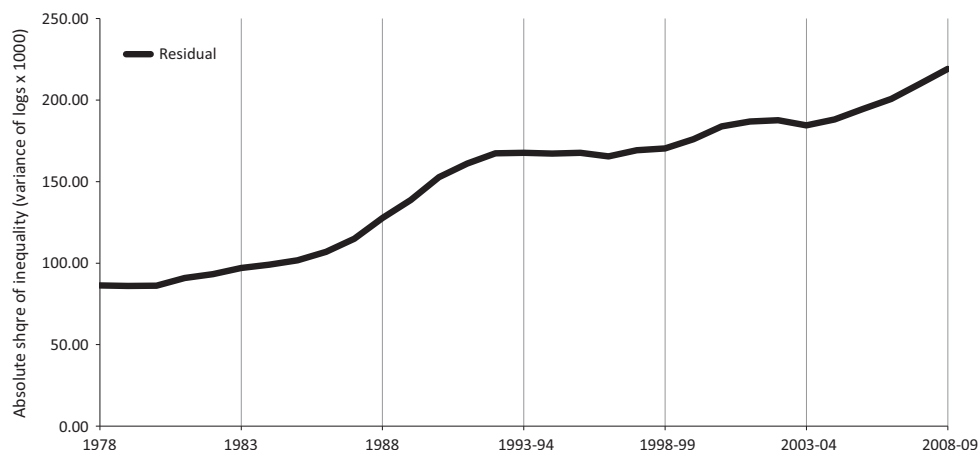


Figure 5. Residual remaining when income inequality (variance of logs) decomposed through multivariate regression-based decomposition

*Note:* Income inequality is measured as 1,000 times the variance of logs.

*Source:* Authors' calculations using Family Expenditure Survey and Family Resources Survey, various years, as described in Appendix D.

of these population groups. The price effect, on the other hand, occurred mainly after 1984, when the incomes of the employed and self-employed grew substantially compared to other groups, worsening inequality. Summing the appropriate terms in Table 4 tells us that together, men's employment status accounts for 18% of the overall rise in inequality between 1978 and 1991.

In 1978, the employment status of women explained a similar amount of household income inequality to the employment status of men: 13% compared to 11% (see Table 3). However, unlike the employment status of men, this variable played almost no role in the rise in total inequality between 1978 and 1991. The subgroup decomposition shows that this was partly the result of very small changes in female employment over the period: 47% of households had a woman employed or self-employed in 1978, compared to 48% in 1991. Moreover, the relative incomes of households with employed women did not change substantially over the period relative to the average household, unlike that of households with employed men.

The education levels of household members also explained a significant share of the rise in income inequality between 1978 and 1991. According to Table 4, this was made up of both a price effect (increasing returns to education) and quantity effect (a more unequal distribution of education) for both men and women. This is consistent with the literature (e.g. Gosling, Machin and Meghir, 2000).

Household type explains a statistically significant but small part of the increase in inequality. The subgroup decomposition suggests that the main change was an increase in the proportion of childless households, who, on average, have a more unequal and slightly higher equivalised household income than other household types.

Region also explains a small part of the rise in inequality. Table 4 shows a positive price effect for region during the 1980s – reflecting that income became more unequally distributed across regions – but this only explains about 4% of the rise in income inequality

TABLE 4  
Changes in income inequality (variance of  $\log s \times 1,000$ ) decomposed into characteristic price and quantity effects

Years	Total	Residual	Region	Household type			Age			Education			Employment status		
				P	Q	Q	Male	P	Q	Male	P	Q	Male	P	Q
1978 to 1991	157	87	6	0	3	6	-2	2	4	1	8	4	6	4	4
1991 to 2008-09	28	61	-4	1	-18	-1	5	1	-8	2	-8	7	-7	7	-2

Notes: Decomposition based on Yun (2006) – see equation (6). Data on education begins in 1978 and therefore is counted as zero in years prior to then. Income inequality is measured as 1,000 times the variance of logs.

Source: Authors' calculations using Family Expenditure Survey and Family Resources Survey, various years, as described in Appendix D.

during the period. The subgroup decomposition confirms that this is explained by a relative decline in the income of the North of England, Wales and Scotland, especially when compared to London and the South East (this is consistent with Jenkins (1995), who finds some evidence of a small but growing North-South divide over the period between 1971 and 1986).

Finally, over half of the rise in income inequality in this decomposition is attributed to the residual term. A large portion of this reflects increasing earnings inequality among the employed and self-employed: when we include the occupation and industry of workers in the regression, the residual only accounts for around a quarter of the rise. Some of this change in the residual is also likely to be a result of the imprecision of our education measure.

Overall, our decompositions by characteristic have identified a number of factors behind the rise in income inequality between 1978 and 1991. A rise in unemployment and the falling relative income of the unemployed and inactive explains about a fifth, and factors such as education and region also increased income inequality, most likely through making earnings less equal. About half of the rise in inequality remains unexplained by our main explanatory factors, but a significant part of this is due to inequalities between workers in different industries and occupations.

#### *1991 to 2008–09*

Perhaps, the most striking comparison between the decomposition of changes in the two periods is that the contribution of the ‘residual’ term in the two periods is fairly similar in absolute magnitude (Table 4). In other words, unobserved factors pushed up inequality almost as much in the second period as in the first. The key difference between the two periods therefore is in the contribution of the observed household characteristics: these generally acted to push up inequality between 1979 and 1991, but acted to reduce inequality between 1991 and 2008.

The absolute contribution of male employment status to income inequality did not rise between 1991 to 2008–09 (Table 4). Indeed, over the period, this variable has had an equalising effect of over half of the magnitude of the dis-equalising effect in the previous period. Table 4 suggests that this was due both to a price and quantity effect: a smaller correlation between male employment status and income, and a change in the distribution of employment statuses that reduced inequality. Although neither is statistically significant, both are consistent with the subgroup decomposition by men’s employment status, which finds that the proportion of households with an unemployed man as the head of household has fallen from around 4% in 1991 to 2% in 2008–09. There was also a small relative income effect, which arose due to the higher relative income of pensioners. Women’s employment has pushed inequality in the other direction, with a significant price effect pushing up household income inequality, suggestive of an increase in the income of employed women. However, no equivalent effect shows up in the subgroup decomposition, which perhaps implies that households with employed women have also lost income for other reasons, such as a fall in male employment income.

Neither education nor region appears to have had a large effect on changes in inequality since 1991. For education, positive price effects appear to have been mitigated by negative quantity effects; the subgroup decomposition shows that this reflects an increase in returns to education alongside a greater supply of households with higher education levels.

The only other characteristic that has had a fairly large impact on income inequality since 1991 is household type: this has gone from explaining 10% of total income inequality in 1991 to explaining only 4% in 2008–09 (Table 3). This is due to a negative price effect (Table 4); the subgroup decomposition reveals that this is due to the increasing income of two relatively poor groups: pensioners and households with children under five. The relative incomes of pensioners have been increasing in recent years, partly due to successive cohorts of retiring pensioners having larger private pension incomes to draw upon on average, and partly due to the increasing generosity of state benefits targeted at low income pensioners (such as the Pension Credit) – see Brewer *et al.* (2007) for more details. Meanwhile, the increasing relative income of households with children under five is likely to be the result of changes to the benefit system (in particular the rapid increase in generosity of welfare benefits and tax credits for low income families with children since 1997). Supporting evidence for this comes from decomposing employment income by household type, which shows us that the relative earnings of this group have neither risen over the period nor has their share in the full-time workforce risen notably. The larger effect of these benefits on households with younger children compared to other households with children is due to the nature of the changes in benefits and tax credits, and is consistent with the findings of Gregg, Waldfogel and Washbrook (2006).

## V. Conclusions and discussion

Our decompositions have provided several new insights that improve our understanding of changes in income inequality over the last two decades. This has helped us to provide an answer to the question which we asked in the introduction: Why did inequality rise so rapidly in the period 1978 to 1991 but since then remain relatively flat?

In both periods, employment and self-employment income became more unequally distributed among the economically active, but a number of factors have mitigated the effect of these changes on total income inequality since 1991. First, inequality between those with different employment statuses has fallen, primarily due to a fall in the number of unemployed. Second, employment taxes have played a larger role since 1991 in mitigating the increase in inequality of gross employment income than they did before 1991. Third, investment income has contributed less to total incomes inequality since 1991, largely due to the decline in its importance as an income source. Finally, a rise in the relative incomes of pensioners and households with children under five – both groups that benefited from reforms to welfare benefits and tax credits during the 1990s and (especially) 2000s has pulled inequality down. Overall, since 1991, these four factors have almost entirely offset the impact on income inequality of the inequality-increasing changes in the distribution of earnings and self-employment income.

How do these results compare with those of the US, a country with a similar inequality experience during the 1970s and 1980s? Burkhauser *et al.* (2011) show that, as in the UK, there was also a large rise in income inequality in the 1980s and then a substantial slow-down in the early 1990s. A number of papers have carried out decomposition analyses in order to understand the factors behind the US trend (Reed and Cancian, 2001; Gottschalk and Danziger, 2005; Larrimore, 2014). Similar to what we find for the UK, they show that slower growth in male earnings inequality is part of the explanation.

Moreover, they also find female earning inequality pushing inequality up in the 2000s in a comparable way to our finding for the UK. However, there are two apparent differences between the two countries. First, increasing female employment appears to have been a major factor in keeping down US household income inequality during the 1990s, whereas we find no such effect for the UK. Indeed, in the UK, it is rising male employment that plays an important role in this period, with no similar effect being detected in the US. Second, the US studies suggest that non-labour income generally increased their contribution to income inequality over the period, whereas we find the opposite for the UK.

Going forward, one point of concern may be that at least two of these four factors are unlikely to continue pushing inequality down from 2008–09 onwards. Unemployment has rapidly increased since 2008 and in the medium term is unlikely to move below the less achieved during the 2000s. Meanwhile, recent changes to the benefit regime are likely to further increase inequality (see Browne and Elming, 2015). Future movements in net earnings inequality are therefore likely to become central to the trend in income inequality.

More broadly, this article has underlined the importance of studying changes in the inequality of a range of economic indicators. This is clearest in the demonstration that a number of factors beyond wage inequality have impacted strongly on the inequality of household income. Moreover, we have noted that in the recent period the effect of male employment income on income inequality has been very different from the effect of female employment income. We have also noted that our results regarding income from investments may be driven by nominal interest rates, and this exposes the need to consider changes in income inequality alongside studies of inequality in consumption and wealth.

## **Appendix A: Data appendix**

Our analysis is performed on annual cross-sectional household surveys from (calendar) 1978 to (financial) 2008–09 covering Great Britain (data for Northern Ireland are not available from 1994–95 to 2001–02 and so we exclude the Northern Ireland throughout). The data are derived from the Family Expenditure Survey (FES) from (calendar) 1978–93 and from the Family Resources Survey (FRS) for (financial) 1994–95 to 2008–09.

Both surveys are stratified, clustered random samples; each release of data covers a 12-month period, with households being sampled continuously throughout the year. The FES provides a sample of around 7,000 households per year, and the FRS provides around 24,000 households per year.

Since the mid 1980s, UK government statisticians have used these various household surveys to produce an ‘official’ data set of household incomes, known as the ‘Households Below Average Income’ (HBAI) data series, and an annual report analysing the distribution of disposable income in Britain (the name ‘Households Below Average Income’ is deeply misleading, as the data set and the annual report cover the whole income distribution). The idea is that the HBAI report defines various concepts (most notably that of ‘income’), and then the ‘Households Below Average Income’ (HBAI) data series can be produced from any sufficiently rich household survey.

UK government officials created these HBAI data sets from the FES for 1979 and from the mid 1980s to 1994, and from the FRS for all years from 1994–95, and researchers at the Institute for Fiscal Studies created their own, equivalent version from the FES from 1961 to 1993. We take our data for 1978–91 from Goodman and Webb (1995); we take our data from 1994–95 from DWP (2014a); and our data from 1992 and 1993 were produced by IFS researchers using the same rules as generated the series from 1968 to 1991. There is, therefore, the potential for a discontinuity in our time series between 1993 and 1994–95. As the FES survey continued after 1994–95, Frosztega et al (2000) were able to compare HBAI-like series derived from each of the FES and the FRS; the report attempts to attribute any differences to (i) the change in the survey (ii) the change in the definition of income (iii) the change to the grossing regime and corrections for very high incomes and (iv) other changes. Frosztega et al (2000) show that the two surveys have different response rates and response profiles (although the post-stratification weights in both surveys will correct this to some extent) but ultimately concludes that the FRS leads to a lower mean and median income, and more low-income households. They do not present evidence for the Gini or other summary measures of inequality, but their Appendix Table 7 presents low-income shares, which are extremely similar. We also find no noticeable discontinuities between the FES and FRS for any of the variables used in our analysis.

The advantage of using these HBAI data sets is that they have created to be consistent and comparable, as far as is possible given the inevitable small changes in the concept of income and the content of the survey instruments. The disadvantage is that is very hard to use different concepts of income. In particular, we use throughout the HBAI measure of ‘weekly net disposable equivalent household income’, in which incomes are measured net of taxes and benefits, summed across all individuals living in the same household and then equivalised to take into account the size and composition of households (we use the modified OECD equivalence scale). Two small very-near-cash benefits-in-kind are included: free meals for school children whose parents receive certain means-tested benefits, and free TV licences for those aged 75 or over. No allowance is made for the implicit income that accrues to owner-occupiers or those with below-market-rent social housing.

Some of the inequality measures used in this paper are highly sensitive to changes in incomes at the very top and bottom of the distribution, which is unfortunate, because those are also the parts of the income distribution which household surveys are likely to measure with the most error. To mitigate the risk that fluctuating, but mismeasured, incomes in the extremes of the distribution are driving our results, we trim by removing the top and bottom 1% of the income distribution and use the trimmed income distribution in all decompositions contained in this paper. In doing so, we do not wish to downplay the importance of the tails of the distribution to overall inequality; nor, however, do we wish our results to be driven entirely by changes in the worst-measured parts of the income distribution. Our decision to trim only the top and bottom 1% of the distribution represents a trade-off between these two concerns. It also means that we remove from the data those households whose reported income is adjusted by government statisticians before the data are released: the income distribution in the HBAI data is left-censored at the bottom, with households with negative income assigned a value of £0 (the percentage of households recorded as having zero income ranges from 0.15% in 1968 to 0.8% in

TABLE C1  
Income inequality (I<sub>2</sub>) decomposed by income source, annual values

Year	Total (I <sub>2</sub> * 1000)	Employment - Male - Single	Employment - Male - Couple	Employment - Female - Single	Employment - Female - Couple	Employment Tax	Self-employment	Pensions	Investments	Payments	Benefits received by pensioners	Benefits received by households with children	Benefits - Other	Tax Credits	Other
1968	84	23	55	10	20	-24	9	1	4	-2	-8	-4	0	0	1
1969	89	23	57	10	21	-26	10	2	6	-3	-7	-5	0	0	1
1970	91	24	63	8	24	-29	8	2	6	-3	-8	-4	0	0	0
1971	97	27	67	9	27	-32	11	1	5	-3	-9	-5	-1	0	0
1972	97	23	69	10	29	-31	8	1	5	-3	-9	-5	-1	0	0
1973	92	23	65	8	27	-32	11	3	5	-2	-9	-5	-1	0	0
1974	85	24	57	9	27	-33	9	2	6	-2	-9	-5	0	0	0
1975	81	26	59	11	32	-41	4	2	5	-2	-9	-5	-1	0	0
1976	81	27	58	11	32	-42	6	2	4	-2	-10	-6	0	0	0
1977	78	26	53	11	31	-36	6	2	4	-2	-10	-6	0	0	0
1978	78	24	56	12	31	-37	5	3	3	-2	-9	-7	0	0	0
1979	87	27	60	9	33	-37	8	2	4	-3	-11	-6	0	0	0
1980	90	26	65	11	32	-39	9	2	5	-3	-11	-7	0	0	0
1981	95	31	66	14	33	-44	9	3	7	-3	-10	-9	0	0	0
1982	94	27	69	12	34	-44	10	3	6	-3	-10	-9	-1	0	1
1983	100	25	69	15	32	-43	11	6	7	-2	-9	-10	-1	0	0
1984	101	26	72	14	34	-46	11	5	7	-2	-9	-11	0	0	0
1985	113	31	73	14	34	-47	18	5	8	-2	-10	-11	-2	0	1
1986	118	35	76	17	37	-51	13	5	8	-2	-11	-10	-2	0	1
1987	134	36	81	19	38	-52	19	5	12	-2	-10	-11	-3	0	1
1988	145	37	81	18	37	-50	25	7	13	-2	-11	-9	-3	0	1
1989	148	34	84	21	41	-51	25	5	12	-2	-11	-9	-3	0	2
1990	164	29	100	13	52	-57	28	6	15	-2	-11	-9	-2	0	1
1991	166	31	108	13	53	-60	18	8	18	-1	-9	-11	-3	0	2
1992	163	25	100	15	49	-54	26	9	16	-1	-8	-12	-3	0	1
1993	168	30	106	12	58	-62	19	10	17	-1	-8	-13	-2	0	4
1994	158	25	101	14	54	-58	29	8	11	-4	-9	-12	-2	0	1
1995	158	25	99	13	57	-59	28	9	12	-4	-9	-12	-3	0	2
1996	159	26	101	13	55	-58	26	9	14	-4	-8	-12	-3	0	2
1997	162	24	103	13	55	-57	30	8	13	-6	-8	-12	-3	0	2
1998	171	27	105	14	57	-59	34	9	14	-7	-9	-12	-3	0	2
1999	164	29	105	12	59	-61	27	8	13	-6	-9	-12	-3	0	2
2000	172	31	113	14	58	-65	26	8	14	-6	-9	-10	-3	-1	3
2001	165	31	111	15	59	-66	25	7	10	-6	-9	-10	-3	-1	1
2002	162	24	109	13	60	-62	28	6	10	-6	-9	-9	-3	-2	2
2003	161	27	107	13	62	-65	25	7	10	-5	-9	-9	-3	-2	3
2004	162	28	107	12	61	-66	28	7	11	-6	-8	-9	-3	-2	2
2005	165	25	115	12	64	-68	23	8	10	-5	-8	-8	-3	-3	2
2006	168	23	117	12	64	-67	26	7	12	-6	-8	-8	-3	-3	2
2007	174	24	119	13	65	-70	29	6	13	-5	-8	-7	-3	-3	2
2008	171	24	120	12	65	-69	24	7	12	-5	-7	-7	-3	-3	1

Source: Authors' calculations using Family Expenditure Survey and Family Resources Survey, various years, as described in Appendix D.



TABLE C2  
Income inequality (variance of logs) decomposed through multivariate regression-based decomposition, annual values

Year	Log variation ( $\times 1,000$ )	Region	Household type	Education (male)	Education (female)	Male employment status	Female employment status	Age (male)	Age (female)	Residual
1968	165	4	20	0	0	13	16	8	6	98
1969	176	4	21	0	0	15	15	5	6	109
1970	182	4	23	0	0	12	15	8	7	113
1971	190	4	23	0	0	18	18	10	9	108
1972	206	5	20	0	0	26	20	10	6	118
1973	179	3	24	0	0	14	16	10	7	104
1974	172	2	24	0	0	14	19	8	6	100
1975	163	2	25	0	0	15	21	6	4	90
1976	162	1	25	0	0	16	21	6	2	90
1977	156	2	21	0	0	17	18	5	4	89
1978	158	2	23	4	5	18	20	4	4	79
1979	175	2	23	5	5	20	18	8	6	89
1980	183	3	23	6	5	20	22	9	5	90
1981	187	2	22	7	8	23	21	6	4	93
1982	181	2	16	6	6	24	20	8	3	96
1983	188	5	17	7	7	24	18	6	3	102
1984	190	5	19	9	8	24	16	7	3	100
1985	207	6	19	12	7	29	20	6	4	104
1986	225	4	22	8	9	27	25	12	-1	117
1987	247	7	22	14	11	30	25	11	3	124
1988	278	7	23	17	11	37	28	8	6	142
1989	286	7	28	13	10	35	27	11	4	151
1990	315	8	30	17	14	33	27	13	7	166
1991	315	7	31	16	14	46	20	4	9	167
1992	312	6	23	15	14	41	27	11	5	170
1993	312	5	28	18	17	43	24	6	5	167
1994	291	4	21	14	16	30	27	9	5	165
1995	292	4	19	16	15	30	26	7	4	171

(continued)

TABLE C2  
(Continued)

Year	Log variation ( $\times 1,000$ )	Region	Household type	Education (male)	Education (female)	Male employment status	Female employment status	Age (male)	Age (female)	Residual
1996	287	4	21	13	16	30	29	11	4	161
1997	297	4	20	15	13	27	26	9	6	176
1998	305	5	21	17	17	29	27	10	3	174
1999	304	4	18	17	15	28	26	14	4	178
2000	323	5	18	16	13	27	29	10	3	201
2001	303	5	19	15	15	28	24	10	4	182
2002	301	4	16	17	17	27	26	11	4	180
2003	306	5	13	15	14	27	28	9	5	191
2004	303	3	15	14	14	25	25	9	4	194
2005	314	4	14	16	14	27	27	10	3	199
2006	326	4	17	13	14	28	29	9	3	210
2007	337	4	15	15	15	28	30	6	2	221
2008	343	4	12	15	15	28	30	9	3	227

Source: Authors' calculations using Family Expenditure Survey and Family Resources Survey, various years, as described in Appendix D.

TABLE D1  
Shares of income inequality by income source, 95% confidence interval

Year	Gross employment			Self-employment	Benefits received by					
	Male	Female	Tax		Pensions	Deductions	Pensioners	Households with children	Tax credits	Other income
Share of income inequality (%)	1978 (100, 87)	1991 (53, 42)	2008–09 (82, 87)	(53, 57)	(–48, –46)	(6, 8)	(3, 4)	(–3, –2)	(–1, 0)	(–3, –3)
					(9, 13)	(4, 6)	(9, 12)	(–6, –5)	(–7, –6)	(–2, –1)
					(13, 15)	(4, 5)	(6, 8)	(–5, –4)	(–4, –4)	(–2, –1)
										(0, 1)
										(–1, 0)
										(0, 2)
										(0, 1)

*Note:* Confidence intervals are calculated by creating 1,199 pseudo-samples of the entire time-series of data, and carrying out the decomposition on each of these pseudo-samples. See also notes for Table 1.

*Source:* Authors' calculations using Family Expenditure Survey and Family Resources Survey, various years, as described in Appendix D.

TABLE D2  
*Changes in inequality (I<sub>2</sub>) decomposed by income source, 95% confidence intervals*

Change in absolute contribution to income inequality (I2 x 1000)	Year	Gross Employment			Self-employment	Pensions	Investments	Deductions	Benefits received by				
		Total Income	Tax						Households with children	Other income			
			Male	Female									
	1978 to 1991	(82,94)	(52,67)	(18,27)	(-27,-20)	(9,16)	(4,8)	(13,18)	(1,1)	(-1,1)	(-5,-3)	(-3,-2)	(1,3)
	1991 to 2008-09	(-3,11)	(-5,13)	(8,18)	(-12,-5)	(2,10)	(-4,0)	(-9,-4)	(-5,-4)	(1,2)	(3,5)	(-1,0)	(-2,1)

*Note:* Confidence intervals are calculated by creating 1,199 pseudo-samples of the entire time-series of data, and carrying out the decomposition on each of these pseudo-samples. See also note for Table 2.

*Source:* Authors' calculations using Family Expenditure Survey and Family Resources Survey, various years, as described in Appendix D.

TABLE D3

*Shares of characteristics in income inequality (%), 95% confidence intervals*

Year	Region	Household type	Age		Education		Employment status	
			Male	Female	Male	Female	Male	Female
1978	(49, 51)	(1, 1)	(14, 15)	(2, 3)	(2, 3)	(2, 3)	(3, 3)	(10, 12)
1991	(52, 54)	(2, 3)	(9, 11)	(0, 2)	(2, 4)	(4, 6)	(4, 5)	(14, 16)
2008–09	(66, 67)	(1, 1)	(3, 4)	(2, 3)	(1, 1)	(4, 5)	(4, 5)	(8, 9)

*Note:* Confidence intervals are calculated by creating 1,199 pseudo-samples of the entire time-series of data, and carrying out the decomposition on each of these pseudo-samples. See also note for Table 3.

*Source:* Authors' calculations using Family Expenditure Survey and Family Resources Survey, various years, as described in Appendix D.

2007–08), and it is adjusted at the top, with the HBAI series giving most of the richest 1% an imputed value of income derived from administrative data on incomes and tax payments.

We use the underlying FES/FRS micro data sets to provide us with data on individual earnings. We have a measures of the tax paid on employment income, but only at the household level. We also use data from the FRS to estimate the amount of benefit income that is received in the form of tax credits from 2000–01 onwards, which we treat (differently from the official HBAI series) as an income source in its own right. Benefit income is then treated separately according to the type of household that receives the income; in particular, we identify households which are headed by a pensioner, and households which include children. As different benefits are targeted at different types of household, this allows us to approximate which kind of benefits are driving our results. For example, though we cannot distinguish directly between income received from public pensions and other benefits, we can infer that pensions are likely to be responsible for any change observed among benefits received by pensioners. We also use data on self-employment and investment income. For both, we might be concerned with the quality of the data given the known difficulties in collecting accurate income from the self-employed and from those with a large number of sources of investment income. To the extent that any inaccuracies simply adds noise to the data, this will be picked up in the confidence intervals generated by bootstrapping. Systematic bias may also be a problem, but this would only be a major concern if we believed that such bias was likely to have changed significantly over the period analysed.

We also tried including two additional variables for those individuals in work – their occupation and the industry in which they worked. However, we do not have consistent series of either variable: the Family Expenditure Survey changed its occupation categories in 1987, the Family Resources Survey changed its occupation categories in 2001–02, and there are no data on industrial sectors in the Family Expenditure Survey after 1986 (the ONS published a mapping from the pre-2001 to the post-2001 occupation categories in the FRS, but we find that it gives highly inconsistent results and so we do not use it in our analysis).

TABLE D4  
*Changes in income inequality (variance of logs  $\times 1,000$ ) decomposed into characteristic price and quantity effects, 95% confidence intervals*

Years	Total	Residual	Region	Household type						Age						Education						Employment status																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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*Note:* Confidence intervals are calculated by creating 1,199 pseudo-samples of the entire time-series of data, and carrying out the decomposition on each of these pseudo-samples. See also note for Table 4.  
*Source:* Authors' calculations using Family Expenditure Survey and Family Resources Survey, various years.

## Appendix B: Definition of population subgroups

This appendix details the subgroups into which the total population is divided for each characteristic. *Age*: Below 25; 25–34; 35–44; 45–54; 55–64; 65–74; over 75. *Education*: Aged 16 or earlier; Aged 17–19; Aged 20 or older; Unknown/still in education. *Employment status*: Full-time employed; Part-time employed; Self-employed; Unemployed; Inactive and above the state pension age; Inactive and below the state pension age. *Household type*: 1 adult, no children; 2 adults, no children; 3+ adults, no children; 1 adult, 1+ children, youngest under 5; 2 adults, 1+ children, youngest under 5; 3 adults, 1+ children, youngest under 5; 1 adult, 1+ children, youngest over 5; 2 adults, 1+ children, youngest over 5; 3 adults, 1+ children, youngest over 5; 1 adult, household head aged 65+; 2+ adults, household head aged 65+. *Region*: North; Yorks and Humberside; North West; East Midlands; West Midlands; East Anglia; London; South East; South West; Wales; Scotland.

## Appendix C: Annual decompositions

This appendix gives the annual values of the income source and characteristic decomposition, rather than just the years of the inequality turning-points presented in the main paper. C1–C2

## Appendix D: Inference and bootstrapping

Both the LCFS and FRS are stratified, clustered random samples of households (for details, see Bowditch and Rusgys, 2010, for the FRS, and Hossack and Jarvis, 2012, for the LCFS), and both surveys provide household-level, post-stratification weights (known as ‘grossing weights’ in DWP, 2014a). However, as we do not have access to the variables that denote the clusters and the strata in a consistent format over all years, we have ignored these features when constructing bootstrap confidence intervals (Kolenikov, 2010, reviews approaches to undertake inference properly when such information is available; see also Clarke and Roy, 2012). Instead, we constructed a bootstrap sample for each year of data by sampling with replacement households from the unweighted set of households and using the supplied weights, drawing the same number of unweighted households as the raw sample. This is the approach recommended by the government statisticians responsible for the FRS (see DWP, 2014b); they note that the generated confidence intervals are likely to be too small, as they do not reflect the complex survey design (the number of clusters used in the FRS is large, and so, the design factor is likely to be close to 1). However, this bootstrap procedure does not incorporate the variance-reducing aspect of the post-stratification weights (see Berger and Skinner, 2003, for an example of an approach which takes explicit account of these sorts of weights), and this would lead the generated confidence intervals to be too large. We draw 1,119 bootstrap samples, and report 95% bias-corrected percentile confidence intervals; non-bias-corrected percentile CIs, and simple bootstrap CIs, gave extremely similar results and are available on request.

The following tables give the 95% confidence intervals that result from the bootstrapping process. D1–D4

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