

# MEASURING POVERTY WHEN INFLATION VARIES ACROSS HOUSEHOLDS

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**This report** considers alternative measures of poverty that allow for the fact that low-income households may experience a rate of inflation higher or lower than the average in any given year.

Official measures of changes in poverty implicitly assume that price changes affect all households equally. If this assumption fails then conventional analyses may over- or understate changes in living standards at different parts of the income distribution. This report considers the extent to which official statistics may have under- or overstated changes in poverty and income inequality since the early 2000s.

The report includes:

- analysis of inflation rates for low- and high-income households over time;
- discussion of measures of both absolute and relative poverty that account for the fact that inflation may vary across households;
- discussion of the feasibility and implications of tailoring increases in benefits to the inflation experiences of low-income groups.

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# TABLE OF ABBREVIATIONS

AHC	After housing costs
BHC	Before housing costs
CPI	Consumer Prices Index
HBAI	Households Below Average Income
IFS	Institute for Fiscal Studies
IQR	interquartile range
LCFS	Living Costs and Food Survey
MIPs	Mortgage interest payments
MIS	Minimum Income Standard
OBR	Office for Budget Responsibility
ONS	Office for National Statistics
RPI	Retail Prices Index
WFP	Winter Fuel Payment
WHD	Warm home discount

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# EXECUTIVE SUMMARY

Official measures of changes in poverty implicitly assume that price changes affect all households equally. If this assumption fails, and inflation rates differ across the income distribution, then conventional analyses may over- or understate changes in living standards at different parts of the income distribution. In this instance, official measures will give an inaccurate impression of trends in the prevalence of poverty. This is true for both ‘absolute’ poverty measures (which aim to estimate the number of individuals falling beneath a given standard of living) and for ‘relative’ poverty measures (such as those counting how many people live in households with less than 60% of the median income in any given year). This report analyses how price changes have affected low-income and high-income households, and so considers the extent to which official statistics may have under- or overstated changes in poverty and income inequality since the early 2000s.

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## Differences in inflation rates

Low-income and high-income households have experienced significantly different inflation rates since the start of the recession. In recent years, the prices of goods that are relatively more important to the budgets of households in poverty (e.g. food and energy) have increased at a faster rate than the average rate of inflation in the economy. Meanwhile the prices of

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goods which are relatively more important to higher-income households (e.g. motoring, mortgage interest payments and leisure services) have tended to rise less quickly than average. These price trends have caused low-income households to experience higher inflation rates than richer households; for example, over the period 2002–3 to 2013–14, an inflation rate based on the Retail Prices Index (RPI) for those in the bottom income quintile averaged 3.4% compared to 3.0% for the richest quintile (and the average official inflation rate of 3.1%). These differences may seem small, but over time they can compound to produce quite different inflation experiences. Over the whole period, prices for the bottom quintile increased by 50% compared to 43% for the top quintile. The disparity in inflation rates across the income distribution was especially large over the recession; since 2008–9, the average annual inflation rate for the bottom quintile has exceeded that of the richest by just over 1 percentage point.

## Impact on poverty measurement

Official measures understated the rise in absolute poverty since the beginning of the period and understated the increase in relative poverty that occurred with the onset of the recession because they ignored systematic differences in inflation rates across the income distribution.

Once inflation rates are allowed to vary with income, the report finds that absolute poverty was 0.5 percentage points higher in 2013–14 than standard methods would suggest. One cannot talk about levels of ‘real’ relative poverty in the same way (since the level of real poverty in this case will depend on which base year real and standard rates are set to be equal), however one can say whether real poverty increased or decreased faster or slower than standard relative poverty measures. The report finds that real relative poverty increased by more than standard measures between 2007–8 and 2008–9.

There is also evidence of a rise in real income inequality at the onset of the financial crisis that is not reflected by standard measures. The 90–10 ratio measures how many times larger the equivalised income of the 90th percentile of the income distribution is compared to the 10th percentile. According to measures that assume a common inflation rate, the 90–10 ratio fell more or less consistently between 2006–7 and 2011–12. However, once inflation is allowed to vary across the income distribution, there is evidence of a rise in real income inequality with the onset of the recession. These trends imply that, although income growth was relatively protected at the bottom of the income distribution over the recession, these households were hit harder by changes in the cost of living than households at the top and middle of the income distribution.

However, these tendencies are specific to this time period. In the years before the recession there was, if anything, a tendency for households living in poverty to face slightly lower inflation than average and, therefore, for changes in poverty rates to have been marginally more favourable than suggested by official statistics.

## Policy implications

Several policy responses have already been proposed to reduce the impact of high inflation on low-income households. One approach is to introduce price caps or subsidies for certain goods. Although there may be reasons

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to introduce price controls or to subsidise particular goods when markets are functioning poorly, using price controls to redistribute income is often less efficient than using direct income transfers. This is because reforms to price policies in efficient markets can in theory provide enough revenue to compensate losers with a surplus left over for other uses. For example, it has been estimated that removing the zero and reduced rates of VAT on food, children's clothes and energy would give the government enough revenue to increase benefits and tax credits such that the poorest third of households were better off and still have £11bn left over (Crawford *et al.*, 2009).

Another policy response would be to use group-specific inflation rates to uprate state benefits and tax credits, as a means of reducing the inflation risk faced by low-income households. This report finds that uprating pensioner benefits using the average inflation rate experienced by pensioners, and uprating working-age benefits and tax credits by the average inflation rate experienced by benefit-dependent households, would have raised the welfare bill by 1.3% in 2013 relative to the case where all benefits were uprated by the Consumer Prices Index (CPI; or 0.7% with the RPI). This is the inevitable consequence of the poor experiencing higher inflation rates in recent years. However, it is likely that such a policy would be revenue neutral in the longer term as this analysis, and that of Crawford and Smith (2002) and Leicester, O'Dea and Oldfield (2008), suggests that there is no systematic tendency for low-income households to experience higher inflation than average for extended periods of time. Of course this revenue neutrality would come about because, while benefits would increase by more than headline inflation in some years, in other years they would increase by less. The political economy of increasing benefits by less than economy-wide inflation some of the time might complicate the operation of this kind of uprating policy.

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# 1 INTRODUCTION

The recent recession has had a large impact on the living standards of UK households. Almost a decade of real income growth has been wiped out for the average family since 2007–8; median incomes deflated using the Consumer Prices Index (CPI) are projected to be lower in 2013–14 than they were in 2004–5 (Adams *et al.*, 2014). However, over this same period, measures of inequality and relative poverty have fallen. For instance, in 2011–12 relative poverty fell to its lowest level since 1986 and the Gini coefficient measure of inequality was lower than it was in 2007–8 (Cribb *et al.*, 2013). This has occurred because, by official measures, the living standards of high-income households have fallen by more than those of lower-income households.

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However, official measures of both poverty and inequality effectively assume that all households experience a *common* inflation rate. This assumption is unlikely to hold in practice. Households spend their budgets in different ways and so are differentially affected by a given price increase. For example, lower-income households typically spend a larger proportion of their budget on necessities, such as food and energy. They have, therefore, been hit harder by recent increases in food and energy prices.

Other things being equal, one would expect to observe a *rise* in real income inequality, and potentially in poverty, when the prices of necessities rise at a faster rate than average inflation, because this typically implies that the living costs of lower-income households will have increased by more than those of richer households. However, this effect is not observed in official measures of poverty and inequality as they do not capture the impact of differential inflation rates on the evolution of the distribution of living standards.

This report examines trends in poverty and inequality using methods that allow for the inflation rates that households experience to vary across the income distribution. This makes it possible to analyse the extent to which official measures have over- or understated the changes in poverty over time. This report finds that trends in real poverty measures can differ substantially from those calculated using standard techniques, suggesting that it is important to take differential inflation into account. In the years

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following the recession, it is found that standard methods understated the rise in absolute poverty. Standard measures also underestimated the increase in relative poverty that occurred at the onset of the recession. However, in other years, the opposite trend is evident: sometimes low-income households experience lower price inflation than average.

This report not only documents the trends in poverty and inequality that have occurred over the last few years but also discusses policy responses. It is argued that income transfers are often preferable to price policies as a means of redistributing towards low-income households (though there may be other justifications for price policies). The report then turns to consider how governments might better protect low-income households from inflation risk by using group-specific inflation rates to make cost of living adjustments to state benefits. This section includes an assessment of the possible risks that such a policy might have for the public finances.

The structure of this report is as follows. Section 2 discusses how poverty is measured and how different poverty measures might be biased if they fail to account for differential inflation. Section 3 documents how and why inflation rates have differed between low- and high-income households since the early 2000s. In sections 4 and 5, trends in relative and absolute poverty rates and income inequality measures that reflect the fact that there have been differences in inflation rates across the income distribution are considered. Section 6 goes on to discuss policy implications of the report's findings and includes an assessment of the cost to the public finances of uprating benefits by the inflation rate experienced by benefit-dependent households. Section 7 concludes.

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## 2 LIVING COSTS AND POVERTY MEASUREMENT

Poverty can be measured in a variety of ways, reflecting different conceptions about what it means for someone to be poor. This section outlines the poverty measures that are commonly used by the UK government and discusses how these measures can be biased if inflation rates differ systematically across the income distribution.

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### Approaches to measuring poverty

Many official measures of poverty are *relative*. That is, whether an individual is considered in poverty or not depends upon their living standards relative to the living standards of other households in the economy. For instance, in the European Union, an individual is classed as being in poverty if they cannot achieve a 'standard of living considered acceptable in the society in which they live' (Eurostat, 2010). This standard can change as societies become richer or if inequality in a given society increases. In official European statistics, the poverty rate is calculated by taking the proportion of people who have an equivalised income (income adjusted for household size) below 60% of the median in their respective country.<sup>1</sup> This is a relative measure because the poverty line moves with median income each year and so it is not tied to a particular measure of resources required to attain some fixed standard of living.

Other common measures of poverty are *absolute*. These are defined by income thresholds that do not depend on one's situation relative to others but rather aim to capture the proportion of households that fall below some basic living standard. The United States currently makes use of an absolute poverty measure: the US poverty threshold was originally defined as three times the cost of purchasing a minimum food diet in 1963. This threshold is now updated annually in line with the national CPI.<sup>2</sup>

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An alternative approach to measuring absolute poverty is to count the number of households that cannot afford to purchase the bundle of goods that are needed to live a healthy and active life. These measures are absolute so long as they are defined 'objectively'; that is, the bundle of goods is defined as that needed to achieve some unchanging minimal standard of nutrition, shelter, social participation and so on. However, budget standards can also be defined subjectively and correspond to the budget associated with social expectations of what it means to be 'poor' or deprived. Measures of poverty based on subjective budget standards are absolute in the sense that they do not directly depend on one's income relative to others in the population, but relative in the sense that the material living standards of those in poverty can fluctuate in line with social expectations of what it means to be in poverty. An example of a subjective budget standard in the UK is the Minimum Income Standard (MIS) published by the Joseph Rowntree Foundation. The MIS income threshold is calculated by working out the cost of a basket of goods selected through consultation with members of the public and relevant experts. The contents of the basket is updated every two years to incorporate changing social expectations on what the budget associated with a minimally acceptable living standard should include (Bradshaw *et al.*, 2008).

In the UK, the government makes use of both relative and absolute measures of poverty. For example, the official poverty targets set out in the 2010 Child Poverty Act are defined according to: the relative poverty measure adopted by the European Union; an absolute measure defined as having an equivalised income below 60% of the median income in 2010–11, which is updated annually according to national inflation; and a measure of material deprivation. Since the recession, relative and absolute poverty measures have given rather different impressions of poverty trends. Relative income poverty fell over the recession from 17.8% in 2008–9 to 15.8% in 2011–12, reaching its lowest level since 1986 (Cribb *et al.*, 2013). However, poverty rose over the recession according to the absolute measure, from 16.8% in 2008–9 to 17.3% in 2011–12.<sup>3</sup> The risk of living in a household with an income insufficient to attain the MIS has also risen since the recession. Between 2008–9 and 2011–12 the number of individuals living in 'MIS households' and falling short of the threshold increased by almost 4% and the depth of shortfalls beneath the MIS increased (Hirsch, 2013).<sup>4</sup>

## Poverty and inflation

Official poverty measures can give a biased impression of changes in the prevalence of poverty because they calculate real incomes assuming that all households face a common inflation rate. The bias is relative to 'true' poverty measures defined in a way that allows for differences in households' inflation experiences. It is important to take inflation into account when measuring poverty because the cost of purchasing particular goods and services changes over time, meaning that a given cash income can correspond to a very different material living standard from year to year. Adjusting changes in the monetary value of income for changes in the cost of living is technically referred to as 'deflating' nominal income (money income) into real income (a quantity that reflects the resources under a household's command).

In the UK, official statistics cover two different measures of poverty: one 'after housing costs' (AHC), which is calculated once housing costs have been deducted from incomes, and one 'before housing costs' (BHC), which does not subtract these expenditures. Only absolute poverty lines need to

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be deflated explicitly for official statistics. For the AHC measure of absolute poverty, it is assumed that the relevant change in living costs from year to year can be approximated by a variant of the RPI known as the Rossi Index, which excludes rent, mortgage interest and Council Tax expenditures. The BHC measure uses an inflation rate calculated using a derivative of the RPI that excludes Council Tax expenditures (that this report will refer to as the 'HBAI deflator').<sup>5</sup> The income threshold associated with the official measure of absolute poverty is increased annually by the HBAI deflator or Rossi Index. However, measures such as the HBAI deflator are average measures of inflation and so are unlikely to be representative of the change in living costs that is actually experienced by any given household. The official measure of relative poverty is calculated off nominal incomes, which also implicitly assumes that all households experience a common inflation rate (which would mean that the real and nominal distributions have the same shape).

Studies of different time periods, and of different countries, have found that differences in household inflation rates can have a significant impact on one's impression of the trends in measured poverty and inequality rates. In the UK over the period 1976 to 2000, Crawford and Smith (2002) found that the annual growth rate in inequality was overstated or understated by as much as 6 percentage points when differences in household inflation rates were not taken into account. Muellbauer (1974) found that differential inflation rates could have been sufficient to undo the slight reduction in nominal income inequality that was achieved by the 1964–70 Labour Government. Using a similar method to that used in section 5, Günther and Grimm (2007), considering Burkina Faso during the period 1994 to 2003, found that growth rates were significantly less beneficial to low-income households once their higher cost of living was taken into account.

However, any biases in official poverty measures over the period 2002–3 to 2013–14 could be small if recent differences between household inflation rates were not that great (so that the HBAI deflator has been close to the inflation experience of the great majority of households) or if the inflation rates that different households experienced did not vary in a systematic way across the income distribution. Yet, there is evidence that these conditions have not held in the UK since the recession. Price dynamics over the recession appear to have been, on average, relatively beneficial to high-income households and relatively harmful to low-income households (Adams *et al.*, 2014). The extent to which the inflationary experiences of low- and high-income households have varied in the UK is discussed in more detail in the next section.

It is worth noting that income thresholds set according to the cost of a basket of goods, whether objective, or subjective such as the MIS, do not directly depend on households' inflation experiences and thus are not biased by variation in household inflation rates. Rather, these income thresholds increase or decrease depending on what happens to the costs of the goods included in the basket. For these measures, it is not directly relevant if a household faces a lower or higher cost of living than the increase in the cost of the basket of goods determining the poverty threshold. What is important is whether a household has the necessary nominal income required to purchase the basket of goods. For this reason differences in the inflation experiences of high- and low-income households will not lead to biases in such indices.

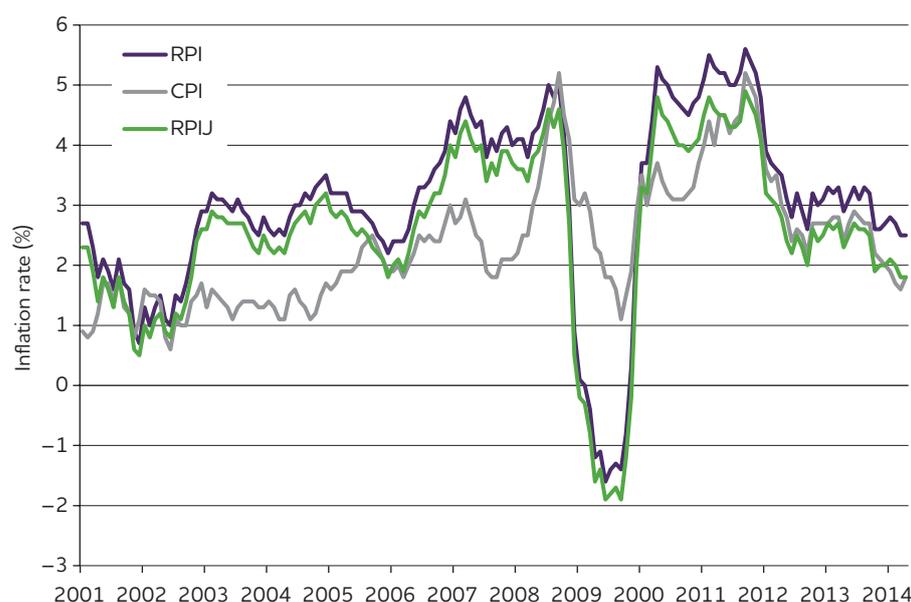
## Different deflators

So far this report has discussed the implications of using a common deflators rather than the distribution of inflation rates to calculate poverty rates. However, the choice of which deflator to use can be of equal importance. In the UK, there are several measures of consumer price inflation to choose from. As mentioned above, official AHC and BHC measures make use of two derivatives of the RPI – the Rossi Index, and the RPI less Council Tax. However, these are not the only possibilities open to the government. As well as using the RPI itself, there is also: a further derivative of the RPI which excludes mortgage interest payments (RPIX); the CPI; a version of the CPI which includes a measure of owner-occupied housing costs (CPIH); and a version of the RPI which makes use of a different mathematical formulae to the standard RPI (the RPIJ). The RPIJ was introduced owing to concerns about the methods used to calculate price changes in the RPI (which are thought to lead to an upward bias in the index). Importantly, the different indices can often give quite different impressions of what is happening to consumer price inflation from year to year. Figure 1 shows these indices from 2001 to the present.

It is clear that there are substantial differences. The RPIJ and CPI both tend to be lower than the RPI: over the whole period the average RPI inflation rate was 3% compared to 2.4% for the CPI and 2.6% for the RPIJ. However, there are times when the RPI is lower than the CPI – most notably in 2009 when the RPI fell to -1.6% (and the RPIJ fell to -1.9%) compared to a low of 1.1% for the CPI. This difference owes much to the fact that both the RPI and RPIJ include mortgage interest payments while the CPI does not, as these costs fell steeply in that year.

Unsurprisingly, the choice of index can have a large effect on assessments of changes in living standards. For example, median real income adjusted using the RPI was 4% lower in 2011–12 than it was in 2005–6. However, when incomes are adjusted using the RPIJ, median real incomes fell by 1.1% from 2005–6 to 2011–12 (see Cribb *et al.*, 2013 for a further discussion). Yet, inequality and relative poverty measures are typically invariant to the

**Figure 1: RPI, CPI and RPIJ, 2001–14**



Source: ONS

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choice of price index so long as all incomes are deflated by the *same* index. This is because these measures are concerned with relative differences in household incomes, which are not affected by differences in scaling.

Yet, as this report considers the impact of household-specific inflation rates on the measurement of poverty, the results presented *will* be sensitive to the choice of index because of differences in the coverage of goods and in the way the indices are constructed. This report makes use of the HBAI variant of the RPI to ensure that the figures presented can be compared to official statistics. However, the use of the RPI as an income deflator is contested. The RPI is thought to overstate the true rise in living costs experienced by households due to a technical point relating to the mathematical formula underlying the index's calculation. Other things being equal, this would cause the RPI to *understate* the true growth in living standards. Indeed, inflation given by the RPIJ, which uses an alternative formula that is not subject to the same problems, was on average 0.4 percentage points lower from 1999 to 2014 (a figure which grew to 0.65 following changes to price sample used in the RPI in 2010).<sup>6</sup> As a result of such concerns, the RPI lost its National Statistics status in March 2013. Ideally, this report would include additional analysis on the impact of allowing for differences in household experiences of the RPIJ and the CPIH on changes in poverty and inequality rates. However, this is not possible. Price indices for the subcomponents underlying the RPIJ are not published, which precludes its use in the analysis carried out in the rest of the report. Furthermore, the CPIH is not available before 2005.

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## 3 INFLATION AND SPENDING PATTERNS

If inflation rates vary systematically across the income distribution, then official statistics can give an inaccurate impression of changes in the prevalence of poverty. This section considers how, and why, inflation has varied across the income distribution in recent years.

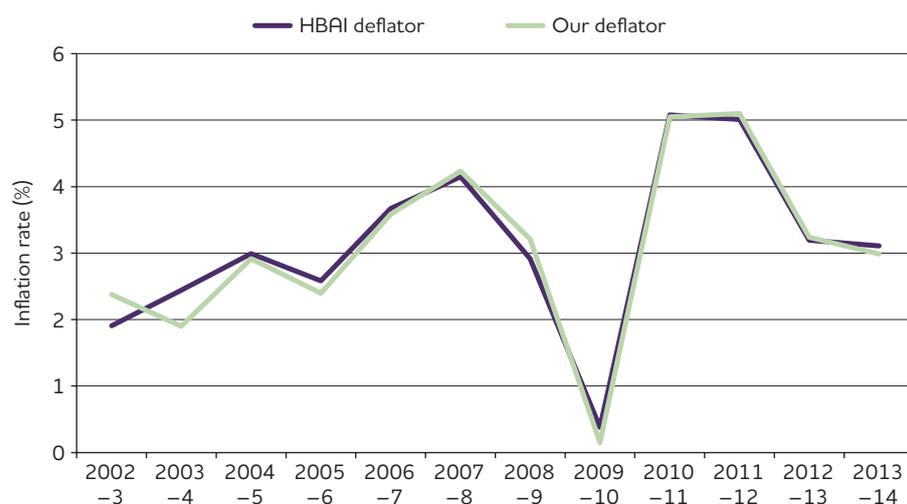
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### Headline vs. household inflation

As mentioned in section 2, household incomes are adjusted using a headline measure of inflation, the HBAI deflator (the RPI excluding Council Tax expenditures), to construct official absolute poverty statistics. Headline inflation measures combine information on the price changes of a wide range of goods and services to produce a single impression of what is happening to the general price level over time. To do this, national statistical agencies (such as the Office for National Statistics, ONS, in the UK) first decide on a representative bundle or 'shopping basket' of goods and services that consumers regularly buy, calculate the inflation rate for each good in the basket and then take a weighted average of these good-specific inflation rates to produce an estimate of the overall increase in consumer prices. The weights in the averaging process are chosen to reflect the share of total consumer spending devoted to each item in the economy, which can be thought of as the spending patterns of an 'average' consumer, in some base period. The base period used in the RPI (and so in the HBAI deflator) is the period from June two years previously to July in the previous year.<sup>7</sup>

Figure 2 gives the official deflator from 2002–3 to 2013–14.<sup>8</sup> According to the HBAI deflator, inflation rose between 2002–3 and 2007–8 before declining sharply over the recession, in large part due to the falls in mortgage interest costs that occurred when the Bank of England reduced interest rates in response to the recession. However, in the aftermath of the recession the deflator rose to a decade high of over 5%.

**Figure 2: Comparison between the official HBAI deflator and that calculated from the LCFS**



Source: Authors' calculations from ONS' Living Costs and Food Survey and price data from the ONS

As the official HBAI deflator is a headline rate of inflation, it does not measure the inflation rate that is actually experienced by any given household. An increasing number of papers show that there can be a large dispersion in household inflation rates around the headline rate. Crawford and Smith (2002) found that, for the period 1976 to 2000, only about a third of households experienced inflation rates within 1 percentage point of the headline inflation rate (the RPI) on average. In some years, the average rate of inflation has been found to provide a particularly poor approximation to the inflation rate experienced by any one household. Leicester *et al.* (2008), found that 87% of household experienced inflation more than 25% from the mean in 1999. Crawford and Smith (2002) found that only 9 per cent experienced an inflation rate within 1 percentage point of the average inflation rate in 1989.

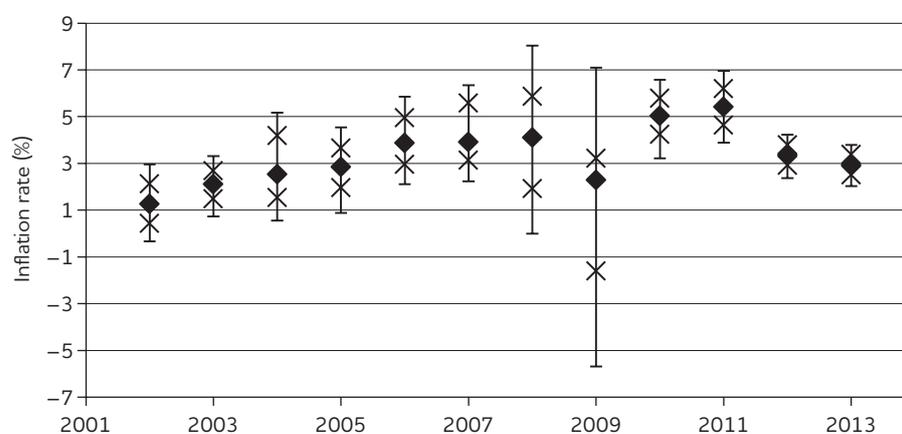
There is a particular worry that headline measures of inflation do an especially poor job at reflecting the changes in the cost of living of low-income households. Because the composition of the basket of goods used to determine inflation depends on total consumer spending on some good divided by total economy-wide spending (which is known as a 'plutocratic average'), it will be skewed to better reflect the spending patterns of richer households. This is because richer households are naturally responsible for a disproportionate share of total spending, and so their spending patterns will be given greater weight in determining the budget shares used in the overall index. This means that the trend depicted in Figure 2 may not give an accurate impression of how the cost of living has varied for the majority of households. An alternative 'democratic' average inflation rate would take an average of each individual household's budget shares, assigning an equal weight to high and low spending households.

To see more clearly the difference between plutocratic and democratic averages, imagine that there are two individuals in the economy. Person 1 spends 100% of their budget on essentials, while Person 2 spends 75% on essentials and 25% on luxuries. Person 2 also spends twice as much as Person 1. A democratic inflation rate would place 12.5% weight on luxuries, while the plutocratic inflation rate gives 16.7% weight on luxuries. The plutocratic inflation rate is, therefore, skewed to better reflect the spending patterns of the high spending party.

To analyse how inflation experiences have varied between households and across the income distribution, inflation rates for each household in the Living Costs and Food Survey (LCFS) dataset (upon which the HBAI deflator is largely based) are calculated in each year between 2002–3 and 2013–14.<sup>9</sup> To do this, an analogous approach is employed to the method used to calculate headline inflation rates but using each household's budget shares, rather than shares of total consumer spending, as weights (following Crawford and Smith, 2002). Data for the calendar year 2013 is not yet available, so in order to produce figures up to the most recent year it is assumed that households in this year had the same budget shares as households in 2012 (and that incomes increased in line with average earnings growth from the Office for Budget Responsibility). Figures for 2013–14 only use the first three quarters of 2013. (For more details on the procedure, please see Appendix A1.)

Figure 3 shows the 10th, 25th, 50th, 75th and 90th percentiles of the inflation distribution in each year between 2002–3 and 2013–14 for all households. It is clear that focusing on the average inflation rate can conceal a great deal of variation across households. Differences in inflation rates across households can be large, spanning more than 1 percentage point above and below the median in all years prior to 2010–11. The variance in inflation rates was especially large over the period of the financial crisis in 2008–9. The interquartile range (IQR), that is, the difference in the 75th and 25th percentiles of the inflation distribution, was 4.8 percentage points in 2009–10. Since the crisis however, differences across households have been smaller; between 2010–11 and 2013–14, the IQR has averaged 1.2 percentage points.

**Figure 3: Distribution of household inflation rates 2002–3 to 2013–14**



Notes: The budget shares used to calculate inflation for 2013 are the same as those for 2012. Incomes in 2013 are taken to be the distribution in 2012 increased in line with average earnings growth. The figures for 2013–14 only include the final three quarters of 2013. Inflation rates are adjusted according to the difference between a version of the HBAI deflator calculated off the LCFS and the official deflator. Figures exclude Northern Ireland.

Source: Authors' calculations from ONS' Living Costs and Food Survey and price data from the ONS.

## Inflation across the income distribution

The differences in household inflation rates are especially relevant for poverty measurement if inflation varies systematically across the income distribution. This will occur if:

- there are significant differences in the spending patterns of low- and high-income households;

- prices change differently for goods that are disproportionately consumed by low- or high-income households.

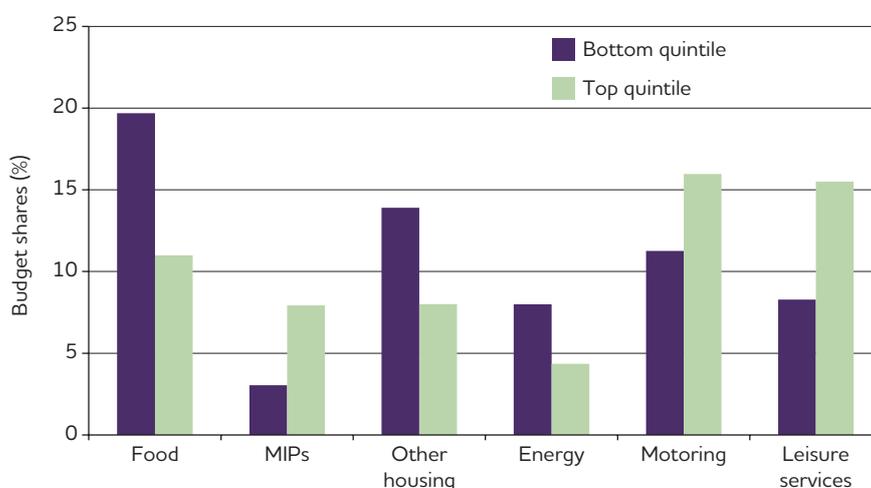
Thus, the low-income households will tend to experience a higher inflation rate than high-income households if the goods which are relatively more important in their budgets tend to see faster price increases than the goods which are relatively more important in the budgets of richer households. This subsection looks at how spending patterns vary over the income distribution and which goods have seen the fastest price increases in recent years.

### Spending patterns

Figure 4 gives the budget shares for food, mortgage interest payments (MIPs), other housing costs, energy, motoring and recreation for those in the top and bottom (quintiles) of the income distribution. The goods were selected because the differences in budget shares between the two groups were particularly large, and so they tend to play an important role in explaining differences in the inflation rates experienced by high- and low-income households. Those in the bottom quintile tend to spend a much greater share of their budgets on food (an average of 19.7% compared to just 11.0% for those in the top quintile) and energy (8% compared to 4.3%), as well as other housing costs. As one might expect they also tend to spend less on mortgage costs, motoring and leisure services. Differences in budget shares between income and other groups are discussed in more detail in Levell and Oldfield (2011).

The differences in shares devoted to mortgage interest and other housing reflect differences in rates of ownership between high- and low-income households. Figure 5 shows the differences in tenure across the income distribution and for households above and below the official poverty line. It shows that low-income households are far less likely to be homeowners with a mortgage. Just less than 50% of those in the bottom quintile rent their homes compared to just 12% in the richest quintile. By contrast around 65% of those in the top quintile own their homes with a mortgage compared to 21% in the bottom quintile.

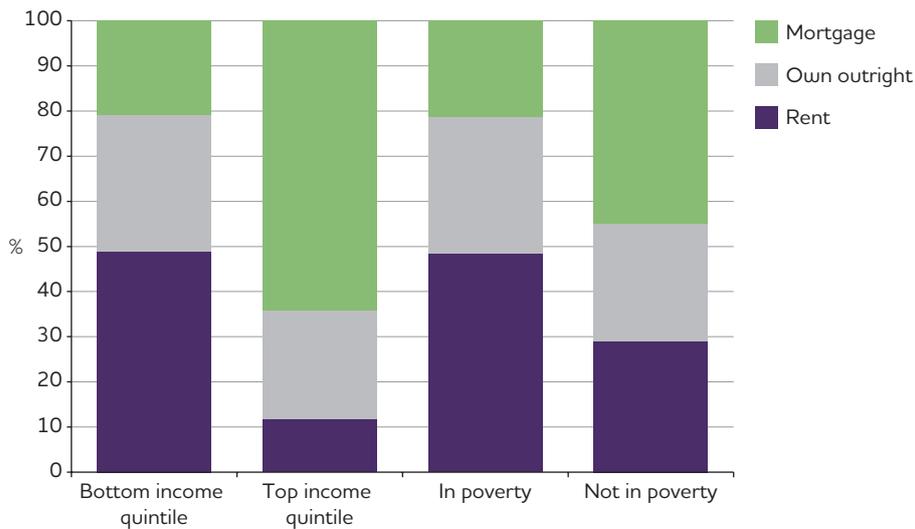
**Figure 4: Budget shares for key goods for top and bottom income quintiles, 2011–12**



Notes: MIPs are mortgage interest payments. Poverty is defined as below 60% of the 2010–11 median income (before housing costs) uprated to 2011–12 values using the RPI minus council tax. Spending excludes council tax. Incomes are equalised using the modified OECD scale. Figures exclude Northern Ireland.

Source: Authors' calculations from ONS' Living Costs and Food Survey

**Figure 5: Proportions renting, owning outright and owning mortgages for different groups, 2011–12**



Notes: Incomes are before housing costs and are equivalised using the modified OECD scale. Figures exclude Northern Ireland.

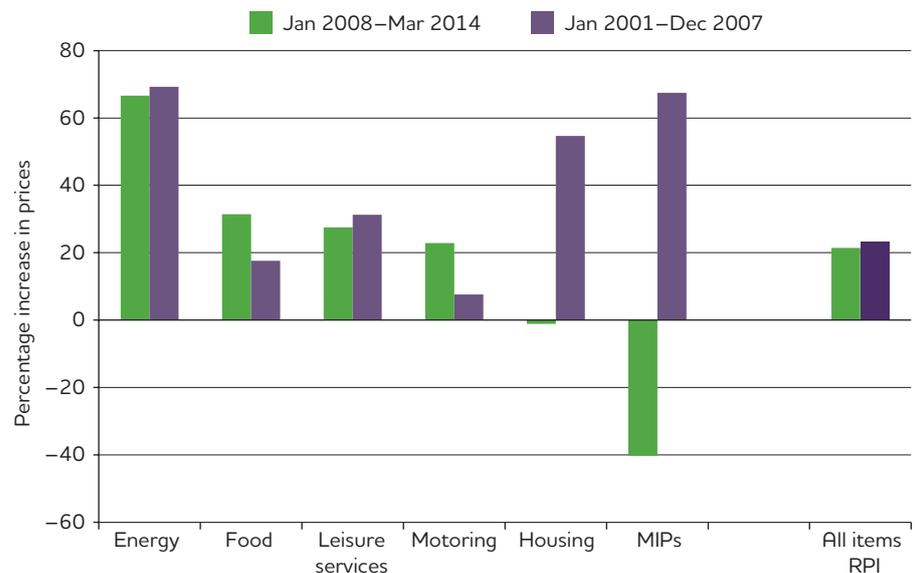
Source: Authors' calculations from ONS' Living Costs and Food Survey

### Price changes

Figure 6 shows the price increases of the goods included in Figure 4 as well as the overall RPI for the periods 2001–8 and 2008–14. There is no price index specifically published for 'Other housing' excluding MIPs so the increase in the housing index is shown instead.

It is especially noteworthy that, in the years following 2008, goods that were relatively more important in the budgets of households below the poverty line (food and energy) have tended to see their prices increase faster than the RPI, while goods that were relatively less important (motoring, MIPs and leisure services) have tended to see prices rise less quickly than the RPI. One would expect this to be reflected in differences in the inflation rates that high- and low-income households experienced over this period.

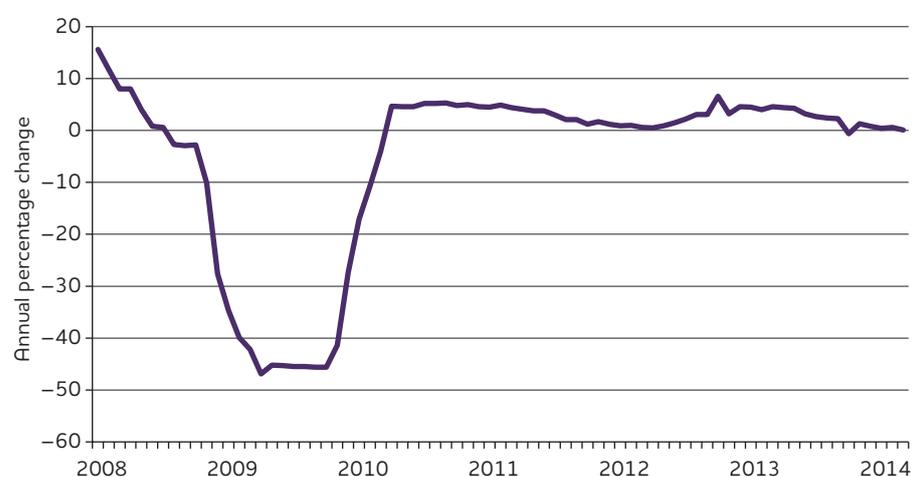
**Figure 6: Percentage increase in prices for selected goods, 2001 to 2008 and 2008 to 2014**



Source: Authors' calculations using price data from the ONS

A second point of interest is the change in MIPs costs in recent years, as past work has identified these as being key drivers for the difference in inflation rates between high- and low-income households. Figure 7 shows the inflation rate for MIPs since 2008. There is an immediately obvious dramatic fall in these costs of over 45% in 2009 that followed steep reductions in the Bank of England base rate following the onset of the financial crisis. It is important to note, however, that the size of the decline in average mortgage interest costs is likely to be somewhat overstated by the RPI in this year because interest costs were measured by the 'standard variable rate' prior to March 2010, which does not take the cost of fixed rate and tracker mortgages into account. In March 2010, the RPI switched to using an 'average effective rate' measure of mortgage costs, which covers a wider range of mortgage types and is thus likely to be less variable than the previous measure. Indeed, since 2010, the growth of mortgage interest costs has been relatively stable and has averaged 2.6% a year since 2011.

**Figure 7: Changes in mortgage interest rate costs, 2008–14**



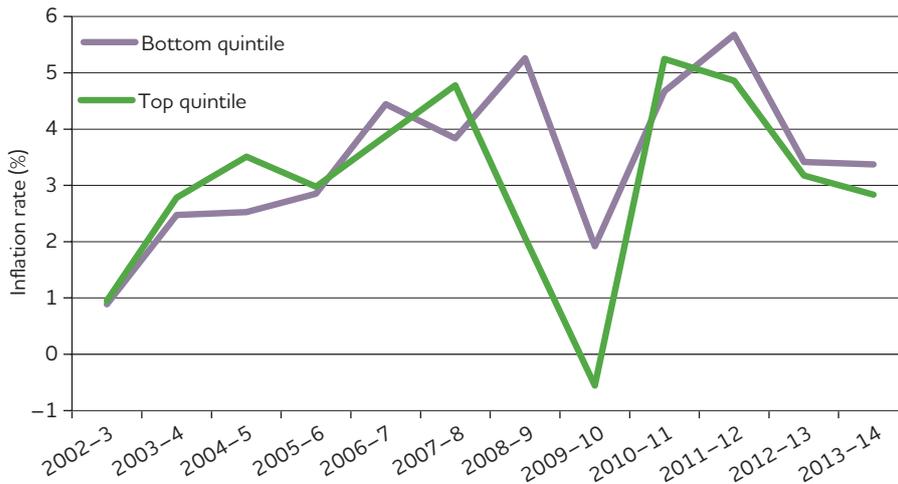
Source: Price data from the ONS

### Differences in inflation rates by income

Figure 8 shows how the differences in spending patterns that were observed for individuals in households in the top and bottom income quintiles translate into differences in the inflation rates they experienced in different years.

The gap between average inflation experienced by high- and low-income households was especially large in 2008–9 and 2009–10 reflecting the differing importance of MIPs costs in the average spending of the two groups and the steep decline in MIPs costs that occurred in these years. Average inflation rates experienced by the top quintile reached 4.78% in 2007–8 before falling to -0.56% in 2009–10. By contrast those for the bottom quintile remained high in 2008–9 (at 5.26%) and only fell to 1.92% in 2009–10. In other years the average inflation rates of high-income individuals could be higher or lower than those of lower-income individuals, with no obvious general tendency for one to be consistently higher than the other. Over the whole period 2002–3 to 2013–14, however, the inflation rates of those in the bottom quintile average 3.44% compared to 3.04% for the top quintile (the 95% confidence for the difference between these two averages is 0.35–0.45, and thus it is statistically significant). These differences meant that, in these years, prices for the bottom quintile increased by 50% compared to 43% for the top quintile.

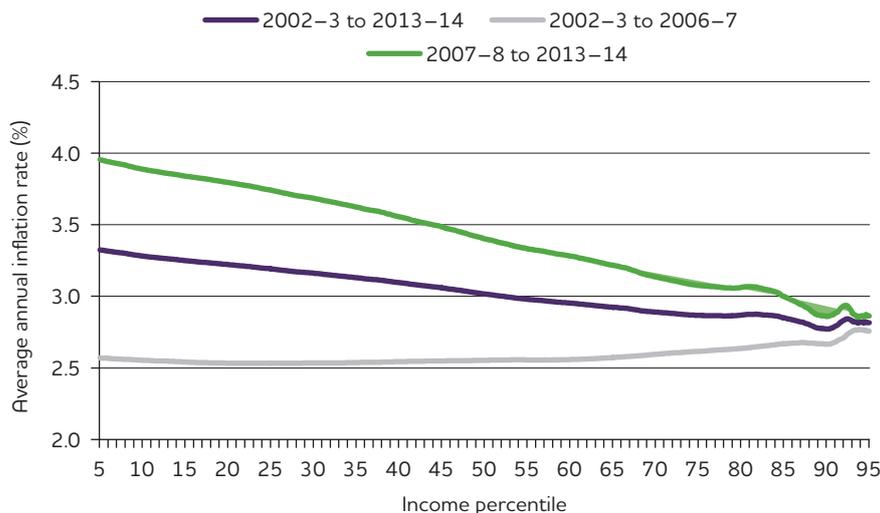
**Figure 8: Average inflation rates for top and bottom income quintiles, 2002–3 to 2013–14**



Notes: The budget shares used to calculate inflation for 2013 are the same as those for 2012. Incomes in 2013 are taken to be the distribution in 2012 increased in line with average earnings growth. The figures for 2013–14 only include the final three quarters of 2013. Inflation rates are adjusted according to the difference between aversion of the HBAI deflator calculated off the LCFS and the official deflator. Figures exclude Northern Ireland.  
Source: Authors' calculations from ONS' Living Costs and Food Survey

Figure 9 shows the (smoothed) distribution of average annual inflation rates across the entire income distribution over the period 2002–3 to 2013–14. Before the recession, there was little systematic relationship between inflation and income – households across the income distribution experienced an inflation rate of approximately 2.5% per year over the period. In fact, there was some tendency for richer households to experience slightly higher inflation. However, since the onset of the recession, average annual inflation has been closely correlated with income, with higher incomes almost always associated with lower rates of inflation.

**Figure 9: Average annual inflation rate across the income distribution, 2002–3 to 2013–14**



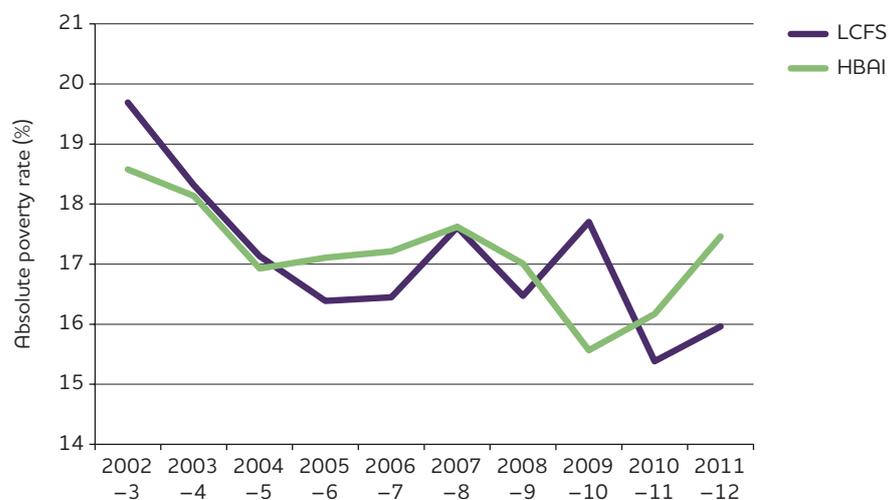
Notes: Data series smoothed at each income percentile using a Nadarya-Watson kernel estimator. The budget shares used to calculate inflation for 2013 are the same as those for 2012. Incomes in 2013 are taken to be the distribution in 2012 increased in line with average earnings growth. The figures for 2013–14 only include the final three quarters of 2013. The deflator used here is adjusted according to the difference between a version of the HBAI deflator calculated off the LCFS and the official deflator. The real price index is calculated using smoothed household inflation rates across the income distribution. All incomes equivalised using the modified OECD equivalence scale and are expressed in terms of equivalent amounts of a childless couple. Figures exclude Northern Ireland.  
Source: Authors' calculations from Living Costs and Food Survey

## 4 ABSOLUTE POVERTY

This section considers how trends in absolute poverty can be affected if different spending patterns for households at the poverty threshold are allowed for when uprating the poverty line.

Throughout, this report focuses on trends in BHC poverty measures. These are the measures used by the government when constructing their own poverty targets. In this and the following section, the ONS's LCFS is used rather than the Department for Work and Pensions' HBAI series for real poverty analysis because the HBAI series does not include the detailed information on household spending that is required to estimate household inflation rates. Figure 10 gives the trends in relative poverty estimated from the HBAI and the LCFS using the 'standard' (i.e. common deflator) methodology. The LCFS gives roughly comparable trends in relative poverty to the HBAI, although there are significant divergences in certain years.<sup>10</sup>

**Figure 10: Comparing absolute poverty rates from the LCFS and HBAI data, 2002–3 to 2011–12**



Note: Figures exclude Northern Ireland

Source: Authors' calculations from ONS Living Costs and Food Survey and price data from the ONS. HBAI figures are taken from [http://www.ifs.org.uk/tools\\_and\\_resources/incomes\\_in\\_uk](http://www.ifs.org.uk/tools_and_resources/incomes_in_uk) and were calculated using the Family Resources Survey.

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Due to these differences this report cannot comment on the exact amount by which the official statistics might over- or understate poverty; it only compares standard and real poverty rates calculated using the LCFS dataset to give an indication of how poverty might differ if differences in household inflation experiences across the income distribution were able to be taken into account.

There are some issues with the LCFS that are worth noting. For example, Brewer *et al.* (2014) show that households with the lowest income in this data do not have the lowest consumption, a fact that they attribute to the under-recording of income at the bottom of the distribution. However, this is a problem that is likely to affect other surveys as well. For instance, the HBAI data used to estimate official poverty statistics appears to only record 77% of housing benefit spending, 70% of tax credit spending and 50% of spending on pension credit when compared to administrative sources (Belfield *et al.*, 2014).

## Calculating changes in the real absolute poverty line

Absolute poverty is defined as having an equivalised income below some absolute standard. In the UK, this is currently defined as having an income below 60% of the 2010–11 median income in real terms (deflated using the HBAI deflator). An alternative approach is to measure the number of households that are capable of purchasing a given bundle of goods and letting this bundle be defined according to the spending patterns of those at the poverty threshold in 2010–11. As with conventional measures of inflation such as the RPI, the ‘threshold bundle’ of goods can then be updated from year to year and the index can then be chained to get the inflation rate over two periods (in the same way the weights used in the RPI basket are updated annually). This approach would define a *real* (as opposed to nominal) absolute poverty threshold, with individuals only counted as being in poverty if they did not have the means to purchase the same goods as those at the poverty threshold in the previous period. Of course, not all individuals would choose to purchase this exact bundle, but the question of whether or not they should be counted as being ‘in poverty’ is whether or not they could *afford* to.

A problem with defining a threshold bundle as being the bundle actually chosen by a real-world consumer observed in the LCFS is that such bundles will be subject to measurement and sampling error – or the individual household in question might have highly idiosyncratic tastes. Spending on many goods in the LCFS is recorded in a two-week spending diary, and a particular consumer’s spending over this period may not accurately reflect how budgets are spent over longer periods of time. Survey respondents may also randomly omit or forget certain items of spending or exactly how much was spent. To get around these problems an *average* (or ‘predicted’) share is found for those at the absolute poverty threshold level of income using linear regression of budget shares on income. More details on this are provided in Appendix A2 of this document.

The procedure used in this report therefore goes through the following steps:

- Beginning in 2010–11, predict the budget shares of an individual at 60% of median income.
- Calculate how much more or less this bundle would have cost in the previous and following period, and use this to deflate/inflate the cash income of those at the absolute poverty line.<sup>11</sup>

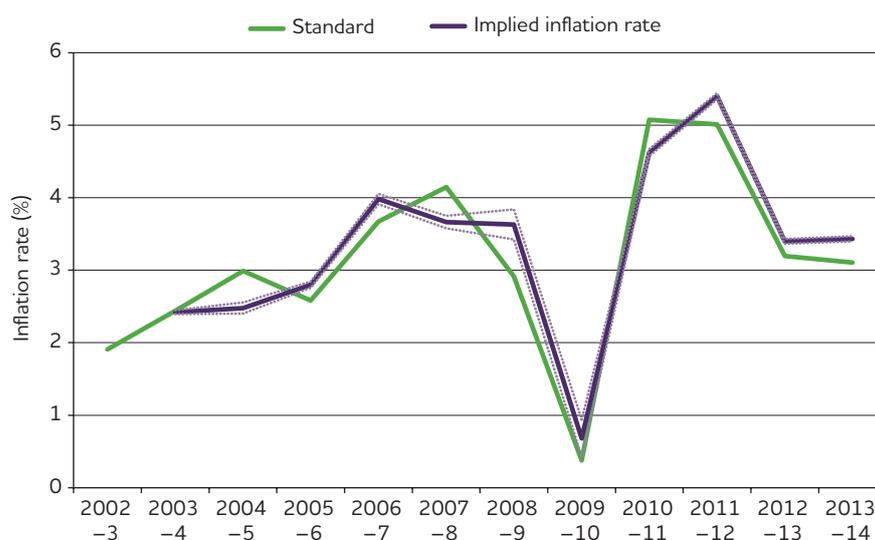
- In the previous and following years, calculate the number of households below this threshold and once again predict the budget shares of those at the poverty threshold to define a new threshold bundle.
- Return to step 2 and repeat.

The threshold bundle consists of 13 of the 14 groups of goods that make up the RPI plus Housing split into its six constituent parts: MIPs, rent, DIY, water, insurance and ground rent, and repairs. MIPs are included since, as noted in section 3, differences in spending on mortgage interest costs have been important in driving differences in the inflation experiences of high- and low-income households in recent years.

Figure 11 shows how the implied inflation rate associated with the new deflator compares to the HBAI inflation rate used to calculate official poverty statistics. It shows that it is neither consistently above nor consistently below the HBAI inflation rate, meaning there is no reason to believe that absolute poverty was consistently over- or underestimated by official statistics over the whole period. Indeed the new deflator was statistically significantly lower in 2004–5, 2007–8 and 2010–11 than the standard HBAI deflator, but higher in 2005–6, 2006–7, 2008–9, 2009–10, and in all of the three most recent years 2011–12 to 2013–14.

A higher inflation rate for those at the poverty threshold will imply a higher poverty line in cash terms in the following period. Figure 12 shows how the differences in deflators translate into differences in the real and nominal absolute poverty rates. Real poverty is calculated using the threshold deflators, while nominal poverty is calculated according to the official definition. As Figure 11 would imply, the real poverty rate can be greater or lower than the nominal rate from year to year. However, since 2011–12 the real poverty rate has been consistently higher than the poverty rate calculated in the standard way. In 2013–14, real poverty was 19.5% compared to a standard poverty rate of 19%. For a population for Great Britain of 61.5 million, this would imply an additional 300,000 or so individuals in poverty relative to a poverty rate calculated via standard methods.

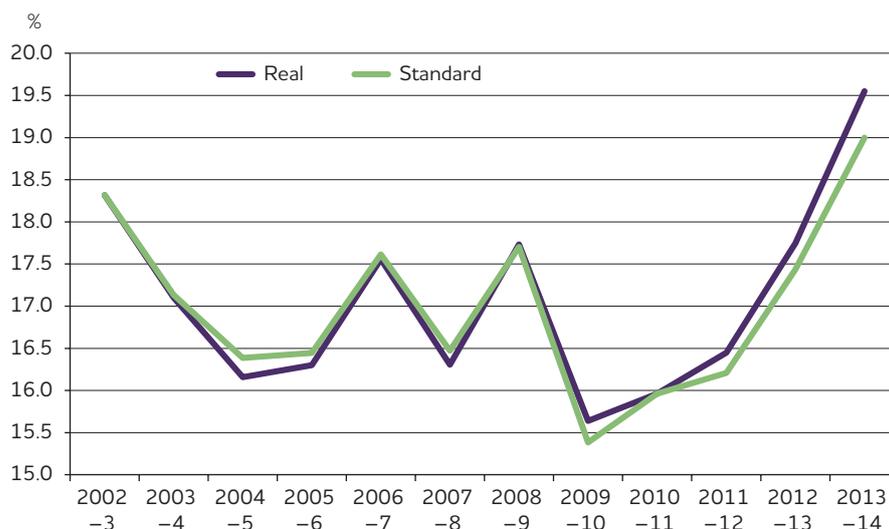
**Figure 11: Poverty threshold implied inflation rate, 2002–3 to 2013–14**



Notes: The budget shares used to calculate inflation for 2013 are the same as those for 2012. Incomes in 2013 are taken to be the distribution in 2012 increased in line with average earnings growth. The figures for 2013–14 only include the final three quarters of 2013. The poverty threshold deflator is adjusted according to the difference between a version of the HBAI deflator calculated off the LCFS and the official deflator. Figures exclude Northern Ireland. Standard errors calculated via bootstrap (see Appendix A2).

Source: Authors' calculations from ONS Living Costs and Food Survey and price data from the ONS

**Figure 12: Real versus nominal absolute poverty rates, 2002–3 to 2013–14**



Notes: The budget shares used to calculate inflation for 2013 are the same as those for 2012. Incomes in 2013 are taken to be the distribution in 2012 increased in line with average earnings growth. The figures for 2013–14 only include the final three quarters of 2013. The poverty threshold deflator is adjusted according to the difference between a version of the HBAI deflator calculated off the LCFS and the official deflator. Figures exclude Northern Ireland.

Source: Authors' calculations from ONS Living Costs and Food Survey and price data from the ONS

One can also consider how the average poverty gap – a measure of the intensity of poverty – changes when this new approach to estimating real poverty rather than standard methods is used. However, as noted above, there are concerns about the accuracy of income data at the very bottom of the distribution, and so the findings should be interpreted with some care. Figure 13 shows the average poverty gap from 2002–3 to 2013–14. The gap does not differ greatly from the standard poverty measure in most years in the same way that the proportion of those in poverty is often quite similar – although there is the same divergence between standard and real measures in the years following 2010–11. The gap is actually lower than standard methods would imply in the years 2005–6 and 2007–8.

**Figure 13: Absolute poverty gap index, 2002–3 to 2013–14**



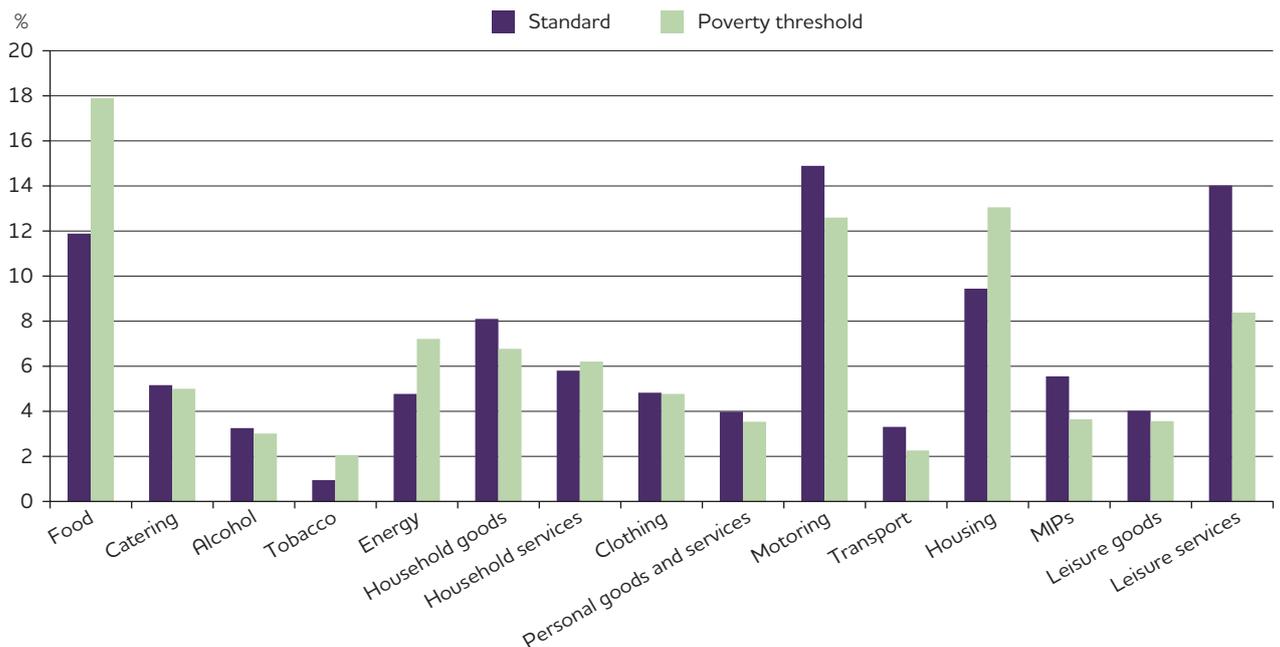
Note: Figures exclude Northern Ireland.

Source: Authors' calculations from ONS Living Costs and Food Survey and price data from the ONS

Now let us take a closer look at the reasons behind the differences between the poverty threshold deflator and the official HBAI deflator (and hence real and standard poverty rates). The budget shares at the poverty threshold in 2010–11 define the weights in the first year for the new deflator. Figure 14 shows the shares of the 14 RPI major groups for those individuals at the poverty threshold and plutocratic average shares that would be used to calculate a standard inflation rate. There are important differences between the bundle of goods consumed at the poverty threshold and what would be used in a standard inflation measure. Those at the poverty threshold spend relatively more of their budgets on food (17.9% compared to 11.9%) and energy (4.7% compared to 7.2%), and less on motoring (12.5% compared to 14.9%), leisure services (8% compared to 14%) and MIPs (3.6% compared to 5.6%) than the plutocratic average that would be used in the headline inflation indices (as discussed in section 3).

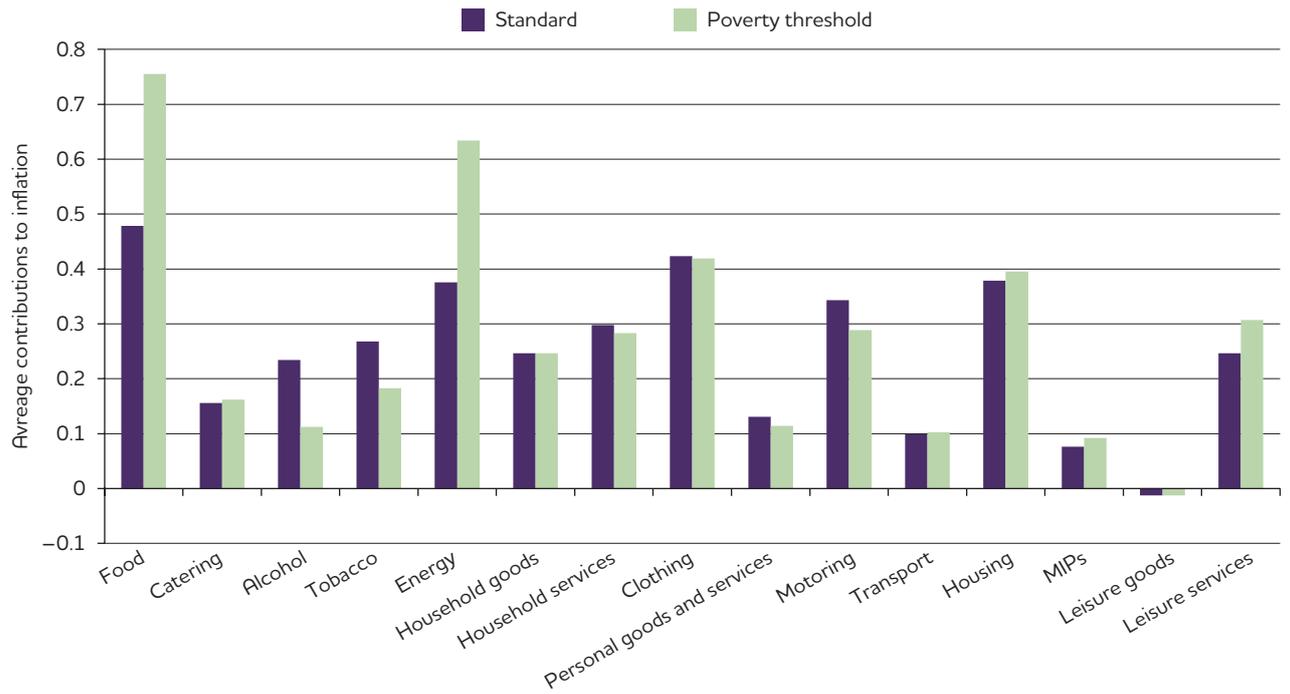
The difference in the real and standard poverty rates from 2011–12 onwards apparent in Figure 12 is particularly noteworthy. Figure 15 shows the average contributions different goods made to the poverty threshold deflator and to the HBAI deflator used in official statistics in the years following 2010–11, showing what drove the difference that emerged in these years. ‘Contributions’ are defined here as the inflation rates of each good multiplied by its weight in each index (with the sum of contributions being equal to the inflation rate itself). It shows that food and energy made much larger contributions to the threshold deflator than to the HBAI deflator, which is not surprising since Figure 14 showed that these goods were more important in the budgets of individuals at the poverty threshold and analysis in section 3 showed that these goods have seen particularly rapid price increases. The aggregate deflator used to uprate the poverty threshold for official statistics in these years did not take account of the fact that higher food and energy prices had a disproportionately greater impact on low-income households, leading to a divergence between it and the threshold specific deflator.

**Figure 14: Budget shares for those at absolute poverty threshold in 2010–11**



Notes: Incomes are equalised using the modified OECD scale. Spending excludes council tax. Figures exclude Northern Ireland.  
Source: Authors' calculations from ONS Living Costs and Food Survey

**Figure 15: Average annual contributions to inflation, 2011–12 to 2013–14**



Notes: Contributions for HBAI deflator are RPI contributions that have been scaled so as to remove council tax.

Source: Authors' calculations from ONS Living Costs and Food Survey and price data from the ONS

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## 5 RELATIVE POVERTY

To measure relative poverty, the UK government counts the number of individuals in households whose nominal income falls below 60% of the median income in that year. In their calculations all incomes are adjusted, or 'equivalised', to reflect differences in household size.

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However, if high- and low-income households are experiencing different rates of inflation, it is important to think about the *real* income available to the household – in other words the purchasing power of the income they have. If the object of concern is the relative position of individuals in the distribution of resources, then inflation taking a higher value for households in poverty compared to those at the median, should translate into a rise in *real* relative poverty.

This section assesses the robustness of standard measures of relative poverty to differences in household inflation rates. To do so real relative poverty statistics are computed using income data that has been adjusted using household-specific inflation rates rather than a common deflator. These statistics reflect the fact that living costs have evolved differently for different households, and thus that a given amount of nominal income growth has translated into different levels of resource growth across the income distribution.

The section begins with an analysis of how real incomes have evolved in recent years. Over the recession, this analysis finds that standard methods overstated the growth in real income for those living in poverty because they did not take into account the higher rate of inflation experienced by these households.

This analysis enables an assessment of how far the standard measure of poverty may have under- or overstated the growth or falls in relative poverty in a given period, by factoring in the different inflation rates experienced by different groups. However, to explicitly calculate a real poverty rate, would require the *level* of real income in each year, not just their changes over time. This introduces some complication to the analysis because the level of real income cannot be observed, only changes in its value over time. A way round this is to assume that real incomes and nominal incomes are equivalent in some base year and compare changes from this base year.

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In what follows it is assumed that the real and nominal income distributions are equivalent in 2001–2 and use this year as the starting point for the analysis. This choice is essentially arbitrary but the primary interest of this report is in how real poverty has changed over the years compared to standard measures. Although changes in relative poverty are not completely invariant to the choice of base year for reasons explained in Appendix A3, it is demonstrated in the same Appendix that this dependence is relatively unimportant over the time period considered in this report: the conclusions are not qualitatively affected by changes in the base year. That said, given these complications, the results should not be interpreted as giving exact measures of the bias of standard measures. Rather, the results highlight the general tendency of standard and real measures of relative poverty to diverge when inflation varies systematically across the income distribution.

## Growth in real incomes

In this report, relative poverty depends on the number of individuals who fall below 60% of the median real income. To find this, one must first determine the shape of the real income distribution. In each year, the change in real incomes at every point along the nominal income distribution can easily be calculated by adjusting pure income growth for the inflation rate experienced by households at that part of the income distribution. This growth rate is informative about how standard methods might have overstated or understated changes in real relative poverty over time; if the real income growth of households living in poverty is diminished relative to that of the median once income-specific differences in inflation are taken into account, one would expect to observe a rise in relative poverty.

This report calculates the change in real income at the  $p$ th percentile between a base year (fixed as 2001–2) and another year  $t$  as the change in nominal income divided by the change in the price level at the  $p$ th percentile between those two years.

Standard methods of tracking changes in real income over time assume that the change in the price level is the same for all households and is measured as variant of the RPI. In this analysis, the change in the price level is allowed to vary by income percentile. To calculate this inflation rate, flexible regression techniques are used to predict the expected inflation rate for individual in households at the  $p$ th percentile using household-level inflation rates. These predicted inflation rates are used to calculate an income-specific Fisher price index, which allows the change in the price level experienced at each percentile to be measured. Further technical details of the procedure used can be found in the Appendix A3.<sup>12</sup>

Figures 16 and 17 illustrate this method graphically for income and prices changes between 2001–2 and 2008–9. All data series have been smoothed to ease interpretation. Nominal income growth from 2001–2 to 2008–9 varied across the income distribution, with the bottom and the top of the income distribution growing more strongly than income around the median. However, the bottom of the income distribution faced a higher rate of inflation than average causing a deviation between the ‘real’ price index and the HBAI price at the bottom of the income distribution. Indeed, the HBAI price index is lower than the real price index experienced by the lower half of the income distribution – reflecting the fact that it is a plutocratic average (see section 3). Correcting nominal income growth for the change in the price level gives the real income growth rate (shown by the red line)

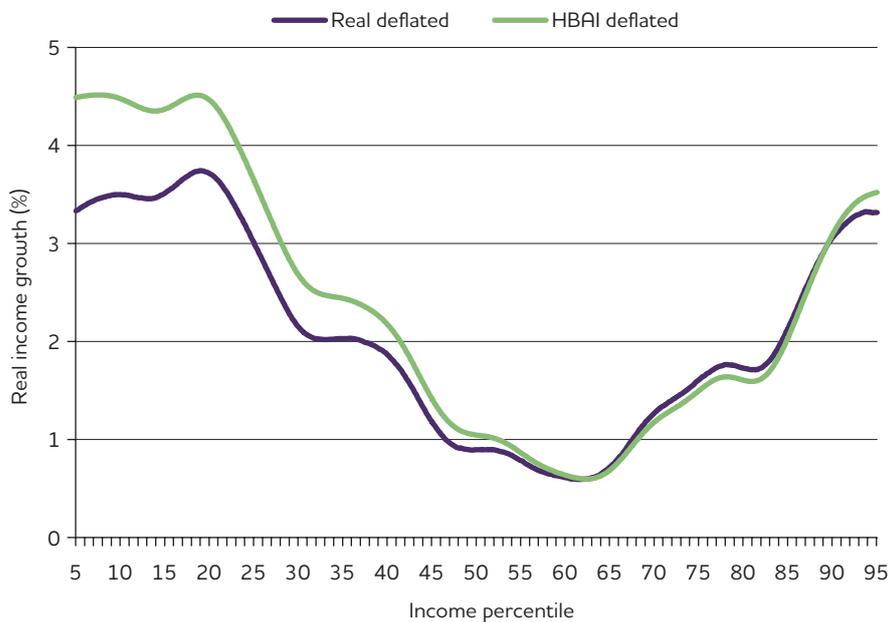
**Figure 16: Nominal income growth, percentile-specific price index and HBAI price index, 2001–2 to 2008–9**



Notes: Data series smoothed at each income percentile using a Nadarya-Watson kernel estimator. The real price index is calculated using smoothed household inflation rates across the income distribution. All incomes equivalised using the modified OECD equivalence scale and are expressed in terms of equivalent amounts of a childless couple. Figures exclude Northern Ireland.

Source: Authors' calculations from ONS Living Costs and Food Survey and price data from the ONS

**Figure 17: Real income growth using percentile-specific price index and HBAI price index, 2001–2 to 2008–9**



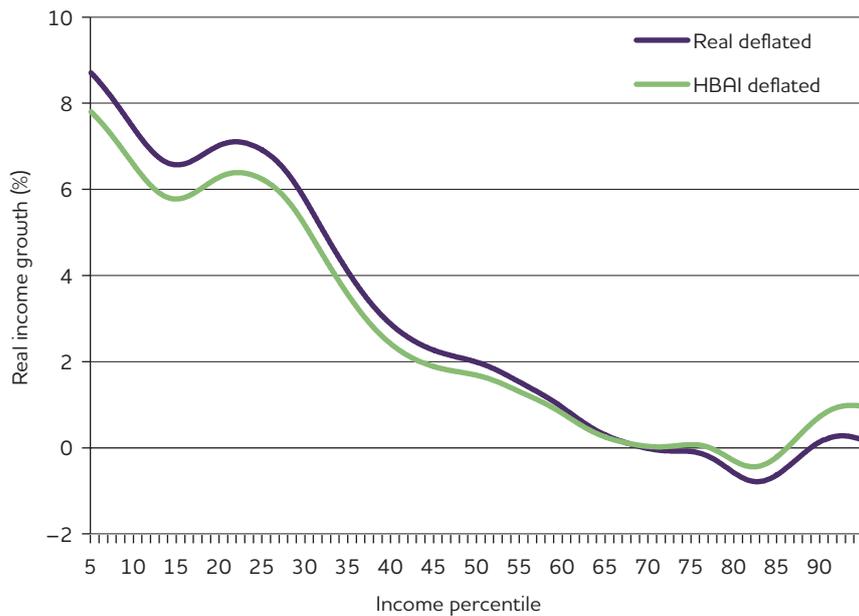
Notes: Data series smoothed at each income percentile using a Nadarya-Watson kernel estimator..

Source: Authors' calculations from ONS' Living Costs and Food Survey and price data from the ONS

in Figure 17. Deflating by the HBAI deflator leads real income growth to be overstated at the bottom of the distribution.

However, income-specific deflators do not always imply that growth at the bottom end of the distribution is overstated by the HBAI deflator. To stress this point, Figure 18 shows real income growth between 2001–2 and 2004–5. Over this period, price changes were in fact marginally pro-poor,

**Figure 18: Real income growth using percentile-specific price index and HBAI price index, 2001–2 to 2004–5**



Notes: Data series smoothed at each income percentile using a Nadarya-Watson kernel estimator.  
 Source: Authors' calculations from ONS' Living Costs and Food Survey and price data from the ONS

causing growth at lower-income percentiles to be understated by standard methods.

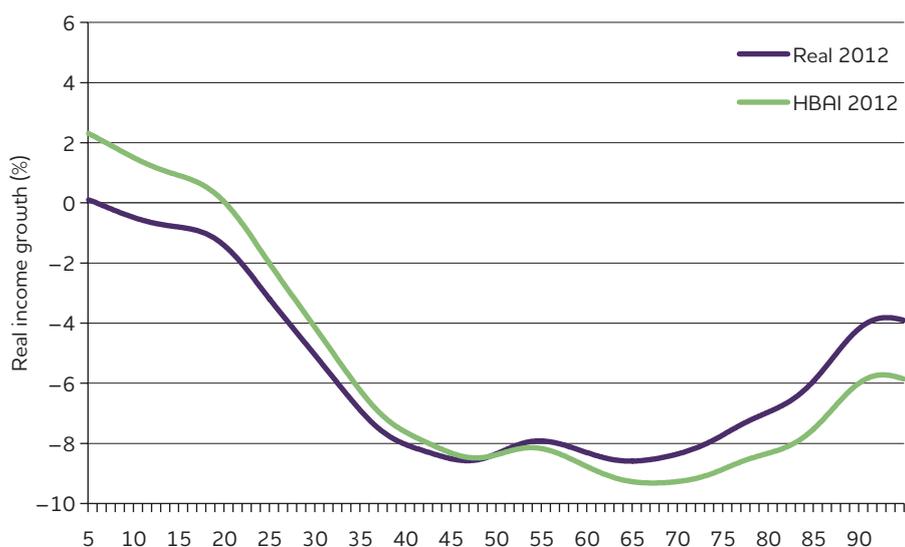
Figures 19 and 20 show real growth rates across the income distribution for the period 2001–2 to 2012–13.<sup>13</sup> Differences in household inflation did not cause significant differences in the growth rates of real income in the period leading up to the recession; there was some slight tendency for the standard method to overstate real income growth at the bottom of the

**Figure 19: Real income growth 2001–2 to 2007–8 and 2007–8 to 2012–13**



Notes: Data series smoothed at each income percentile using a Nadarya-Watson kernel estimator.  
 Source: Authors' calculations from ONS' Living Costs and Food Survey and price data from the ONS

**Figure 20: Real income growth 2001–2 to 2012–13**



Notes: Data series smoothed at each income percentile using a Nadarya-Watson kernel estimator..

Source: Authors' calculations from ONS' Living Costs and Food Survey and price data from the ONS

income distribution, but the difference is not statistically significant. However, since the onset of the crisis, differences in household inflation rates across the income distribution have had a larger effect on real income growth. Although real income growth at the middle of the income distribution is not affected by whether one deflates using the HBAI or income-specific inflation rates, growth at the bottom of the distribution is lower once one takes into account the distributional impact of inflation. This tendency suggests that the trends in official poverty measures may not be robust to the impact of differential inflation. It is to this question that this report now turns.

## Real relative poverty statistics

To compute real relative poverty statistics, one needs the level of real income in a particular year, not just its growth rate. To get from changes to levels, one can simply use the fact that the level of real income at percentile  $p$  is simply the level of real income in the base year multiplied by the change in real income. However, the real income distribution is not observed in any year and, therefore, one particular year must be selected in which to assume that the real and nominal income distributions are equivalent. This report sets real incomes equal to nominal incomes in the base year 2001–2. With this assumption, the real income distribution at each financial year between 2002–3 and 2012–13 is obtained. The patterns emerging from the data are robust to choosing an alternative base year in the period considered. The interested reader is referred to Appendix A3 for a further discussion.

Measures of real relative poverty are then calculated by counting the number of individuals in households with real incomes below 60% of the median of the calculated real distribution. As the real median is used to define the poverty line, higher inflation rate for low-income households does not necessarily mean that relative poverty rates will be higher. Rather, a higher relative poverty rate will result only if individuals in households in the lower half of the income distribution tend to experience higher inflation rates than the individuals in the median household.

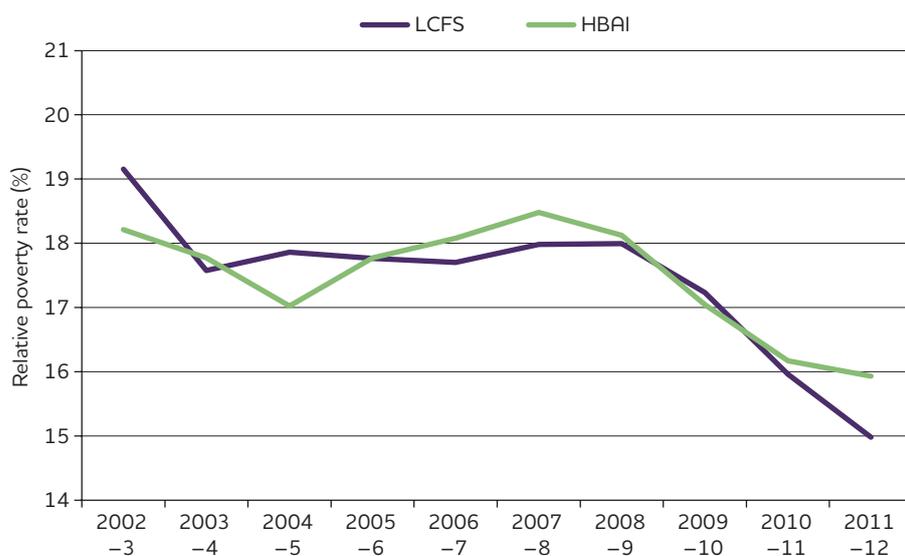
As in the previous section, this section uses the ONS's LCFS rather than the official HBAI series for its real poverty analysis. Figure 21 gives the trends in relative poverty estimated from the HBAI and the LCFS using the 'standard' (i.e. common deflator) methodology. The LCFS gives roughly comparable trends in relative poverty to the HBAI, although there are significant divergences in certain years.<sup>14</sup> However, given that this report's interest lies in comparing the changes in standard and real poverty rates given differences in household inflation experiences, rather than the exact level of relative poverty in any particular year, these differences are of no consequence.

Figure 22 gives the standard and real relative poverty rates from 2002–3 to 2013–14 (setting 2001–2 as the base year when standard and real poverty rates are the same). The measures imply similar trends in the prevalence of relative poverty for the early 2000s. According to both measures, relative poverty fell from a high of 19.5% in 2001–2 to fluctuate between 17.5% and 17.7% in the years 2003–4 to 2007–8. In fact, over this period, the real measure implies a marginally lower rate of relative poverty; between 2003–4 and 2007–8, the real poverty rate had fallen to be 0.2 percentage points lower than the standard rate on average.

There is evidence of some divergence between real and standard relative poverty rates with the onset of the financial crisis. Real relative poverty rose between 2007–8 and 2008–9, while the standard measure stayed constant, as a result of the differences in inflation rates across the income distribution. Real poverty then fell back in the following years in the same way as the standard measure. Figure 23 shows the difference between standard and real poverty rates with the 95% confidence interval. It shows that the impact of differential inflation rates on real relative poverty was statistically significant over the recession.

There is also evidence of a rise in real income inequality at the onset of the crisis that is not reflected by standard measures. As with real relative poverty, one cannot make statements about the level of real inequality, only the sensitivity of changes in inequality to differential household inflation rates. Figures 24 and 25 give the 90–10 and 50–10 ratios from 2001–2

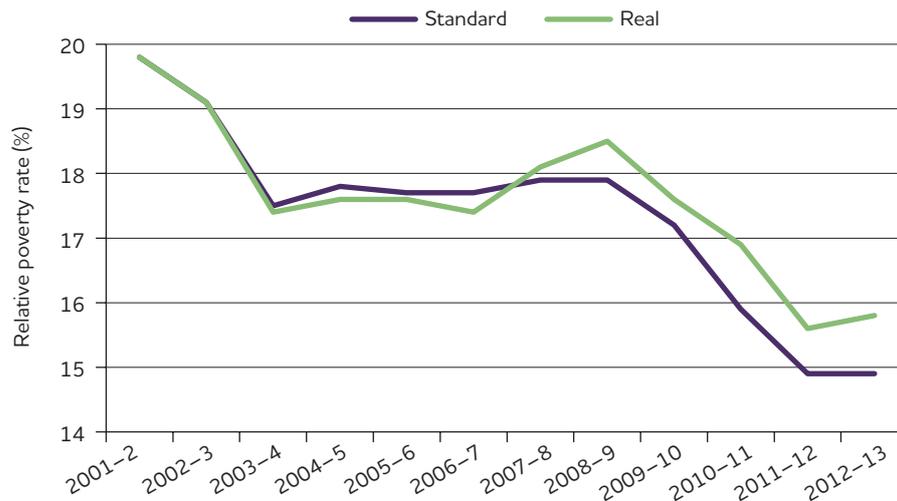
**Figure 21: Comparing relative poverty rates from the LCFS and HBAI data, 2002–3 to 2011–12**



Note: Figures exclude Northern Ireland

Source: Authors' calculations from ONS Living Costs and Food Survey and price data from the ONS. HBAI figures are taken from [http://www.ifs.org.uk/tools\\_and\\_resources/incomes\\_in\\_uk](http://www.ifs.org.uk/tools_and_resources/incomes_in_uk) and were calculated using the Family Resources Survey.

**Figure 22: Real relative poverty, 2001–2 to 2012–13**



Notes: Standard figures are deflated using the HBAI price index. Real figures are deflated using income specific deflators calculated using method in Appendix A3. Figures exclude Northern Ireland. Base year is 2001–2.

Source: Authors' calculations from ONS' Living Costs and Food Survey and price data from the ONS

**Figure 23: Difference between standard and real relative poverty rate with 95% confidence interval, 2001–2 to 2012–13**



Notes: Standard figures are deflated using the HBAI price index. Real figures are deflated using income specific deflators calculated using method in Appendix A3. 95% confidence interval calculated by bootstrapping the whole procedure 500 times. Figures exclude Northern Ireland. Base year is 2001–2.

Source: Authors' calculations from ONS' Living Costs and Food Survey and price data from the ONS

to 2012–13. The 90–10 ratio gives how many times larger the equivalised income of the 90th percentile of the income distribution is compared to the 10th percentile. The 50–10 ratio is defined similarly and gives a measure of inequality in the bottom half of the income distribution ('lower tail inequality'). There is a divergence in standard and real inequality measures at the onset of the crisis. According to standard measures, the 90–10 ratio fell more or less consistently between 2006–7 and 2011–12. However, real inequality at first rose over the recession. A rise in lower tail inequality between 2007–8 and 2008–9 is also evident in the real measure but not in the standard measure. These trends imply that although income growth was relatively protected at the bottom of the income distribution over the

**Figure 24: 90-10 income ratio, 2002–3 to 2013–14**



Notes: Standard figures are deflated using the HBAI price index. Real figures are deflated using income specific deflators calculated using method in Appendix A3. All incomes equivalised using the modified OECD equivalence scale and are expressed in terms of equivalent amounts of a childless couple. Figures exclude Northern Ireland.

Source: Authors' calculations from ONS' Living Costs and Food Survey and price data from the ONS

**Figure 25: 50-10 income ratio, 2002–3 to 2013–14**



Notes: Standard figures are deflated using the HBAI price index. Real figures are deflated using income specific deflators calculated using method in Appendix A3. All incomes equivalised using the modified OECD equivalence scale and are expressed in terms of equivalent amounts of a childless couple. Figures exclude Northern Ireland.

Source: Authors' calculations from ONS' Living Costs and Food Survey and price data from the ONS

recession, these households were hit harder by changes in the cost of living than households at the top and middle of the income distribution.

The differences in the trends of real and standard measures were caused by systematic differences in household inflation across the income distribution. Referring back to Figure 9, which shows the predicted average annual inflation rate experienced at each percentile of the nominal income distribution between 2002–3 and 2013–14, a systematic relationship between inflation and income is evident over the recession. Household inflation rates were higher for low-income households from 2007–8 as they tended to be hit harder by high price inflation for food and energy but did not benefit from the falls in mortgage costs experienced by high-income households. However, prior to the recession, inflation rates were slightly higher for higher-income households, causing official measures to slightly overstate the growth in real relative poverty and inequality rates.

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## 6 POLICY RESPONSES

The previous sections have shown that low-income households have been hit harder by recent price changes than richer households. This section discusses the relative desirability of several possible policy responses to the recent ‘anti-poor’ trends in inflation. These include attempting to influence prices directly through introducing price controls or adjusting indirect taxes; introducing policies to increase the incomes of households experiencing poverty; and changing the way cost of living adjustments are made to state benefits to better reflect the inflation experiences of those on low incomes.

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### Policy levers

#### Price controls and indirect taxes

In a direct attempt to reduce household living costs, the government could set price ceilings on goods that are disproportionately consumed by low-income households. Indeed, energy price and rent controls have recently been proposed by the Labour Party.<sup>15</sup> Such measures have been used in the UK in the past. For example, the Increase of Rent and Mortgage Interest Act 1915 restricted rents to their August 1914 level to prevent landlords from exploiting tenants during the war years. Although this legislation was initially intended to be temporary, rent controls continued to be applied until 1989. In the energy market, Ofgem levies price controls in areas where competition is restricted. However, many retail price controls in the energy market were removed in the early 2000s.

As an alternative to directly controlling prices themselves, the government could reduce the rate of indirect taxation on necessities. Such a reform would cause retail prices to fall if firms pass on some of their tax savings to consumers. This strategy is already pursued to a considerable extent in the

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UK – more so in fact that in most other European Union and Organisation for Economic Cooperation and Development countries. For example, there is a zero rate of VAT on food and children’s clothing and VAT on energy is levied at a reduced rate of 5%, compared to the standard rate of 20%.

However, both price controls and differential indirect tax rates are likely to be costly and inefficient means of achieving distributional objectives if the markets in which they are applied are otherwise well functioning. There might be reasons aside from redistribution why such policies may be desirable. For example, some goods may be overpriced relative to what would be desirable if they are associated with positive social benefits which are not currently reflected in the price. Price controls can also be beneficial in certain markets where competition is limited and there is no realistic way of protecting consumers from the abuse of market power. For example, Ofgem continues to set price controls for the companies that operate Britain’s gas and electricity networks even though many retail price controls were removed in the early 2000s. In these instances, effective regulation of prices is often desirable even if alternative policies are often preferable in otherwise well-functioning markets.

Yet, in general, both price controls and differential indirect tax rates are poorly targeted towards helping low-income households because everyone who buys affected goods benefits from their lower price. In fact, high-income households are likely to save more money than low-income households from these policies because, although richer households spend a lower proportion of their overall budget on necessities, they typically spend a larger absolute amount on these goods.

Both measures can also result in inefficiencies. Price controls can distort the allocation of resources; by artificially lowering the price of a good, they may result in supply shortages and excess demand, and market participants may resort to other costly mechanisms for allocating goods in the regulated market (such as waiting lists and queues). They can also distort incentives for suppliers to invest and innovate, and for competitors to enter a market. Differential indirect taxes can similarly lead consumers to over-consume certain goods relative to what they would choose themselves in a neutral tax regime. They can also create considerable complexity in policing borders between what is and is not subject to VAT.

There are often more efficient ways of easing the burden on low-income households than universal price controls and extending the scope of VAT zero rating. Direct taxes and benefits can be used to boost the incomes of those on low incomes without some of the undesirable distortions associated with price controls or differential indirect taxes: and without making give-aways to richer households which the government did not intend. Indeed, Crawford *et al.* (2009) show that eliminating zero-rating and reduced-rating on VAT would provide sufficient revenue to increase all means-tested benefit and tax credit rates by 15% (which would, on average, leave the bottom 30% better off) and leave an addition £11 billion for further redistribution and/or other ends.

### Policy to boost incomes

There are also various policies that government could, or has, introduced to boost the incomes of lower-income households. A variety of government and opposition proposals to redistribute towards the low-paid are discussed and appraised in Hood *et al.* (2014) – including increases in the personal allowance, raising the threshold for employee National Insurance Contributions, changes to tax credits, increases in the minimum wage and the reintroduction of a 10 p rate of income tax.

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This report instead discusses increasing the generosity of income-related payments to compensate households in times when price rises are having a disproportionate impact on those on low incomes. These payments can be targeted at alleviating particular costs or involve a general increase of tax credit and benefit levels. Both sorts of policies are implemented in the UK.

Some cost-specific payments are targeted towards reducing the burden of household energy bills. For example, the Winter Fuel Payment (WFP) is a universal benefit for those aged at or above the female state pension age, and the warm home discount (WHD) is paid to low-income households during periods of cold weather. The generosity of these payments has declined significantly relative to bills in recent years as energy costs have risen; the value of the WFP has fallen from approximately 46% of the energy bill of a 60–79-year-old in 2005–6 to only 13% in 2013–14 (Advani *et al.*, 2013). Targeting payments at particular goods in this way can change consumption patterns. Households receiving the WFP are almost 14 times more likely to spend the money on fuel than would have been the case had their incomes been increased in other ways (Beatty *et al.*, 2011). In certain circumstances this ‘labelling’ effect may be desirable; if the aim of policy is not just to compensate low-income households for their higher cost of living but to ‘nudge’ them into particular spending patterns, then good-specific cash transfers can help to bring this about. However, if the aim is simply compensation for high living costs, then care should be taken in labelling cash transfers in this way.

Low-income households can also be compensated for changes in their living costs through changes to the general level of benefits. Indeed, most parameters of the social security system (income tax thresholds and benefit amounts) are normally increased each year in line with headline rates of inflation in an attempt to keep the real value of benefits constant. Making systematic changes to the level of benefits is referred to as ‘uprating’ or ‘indexation’ policy. Although seemingly innocuous, uprating policy can have big effects on household living standards as the impacts accrue over time. For example, if the amount of Job Seeker’s Allowance received by a single unemployed person had been pegged to average earnings since 1971, it would be more than double the value that it is now (Sutherland *et al.*, 2008).

In recent years, the government has made some significant changes to uprating policy. Before 2011, most parameters of the tax and benefit system were uprated in line with either the RPI or the Rossi Index, a variant of the RPI that excludes housing costs. However, the government announced in the 2010 Budget that from April 2011, most working-age benefits would be instead uprated by CPI. Historically, the CPI has risen at a slower rate than the RPI, implying that one would expect working-age benefits under this policy change to become less generous over time relative to a policy of continuing to increase them in line with the RPI. Indeed, Joyce and Levell (2011) calculate that the impact of the switch in the default indexation rule was negative across the income distribution in 2012–13, and had the strongest impact on the bottom income decile.

Further reductions in the generosity of uprating policy were announced in the Autumn Statement 2012, in which the government announced that working-age benefits would be increased by no more than 1% per year in cash terms in 2013, 2014 and 2015. Conditional on OBR inflation forecasts, the policy was expected to result in savings of £1.9 billion in cash terms in 2015–16 at the cost of an expected 4 percentage point cut in real benefits by 2015 (Hood *et al.*, 2013). The tightening of uprating policy applied to working-age benefits continued in the Autumn Statement 2013, when it was announced that Universal Credit work allowances were to be frozen in

nominal terms for three years from 2014–15. These uprating caps have not applied to the State Pension or Pension Credit, resulting in starkly different indexation procedures for working-age and pensioner households. In fact, the uprating mechanisms for pensioner benefits have become more generous under the current government. In the 2010 Budget, it was announced that the Basic State Pension would be ‘triple-locked’, that is, that its value would be increased by the highest of CPI inflation, earnings growth or 2.5% per year.

## Reform of uprating policy

There have been calls for the reform of uprating policy (Sutherland *et al.*, 2008) and for greater clarity concerning how benefit rates should be indexed in the longer term (Hood *et al.*, 2013).

The approach taken to adjust benefits and tax credits should depend on the goal of uprating policy. Table 1, taken from Sutherland *et al.* (2008), summarises the arguments for various approaches. UK uprating policy does not fit neatly into any category but can be considered partially consistent with an aim of maintaining a constant living standard for working-age households on benefits, given that many working-age benefits and tax credits are typically uprated in line with CPI inflation.<sup>16</sup> Yet, as shown in section 3, inflation rates can vary systematically across the income distribution. By couching uprating commitments in terms of the ‘general level of prices’, those on low incomes will be exposed to inflation risk because the real value of benefits will vary when the cost of living of benefit-dependent households diverges from the average inflation rate.<sup>17</sup>

The living standards of low-income households might be better maintained by uprating benefits using an inflation rate closer to that which they actually experience. By uprating group-specific benefits using the average inflation rate for the group, households that receive benefits will be less exposed to inflation risk as the adjustment to their benefit income will better reflect the cost of living changes that they experience. This risk would instead be transferred to current and future taxpayers who are arguably better equipped to bear it. Although this alternative uprating policy would not fully insure households against changes in the cost of living (given diversity in their inflation experiences), one would expect that, on average, this uprating reform would better maintain real living standards.

**Table 1: Indexation: summary of aims and implications**

Aim	Implication for choice of up-rating factor
Unchanging inequality	Average income (e.g. mean after tax income)
Unchanging relative poverty	Typical incomes (e.g. median equivalised household disposable income)
Keeping track with the MIS	Change in income necessary to achieve a contemporary budget standard
Unchanging real standard of living	Relevant price index
Constant return on contributions	Gross earnings
Public finance affordability	National income
Coherence	Common factor across elements of the tax-benefit system
Government flexibility	None

Source: Sutherland *et al.* (2008, Table 1)

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The feasibility of such a reform is partly dependent on its longer-term impact on the public finances. If any ‘anti-poor’ inflationary trend is likely to reverse in a relatively short period of time, then any negative effect on the public finances will be temporary and offset by positive effects in future years. This should make the policy relatively cheap to implement in the long term. If, however, inflationary trends deviated over a substantial period of time, then the policy could add an important source of risk to the public finances.

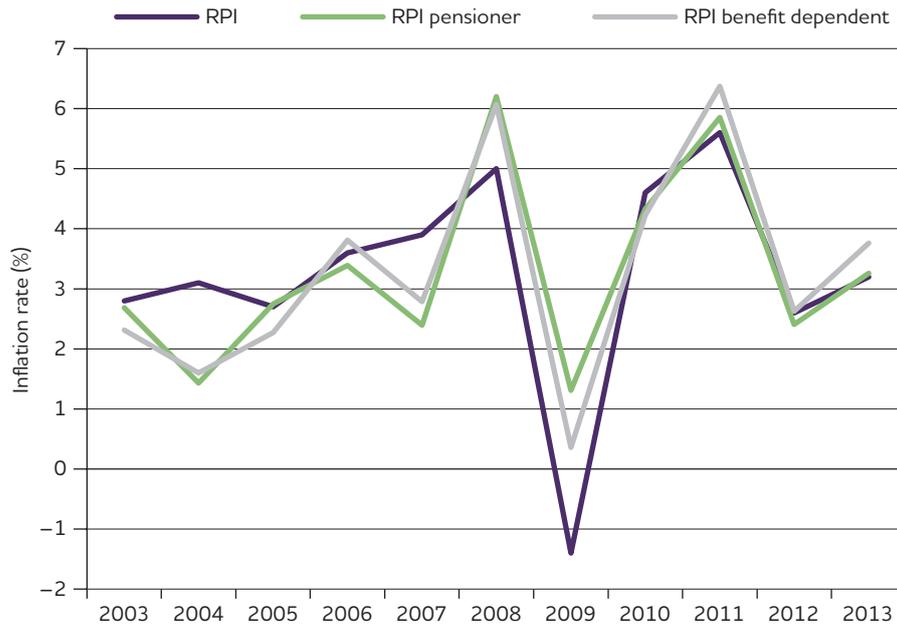
The question of whether it is politically feasible for the government to uprate benefits by less than the headline rate of inflation in years when the inflation rate experienced by low-income households is lower on average is also of relevance. This question is not considered in detail here, although the capping of working-age benefit increases to 1% per year in cash terms in 2013, 2014 and 2015 suggests that it may well be. An additional concern might be that, under the current statutory framework, it is not possible for benefit levels to be *decreased* if inflation is negative. This meant that in April 2010, some benefits were frozen in cash terms and others were increased by 1.5% when headline RPI went negative. This may complicate the use of group-specific inflation rates when inflation is low (as some groups could then experience negative inflation while others do not).

The long-run effect of group-specific benefit uprating on the public finances is ambiguous because the inflation rate experienced by low-income and pensioner households does not trend consistently above or below the average inflation rate in the long run. Over the time period 1976–2000, Crawford and Smith (2002) found no consistent pattern to the difference between the inflation rates experienced by households in the top 10% and bottom 10% of the income distribution, nor between pensioner and non-pensioner households. As shown in section 3, one of the main reasons for the anti-poor inflationary trends in recent years has been the fall in MIPs costs over the recession. One would thus expect the magnitude of the inflationary differences between high-income and low-income households to diminish as MIPs costs rise back to normal levels. Thus, while uprating benefits by the inflation rate experienced by low-income households would have been more expensive over the recession itself, it may be revenue neutral in the longer term.

Here the impact on the public finances of uprating working-age and pensioner benefits by group-specific inflation rates rather than the RPI or CPI since 2004 is estimated.<sup>18</sup> This will give an idea of whether a policy of using group-specific inflation rates could lead to substantially greater or smaller costs than standard indexation policy after averaging over a number of years. To do this benefit-dependent and pensioner-specific headline inflation rates from the LCFS dataset are calculated.<sup>19</sup> The same methodology used to construct the standard RPI and CPI indices is used except that only the allocation of group-spending is considered when constructing the group-specific weights. By following the ONS methodology as closely as possible, it is ensured that indices that could be available to the government on the timely basis needed to make budgetary decisions are being used.

Figures 26 and 27 respectively give the official RPI and CPI indices between 2003 and 2013, and the respective indices calculated for benefit-dependent households and pensioner households. A household is classified as benefit-dependent if over half its income comes from state benefits. This group is not equivalent to the low-income group considered in section 3. Over the recession itself, benefit-dependent and pensioner households faced higher RPI inflation on average than headline rates would suggest.

**Figure 26: Headline, benefit-dependent and pensioner RPI indices, 2003–13**

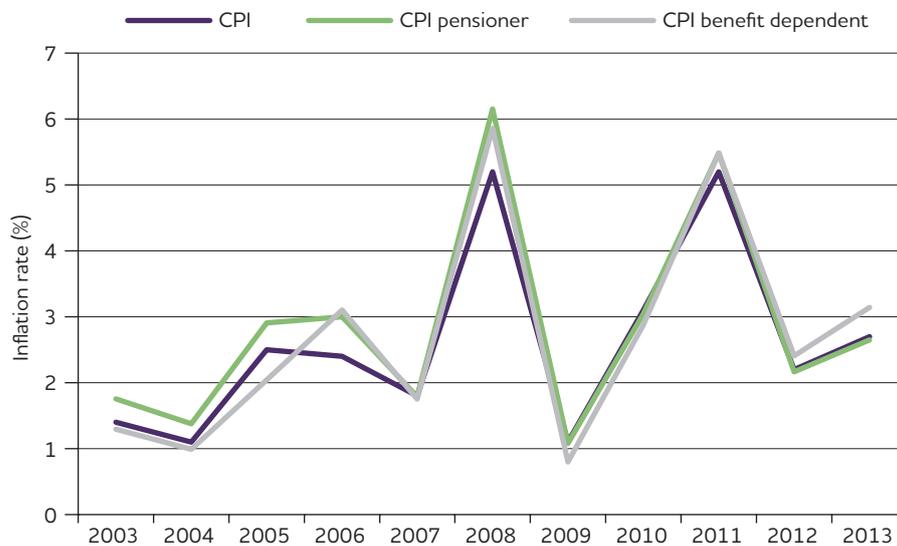


Source: Authors' calculations from ONS Living Costs and Food Survey and price data from the ONS.

In 2009, largely as a result of falling interest rates, the disparity between headline and group inflation rates was especially pronounced; the pensioner RPI was 2.7 percentage points higher than the headline RPI, and the benefit-dependent RPI was 1.8 percentage points higher. In other years, no systematic pattern arises; in some years pensioner and benefit-dependent inflation rates exceed the headline RPI, whereas in other years they are below average inflation.

The differences in headline and group CPI inflation over the recession are smaller than the corresponding differences in RPI inflation. This is in large part because the CPI does not include housing costs, which vary significantly between low-income and high-income households. However, over the period 2003–13 as a whole, the benefit-dependent CPI exceeded headline CPI by 0.1 percentage points and the pensioner CPI exceeded headline CPI

**Figure 27: Headline, benefit-dependent and pensioner CPI indices, 2003–13**



Source: Authors' calculations from ONS Living Costs and Food Survey and price data from the ONS.

by 0.25 percentage points. Thus, on average, uprating using the CPI would not have been quite sufficient to maintain the real value of working-age and pensioner benefits.

The costs of three different uprating scenarios in 2013 are calculated for both the RPI and CPI indices using the Institute for Fiscal Studies' (IFS) simulation model TAXBEN:

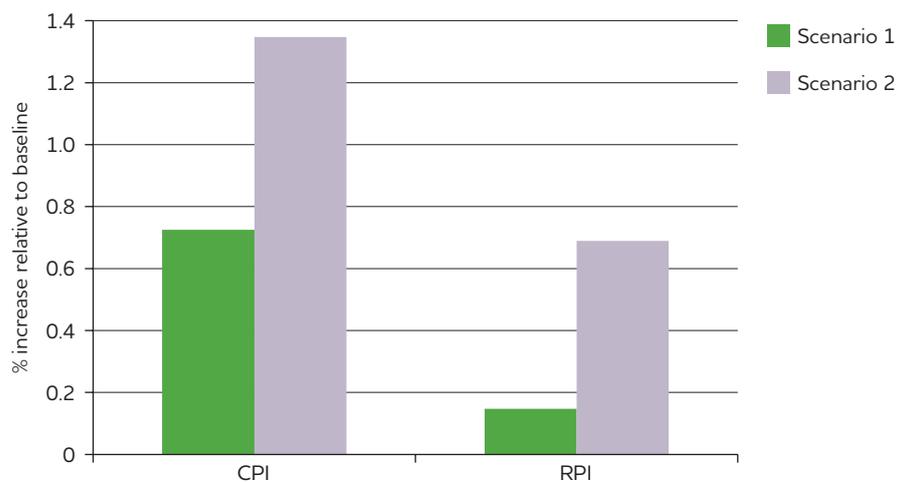
- Baseline: Uprate all parameters by headline inflation.
- Scenario 1: Uprate all parameters by headline inflation except pensioner benefits, which are uprated by pensioner-specific inflation.
- Scenario 2: Uprate working-age benefits by the benefit-dependent inflation rate, uprate pensioner benefits by the pensioner inflation rate and all other parameters by headline inflation.

To calculate the cost of the baseline scenario, the parameters of the April 2004 tax and benefit system are uprated in line with headline inflation in each September in the period 2004–13 (holding the system constant as it was in 2004). The cost of the tax and benefit system in 2013 given this uprating policy is then calculated. To calculate the cost of Scenario 1, state pension and pension credit parameters are adjusted in each September by the pensioner-specific inflation rate rather than the headline inflation rate. Finally, Scenario 2 is costed by uprating all other benefit parameters using the benefit-dependent inflation rate rather than with the headline inflation rate.

This analysis does not account for any labour supply response to the change in uprating policy. If wages or other sources of income rise in line with a different measure of inflation, the value of benefits relative to income earnings will change and work incentives will be affected. Estimating this effect is important to assess the feasibility of the reform but is beyond the scope of this report.

Figure 28 gives the cost of Scenarios 1 and 2 relative to baseline. Over the period 2004–13, the cost of uprating pensioner and working-age benefits by group-specific inflation rather than the RPI or CPI is relatively

**Figure 28: Cost of alternative uprating scenarios**



Notes: Benefit entitlements calculated using IFS's TAXBEN microsimulation model. Assumes full take-up of means-tested benefits. Scenario 2 is uprating all parameters by headline inflation except pensioner benefits, which are up-rated by pensioner specific inflation. Scenario 3 is uprating working-age benefits by the benefit-dependent inflation rate, up-rating pensioner benefits by the pensioner inflation rate and all other parameters by headline inflation.

Source: Authors' calculations using the Family Resources Survey the ONS' Living Costs and Food Survey, and price data from the ONS

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high. Up-rating group benefits by group inflation rates is more expensive than the baseline scenario for both the RPI and CPI. Under the CPI, up-rating working-age and pensioner benefits by the respective group inflation rates is 1.34% more expensive in 2013 than the baseline scenario. The relative cost of group-specific up-rating is lower when the default up-rating system is the RPI; in this instance, Scenario 2 cost 0.7% more than baseline in 2013. These figures should be seen in the context of an actual welfare bill in 2012–13 of £203.6 billion.<sup>20</sup>

Although the cost of the proposed up-rating policies is non-negligible, this suggests that the cost of differential inflation on low-income households has been high over this period. If the cost of the proposed policy was low, it would suggest that the cost of high inflation that low-income households experienced over the recession was balanced out by inflationary trends pre- and post-crisis.

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## 7 CONCLUSION

This report has calculated poverty and inequality statistics in a way that takes account of households' differential inflation experiences and compared them to statistics calculated using standard methods. The report finds that allowing for variation in household inflation experiences can make a noticeable difference to impressions of the change in poverty over time.

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Since the recession, standard methods have understated the rise in absolute poverty. Once inflation rates are allowed to vary with income, it is found that the absolute poverty rate was 0.5 percentage points higher. Assuming a population of Great Britain of 61.5 million, these figures imply that more than an extra 300,000 individuals were in absolute poverty in 2013–14 relative to standard measures. This report also finds that relative poverty increased more with the onset of the recession than standard methods would suggest. However, these trends are specific to this time period. In the years before the recession there was, if anything, a tendency for households living in poverty to face slightly lower inflation than average and, therefore, for changes in poverty rates to have been marginally more favourable than suggested by official statistics.

The report's findings imply that recent inflationary trends have tended to be 'anti-poor', and several policy responses to this have already been proposed. Of these, measures aimed at improving the purchasing power of low-income households through income transfers are generally to be preferred over attempts to redistribute by holding down the cost of certain goods (though there may be other reasons to introduce price policies). This report investigates the consequences of a move towards using group-specific inflation rates to uprate state benefits as a means of reducing the inflation risk faced by low-income households. It finds that over recent years this would not have been costless for the government; uprating pensioner benefits using the average inflation rate experienced by pensioners, and uprating working-age benefits and tax credits by the average inflation rate experienced by benefit-dependent households, would have raised the welfare bill by 1.34% in 2013 relative to the case where all benefits were

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uprated by the CPI (or 0.7% with the RPI). This is the inevitable consequence of the poor experiencing higher inflation rates in recent years. However, it is likely that such a policy would be revenue neutral in the longer term. The analysis presented here, and that of Crawford and Smith (2002) and Leicester *et al.* (2008), suggests that there is no systematic tendency for the low-income households to experience higher inflation than average for extended periods of time. Of course this revenue neutrality would come about because, while benefits would increase by more than headline inflation in some years, in other years they would increase by less. The political economy of increasing benefits by less than economy-wide inflation some of the time might complicate the operation of this kind of uprating policy.

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# NOTES

- 1 See: [http://epp.eurostat.ec.europa.eu/statistics\\_explained/index.php/People\\_at\\_risk\\_of\\_poverty\\_or\\_social\\_exclusion](http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/People_at_risk_of_poverty_or_social_exclusion)
- 2 See: <http://www.census.gov/hhes/povmeas/publications/orshansky.html#C9> and <http://www.census.gov/hhes/www/poverty/about/overview/measure.html>
- 3 These are 'before housing cost' measures, a concept which is explained below.
- 4 The MIS applies to so-called nuclear families and to childless adults. It does not cover families living with other adults.
- 5 HBAI stands for Households Below Average Income and is the term used in official poverty statistics.
- 6 Authors' calculations using RPI and RPIJ 'annual percentage changes' from <http://www.ons.gov.uk/ons/datasets-and-tables/data-selector.html?dataset=mm23>
- 7 For example, the weights used to calculate price changes in each month of 2013 use spending shares for June 2011 until July 2012.
- 8 The small differences between a deflator calculated straight off of the LCFS and the official deflator are discussed in more detail in Appendix A1.
- 9 Poverty measures aim to calculate the number of *individuals* (not households) who are in poverty, so in what follows the inflation rate of the household is assigned to each of its members (in the same way the household's equivalised income will be assigned to each household member).
- 10 Incomes in both datasets are calculated 'before housing costs' using the HBAI definition.
- 11 In order to make deflators calculated in this report comparable to the current deflators used for official statistics, they are adjusted up or down according to the difference between the LCFS plutocratic average inflation rate and the actual HBAI deflator. The adjustments involved are small.
- 12 The key advantage of the Fisher price index is that it means that comparisons going backward in time from some base year will give the same income changes that would have obtained had the comparison been made forward in time from some earlier base year.
- 13 It is not possible to calculate real growth rates in 2013–14 because budget share information from 2014–15 would be required to calculate the Fisher price index in this instance. Please see Appendix A3.

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- 14 Incomes in both datasets are calculated 'before housing costs' using the HBAI definition.
  - 15 See, for example: <http://press.labour.org.uk/post/84412232789/ed-miliband-launches-labours-cost-of-living-contract>
  - 16 That said, the decision to limit benefit increases to 1% was motivated by the fact that otherwise benefit rates would grow faster than real earnings, suggesting that this is not the only consideration the government pays attention to.
  - 17 In addition there is of course the issue of which of several possible indices (RPI, CPI, RPIJ, CPIH and so on) the government should use for uprating purposes. The appropriate choice will depend on the coverage and methods used in the index, and in general how good a measure of the cost of living it is considered to be. This area remains the subject of some debate (see for instance <http://www.statsusernet.org.uk/communities/resources/viewdocument/?DocumentKey=0cb5a678-9e41-4a9c-aa39-b35aed53bf7f>).
  - 18 The year 2004 must be used as the starting year because two previous years of data is required to calculate the weights needed for computing group-specific inflation rates in a way comparable to how the ONS calculates the RPI.
  - 19 A household is classified as benefit-dependent if over half its income comes from state benefits. A household is classified as a pensioner household if the first benefit unit is a pensioner.
  - 20 See benefit summary table in 'Outturn and forecast: Autumn Statement 2013': <https://www.gov.uk/government/publications/benefit-expenditure-and-caseload-tables-2013>

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# APPENDIX A1

## Household-specific inflation rates

This appendix provides more details about the construction of the household-level inflation indices used in section 3 of this report. Formally, the headline rate of inflation between periods  $t$  and  $t + 1$ ,  $\pi_{t,t+1}$ , is calculated as:

$$\pi_{t,t+1} = \sum_{k=1}^K w_{k,b} \frac{p_{k,t+1}}{p_{k,t}}$$

where  $w_{k,b}$  is the weight placed on good  $k$  taken from spending shares in a base period,  $b$ , and  $p_{k,t+1}/p_{k,t}$  is the inflation rate of good  $k$  between the time periods  $t$  and  $t+1$ . The base period used in the RPI (and so in the HBAI deflator) is spending shares for the period of June two years previously to July in the previous year (so for example, the weights used to calculate price changes in each month of 2013 use spending shares for June 2011 until July 2012).

The above formula is adjusted to calculate household specific inflation rates as follows:

$$\pi_t^h = \sum_{k=1}^K w_{k,t}^h \frac{p_{k,t+1}}{p_{k,t}}$$

where  $w_{k,t}^h$  is the budget share of good  $k$  for household  $h$  in period  $t$   $p_{k,t+1}/p_{k,t}$  is the inflation rate of good  $k$  between the time periods  $t$  and  $t+1$ . This inflation rate is then assigned to all *individuals* in the household (in the same way that in the HBAI methodology household equivalised income is assigned to all individuals in the household before they are ranked to determine income deciles, poverty and so on).

The 'goods' used for the index are at the 'section' level of the RPI (that is at the level of categories such as 'bread', 'milk', 'footwear' etc.). The list of sections used in this report, however, differs slightly from those used currently to calculate the RPI, as in some cases sections that have changed over time have been aggregated in order to generate a consistent series of inflation measures over a long time period. For most sections, measuring total expenditures is relatively straightforward: all codes relating to bread purchases are added to give the 'bread' section, spending on all shoes and related items adds up to the 'footwear' section and so on. One less straightforward case is housing-related expenditures. Housing expenditures

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are defined in such a way as to match how they are calculated in the RPI as closely as possible. Rent and local taxes are recorded net of any rebates or status discounts (thus households receiving full housing benefit, for example, will be recorded as having zero expenditure on rent). From the perspective of measuring inflation, this is important – households that have all their rent paid through housing benefit will be shielded from any rise in rental costs and so their personal inflation rate will be unaffected. For those with mortgages, only mortgage interest costs are included as spending, with mortgage principal repayments considered as a form of saving or investment rather than expenditure – this again matches the approach in the RPI.

There are reasons to be confident that the variation in household inflation rates calculated in this report gives an accurate impression of the variation in the HBAI deflator that is actually experienced by UK households. This is because there is a very close correspondence between the official HBAI deflator and the equivalent deflator calculated from the LCFS dataset (using plutocratic weights from the same time period, and otherwise following the RPI methodology as closely as possible). Figure 2 shows that the series are close to identical. The small discrepancies between the measures are likely to arise from two factors. First, although the HBAI deflator is largely constructed using data from the ONS's LCFS, it also draws on other datasets for information on those expenditures that are known to be under-reported in expenditure surveys (such as tobacco, confectionery and alcohol). Second, the HBAI deflator includes the costs and expenditure shares of housing depreciation: an item that covers the costs of maintaining a dwelling at a constant quality. It is not possible to attribute this item to different households using the information in the LCFS and so it cannot be included in this report's analysis. In what follows this will amount to an assumption that this item of expenditure does not vary systematically across the income distribution. Although the differences between the measure calculated using the LCFS and the official measure are small, the household or group-specific inflation rates calculated in this report are adjusted where necessary according to the difference between the two series in Figure 2. This means that if the index calculated in the LCFS is slightly higher than the official index in a given year for instance, household-specific inflation rates will be adjusted slightly downward in that year in order to ensure that they (and any associated poverty statistics) are as closely comparable to official numbers as possible. Throughout this report, households in Northern Ireland are excluded as the energy market there is different from that in England, Scotland and Wales (making it difficult to calculate comparable inflation rates for these households).

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# APPENDIX A2

## Calculating absolute poverty rates

This technical appendix goes into more detail about how budget shares at the absolute poverty threshold are predicted, and real absolute poverty rates calculated, in section 4.

The procedure starts by taking data in 2010. In each year,  $t$ , a simultaneous (seeming unrelated) regression model on all the individuals in the data is run

$$w_{i,t}^k = \beta_{0,t}^k + \beta_{1,t}^k \text{income}_i + \beta_{2,t}^k \text{income}_i^2 + \beta_{3,t}^k \text{income}_i^3$$

where  $w_{i,t}^k$  is the budget share of individual  $i$  for good  $k$  in period  $t$ . One good is left out of this regression, and then the budget shares for this omitted good are taken to be simply

$$w_{i,t}^N = 1 - \sum_{k=1}^{N-1} w_{i,t}^k$$

This ensures that all budget shares sum to 100%. These regressions are then used to predict budget shares poverty threshold (denoted  $y_t$ ). Starting from 2010–11, the absolute poverty threshold in each following period  $y_{t+1}$  is then:

$$y_{t+1} = y_t \times \sum_{k=1}^K \hat{w}_t^k \frac{p_{k,t+1}}{p_{k,t}} + \delta_t$$

where  $\hat{w}_t^k$  is the predicted threshold budget share of good  $k$  in period  $t$  and is a correction adjusting for the difference between the aggregate inflation rate calculated exclusively off the LCFS data (following official methodology as closely as possible) and the official HBAI deflator. In the years prior to 2010–11, the absolute poverty threshold is calculated in a similar way but going ‘backward’ in time:

$$y_{t-1} = y_t \times \sum_{k=1}^K \hat{w}_t^k \frac{p_{k,t}}{p_{k,t+1}} + \delta_t$$

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The 'real' poverty rate is then simply the number of households that fall below these new thresholds in each year.

To calculate standard errors needed to establish statistical significance, the entire procedure for 200 replications is bootstrapped for 200 replications.

All calculations are weighted to account for survey non-response.

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# APPENDIX A3

## Calculating relative poverty rates

This section outlines the methodology underlying the relative poverty results in section 5.

To calculate changes in real income, nominal income growth must be adjusted for changes in prices. Nominal expenditure growth between a base period, 0, and a later period  $t$  can be broken down into a price growth component,  $P_{0t}^p$ , and a quantity (or real income) growth component,  $Q_{0t}^p$ :

$$\frac{x_t}{x_0} = P_{0t}^p Q_{0t}^p$$

The aim is to recover the growth rate of real income at each percentile of the nominal income distribution in the base year. Let  $Q_{0t}^p$  represent the change in real income at the  $p$ th percentile of the nominal income distribution between the base period and period  $t$ . From above,  $Q_{0t}^p$  can be calculated by dividing the growth rate in nominal expenditure by the change in prices at the  $p$ th percentile:

$$Q_{0t}^p = \frac{x_t^p}{x_0^p} \frac{1}{P_{0t}^p}$$

The growth in nominal expenditure is easily calculated from equivalised income data. Additional computation is required to recover the change in prices at each percentile. To calculate  $P_{0t}^p$ , annual price indices are *chained* together. This involves first calculating a price index between period 0 and 1 ( $P_{01}^p$ ), and between period 1 and 2 ( $P_{12}^p$ ) and so on; the final index linking the base period to period  $t$  is then the product of the annual indices:

$$P_{0t}^p = P_{01}^p \cdot P_{12}^p \cdot \dots \cdot P_{t-2,t-1}^p \cdot P_{t-1,t}^p$$

A Fisher price index is used to calculate year-on-year price changes. The Fisher price index at percentile  $p$  for any two periods  $s$  and  $t$  is calculated as the square root of the product of the Laspeyres and Paasche price indices:

$$P_{st}^p = \sqrt{(1 + \pi_{st}^{LASP,p}) (1 + \pi_{st}^{PAA,p})}$$

where

$$\pi_{t,t+1}^{LASP,p} = \sum_{k=1}^K w_{k,t}^p \frac{p_{k,t+1}}{p_{k,t}}$$

and

$$\pi_{t,t+1}^{PAAS,p} = \sum_{k=1}^K w_{k,t+1}^p \frac{p_{k,t+1}}{p_{k,t}}.$$

The Laspeyres and Paasche price indices use different periods for the weights in the inflation calculation. By combining the two the Fisher has the desirable property that  $P_{0t}^p = I / P_{t0}^p$ . Neither the Laspeyres nor the Paasche index satisfies this property, meaning that comparisons backward in time from some base year would give different results to comparisons going forward in time from some earlier base year.

Using flexible regression techniques,  $\pi_{st}^{i,p}$  is predicted, smoothing over the Laspeyres and Paasche inflation rates experienced by households with incomes ‘close’ to the income level associated with percentile  $p$ . In each time period, the nonparametric regression model is specified as:

$$\pi_{t,t+1}^p = f_t(x_t) + e_t$$

The model is estimated at each percentile of the income distribution using the Nadaraya-Watson kernel smoother with an Epanechnikov kernel function and with the bandwidth selected using the ‘rule of thumb’ method set out in Fan and Gijbels (1996).

To compute relative poverty statistics, the level of real income in each year is needed, not just its growth rate. The real income associated with the nominal income percentile  $p$  at time  $t$ ,  $r_t^p$ , is given as:

$$r_t^p = \frac{x_t^p}{x_0^p} \frac{I}{P_{0t}^p} r_0^p$$

The real income distribution and quantiles of this can then be obtained by putting  $r_t^p$  in order (nominal percentiles may be re-ranked once the fact that some have experienced higher rates of inflation than others is taken into account).

Using this method, the real income distribution at each financial year between 2002–3 and 2012–13 is obtained. The same approach but using the change in the price level implied by the HBAI deflator is applied to calculate the real income distribution according to ‘standard’ methods so that compare the impact of moving from a common inflation rate to income-specific inflation rates can be compared.

Measures of real relative poverty are then calculated by counting the number of households with real incomes beneath 60% of the median of the real distribution.

To assess the significance of the impact of differential household inflation rates on the trends in relative poverty, the procedure that generates the real price index and real relative poverty rates is bootstrapped with 500 replications.

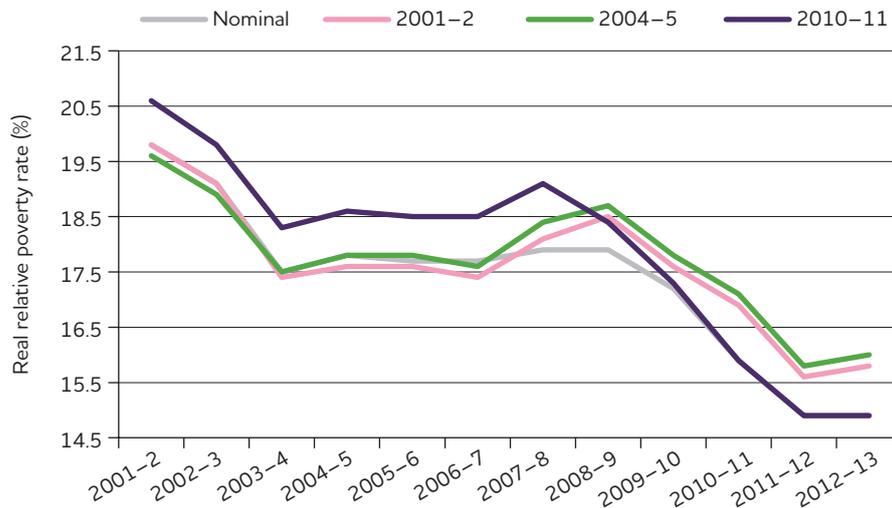
### Base year effects

The use of the Fisher price index means that growth rates between  $r_t^p$  and  $r_{t-1}^p$  will be invariant to levels of real income in the base year, and will not

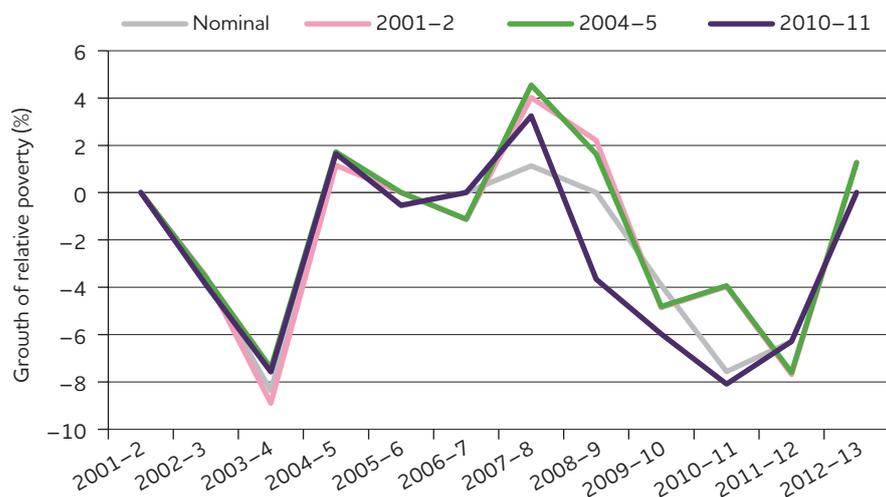
depend on which period is designated period 0 (or whether the base year comes before or after period  $t$ ). However, levels of real income will of course depend on  $r_0^p$ . In section 5, base year real incomes are taken to be given by the nominal income distribution in 2001–2 deflated by the standard HBAI deflator.

This choice is essentially arbitrary but is not especially important since this report is primarily concerned with how relative poverty has changed over time when a real measure is used. This will depend on the evolution of quantiles of the real distribution (such as the median). Unfortunately, these also need not be independent of the choice of base year. Median real income depends not just on what growth rates for each nominal percentile were but also on what nominal incomes were in the initial period. The sensitivity of real income quantiles to the base year results from the re-ranking that must be done once real growth rates have been added on. The effect of this ranking depends on how different nominal incomes were in the base year, and it may not matter much if the effect is small. The robustness of the results in this report to the choice of base year is examined in Figures A1 and A2.

**Figure A1: Comparing relative poverty rates given different choice of base year, 2001–2 to 2012–13**



**Figure A2: Comparing growth of relative poverty rates given different choice of base year, 2001–2 to 2012–13**



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Figure A1 shows real poverty rates for different base years. That the levels of real poverty depend on when nominal incomes and real incomes are set to be the same is no surprise. Figure A2 shows changes in real poverty rates for different base years. These do differ but key results are robust to which base year is used. Real poverty largely follows growth in standard measures until 2007–8 when real poverty increases by much more.

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