Comparing household inflation experiences measured by the CPI and RPI

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Abstract

In October 2012, the ONS announced a consultation on whether the statistical methods used to calculate the Retail Prices Index (RPI) should be changed to bring them closer in line to those used in the Consumer Prices Index (CPI). Previous IFS work has looked at how inflation rates varied across different households, using survey data on household expenditure to calculate RPI-based measures of household-specific inflation. This paper analyses whether CPI-based measures give similar results and the reasons behind any differences. In doing so, we investigate whether proposed methodological changes to the RPI would have changed our previous results on the difference in inflation rates across household groups had they been implemented before. We find that, after stripping out housing costs, there are only small differences between RPI and CPI-based measures of the gaps between high and low income households and pensioner and non-pensioner households. This suggests that the 'formula effect' difference between the two indices doesn't systematically affect the goods typically consumed by either pensioners or low income households more than the goods typically consumed by non-pensioners and high income households.

1. Introduction

Headline measures of inflation such as the Retail Prices Index (RPI) and Consumer Prices Index (CPI) give an average measure of inflation for households across the economy. However, individual households may experience inflation rates which are very different from this average. One reason for this is that households spend their budgets in different ways and so will feel the impact of given price changes more (or less) than others.[2] Household spending patterns – and so inflation experiences – could vary systematically across different groups. For instance, lower income households tend to spend more of their budget on food, meaning that when food prices are rising quickly, low income households will experience higher inflation rates than high income ones.

Previous IFS research has used the RPI inflation measure to investigate how variation in spending patterns has affected the distribution of inflation rates across households.

Crawford and Smith (2002) look at household level inflation rates over the period 1976-2000. Over the period as a whole they find that the richest 10% of households experienced an average annual inflation rate of 7.1% while the poorest 10% experienced an average rate of 6.8%. In individual years however, these differences could be much larger, and the ranking of rich and poor households often changed. They found that the variation of inflation rates among households changed considerably from year to year. On average over the period only about a third of households experienced inflation rates within 1 percentage point of the average, but this proportion ranged from just 9% in 1989 to 65% in 1994.

Leicester, O'Dea and Oldfield (2008) examine the inflation experience of older households from 1977-2008. They find periods when pensioners experienced higher inflation than non-pensioners, but also periods when the reverse was true. Overall the differences between the two groups were small over the long-term.

Levell and Oldfield (2011) find that between 2000 and 2009, inflation rates were higher on average for low income households, pensioners and benefit dependent households.

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[2] Households may also experience different price changes for the same products. We do not consider this source of variation here as there is no comprehensive data on which we can draw to analyse this.

These previous studies based their analyses on the RPI inflation measure. As we discuss below, the CPI differs from the RPI in several respects, and in some years has given a very different rate of inflation. This naturally raises the question of whether patterns of average inflation rates for different household groups vary from one measure to another. Two developments in recent years mean that an analysis of this kind using CPI-based measures is of greater interest:

1) The RPI is increasingly being replaced by the CPI for policy purposes. The CPI replaced RPIX[3] as the Bank of England's measure for inflation targeting in December 2003. In the June 2010 Budget,[4] it was announced that CPI would also become the measure used to uprate state benefits and tax credits from April 2011, replacing the RPI (for universal benefits) and the Rossi Index (for means-tested benefits) which had been used previously.[5] The CPI also replaced the RPI in the 'triple lock' guarantee for the basic state pension.[6] Finally in the June 2011 Budget[7], it was announced that CPI would be used to index direct tax thresholds and tax free allowances from April 2012, replacing the RPI.

2) In October 2012, the ONS announced a consultation on possible changes to the RPI (see ONS, 2012a). These included the possibility of eliminating the so-called 'formula effect' (see below) by calculating the RPI using the same methods as the CPI.[8] As we will see, this would have a substantial effect on the level of measured RPI inflation. Looking at the distribution of inflation

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[3] RPIX is a derivative of the RPI measure that does not include mortgage interest payments

[4] HM Treasury (2010), *Budget 2010*
http://cdn.hm-treasury.gov.uk/junebudget_complete.pdf

[5] The Rossi Index is an RPI measure excluding mortgage interest payments, council tax, housing depreciation and rents

[6] The rule that the basic state pension will be increased annually in-line with the highest of earnings, prices or 2.5%.

[7] HM Treasury (2011), *Budget 2011*
http://cdn.hm-treasury.gov.uk/2011budget_complete.pdf

[8] The other possibilities under consideration were:

1) Changing the RPI so as to make the calculation of prices for clothing and footwear consistent with the CPI;

2) Replacing one of the formulae used in the RPI, but not the other (which would also have the effect of brining the RPI and CPI closer together).

3) Making no changes to the RPI.

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across households using a CPI-based measure would help to tell us if the pattern of inflation across household groups would be affected by such a change.

In this paper, we will compare patterns of inflation across household groups using measures based on both the RPI and CPI over the period 2001 to 2010. We assess how far we can explain differences in the results for the two measures and what this might imply for any change to the way in which the RPI is calculated.

The remainder of the paper is structured as follows. Section 2 discusses some of the differences between the RPI and the CPI. Section 3 describes the data we use and how we construct measures of household level inflation. It also gives some reasons why the distribution of inflation across households may differ when we move from the RPI to the CPI definition. Section 4 looks at how spending patterns and inflations rates differ across income groups and across pensioners and non-pensioners. Section 5 concludes.

2. Differences between the RPI and CPI

In this section we will discuss some of the differences in the way the RPI and CPI are calculated and how this might mean they give different impressions of the relative inflation experiences across household groups.

2.1   Differences in measured inflation over time

The RPI and the CPI are the two most widely used measures of inflation in the UK. The CPI was introduced in 1996 according to regulations set down by Eurostat, with the aim of producing comparable inflation measures across European countries. The RPI was first constructed in the 1950s, drawing on an index introduced at the end of the First World War to document the sharp price increases associated with the end of the war.

The CPI typically gives a lower measure of inflation than the RPI. Over the period 2001-2010, it was on average 0.7 percentage points lower each year. However, the differences between the RPI and CPI vary quite a lot from year to year – and in some years the CPI has been higher than the RPI. For instance, in 2009 the RPI fell substantially while the CPI did not, leading to the CPI being 2.7 percentage points higher than the RPI. The official rates of RPI and CPI inflation are shown below in Figure 2.1.

Figure 2.1 CPI and RPI annual inflation, 2001 –2012
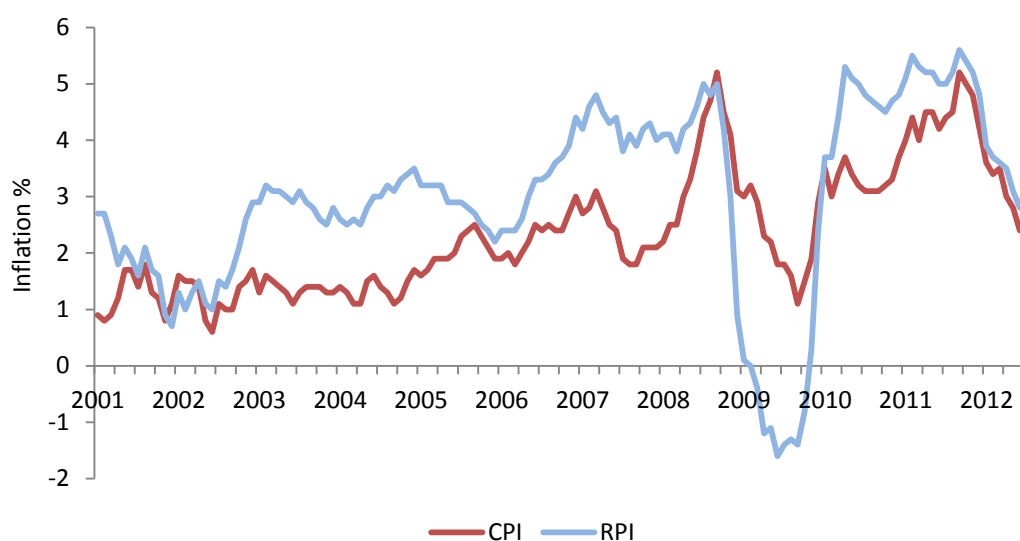
Source: Office for National Statistics

2.2 Methodological differences

The CPI and RPI are similar in their basic approach to measuring inflation. Both track the cost of purchasing a representative 'basket' of the most commonly bought goods and services. This is done by collecting a large sample of prices across the economy and then weighting price changes for different items from one period to the next according to how important they are in households' average budgets. This means that a price rise for a good which makes up 10% of spending will have a much bigger impact on the inflation rate than for a good making up 1% of spending. The indices do vary, however, in their coverage and construction, which means that they may give different rates of inflation in any given year. These differences include the data they use, the populations they cover, the coverage of goods and services which make up the 'basket', and the formulae used to calculate price changes.

Data

The RPI primarily draws on household-level expenditure data from the Office for National Statistics (ONS) Living Costs and Food Survey (LCFS) to construct expenditure weights. The CPI uses aggregate data from Household Final Monetary Consumption Expenditures in the UK National Accounts, which are in turn partly based on information from the LCFS.

Population

Owing partly to the differences in data used, the RPI represents expenditure in the UK and abroad by the majority of UK private households. It excludes those living in institutions (such as nursing homes and halls of residence) and spending by foreigners in the UK, none of which is captured in the LCFS data. It also excludes very high earners and low-income pensioners dependent on state benefits, because it is believed that their expenditure patterns are very different from 'average' households. The CPI on the other hand represents all UK private households and those living in institutions. It includes spending by foreign visitors to the UK, but excludes foreign spending by UK households.

Coverage

The RPI includes several items of expenditure not covered by the CPI. This includes most housing costs, including mortgage interest payments (MIPs), council tax, building insurance and house purchase costs (though the CPI does include a measure of housing rent).[9] The RPI also includes vehicle excise duty, TV licences and trade union subscriptions which, prior to 2012 were not covered by the CPI. The CPI includes stockbroker fees, university accommodation fees, foreign student tuition fees and unit trust fees which are not covered by the RPI.

These differences in data, population and coverage mean that the spending weights of individual items in the CPI differ from those in the RPI, affecting how a given price change influences the overall CPI and RPI inflation figure. The extent to which this means the CPI inflation rate will be higher or lower than the RPI will depend on the price changes for the items included or excluded by each index and the weights given to items covered by both measures.

Formula effect

A final, more technical, difference between the RPI and CPI concerns the method used to construct inflation rates for different items in the basket.

Price indices such as the RPI and CPI are calculated in successive stages.[10] First the ONS calculates average price increase for very similar products such 800g loaves of white unsliced bread sold in the South East of England, then an average

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[9] In 2013, the ONS will publish an index alongside the CPI which would include owner occupied housing costs known as CPIH.

[10] Details of this procedure can be found in Chapter 2 of the ONS CPI Technical Manual (ONS, 2012b).

of these is taken to calculate the inflation rates of broader categories (bread, then food and so on). For most of these stages, the CPI and RPI average price changes in the same way. Where they differ is at the very first stage. At this level the CPI sometimes takes a geometric mean of prices,[11] whereas in the RPI one of two arithmetic means is used.[12]

The difference between the RPI and CPI that results from this is known as the 'formula effect'. The formula effect reduces the CPI inflation rate relative to the RPI. This could be thought of as reflecting the fact that people are assumed to substitute away from goods whose prices are rising relatively quickly.

In October this year, the ONS announced a consultation considering various options to change the way the RPI was calculated. One of these options was to eliminate the formula effect entirely by using the same formulae in the RPI as are used in the CPI.

The ONS publishes a decomposition of the gap between the RPI and CPI in each month which allows us to compare the contributions of each of the methodological differences between them. Figure 2.2 shows the impact of excluding most housing costs from the CPI, the formula effect, and the residual differences between the two measures between 2005 and 2012. A positive value means that the factor increases CPI inflation relative to RPI.

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[11] The GM is only sometimes used in the CPI, the remaining elementary aggregates prices are calculated using one of the arithmetic means used in the RPI (the "ratio of averages"). Details can be found in Chapter 9 of the CPI Technical Manual (see footnote 9).

[12] These are the ratio of averages and the average of relatives. Details of these methods and the reasons why different formulae are used can be found in sections 9 and 10 of ONS (2012b).

Figure 2.2 Contributions of factors to differences in the CPI and RPI, 2005-2012
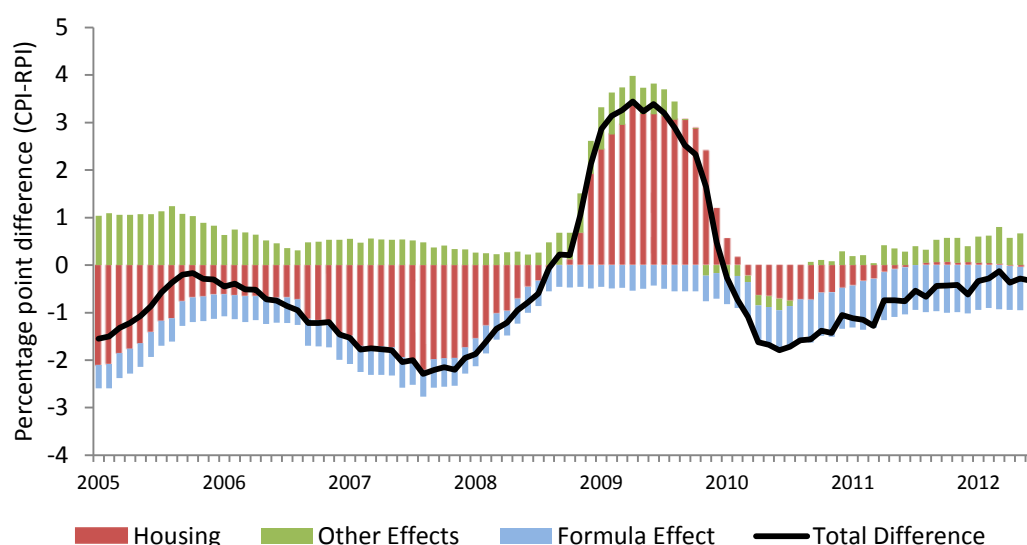
Source: Office for National Statistics

Note: A positive value means that the factor increases CPI inflation relative to RPI.

The formula effect consistently exerts downward pressure on the CPI compared to the RPI, averaging -0.5 percentage points in 2005-2009, increasing in size to -0.9 percentage points from 2010 onwards. The recent increase in the formula effect has made it the most important difference between the two inflation measures in recent years, and was almost entirely due to a change in the sampling of clothing prices that took place in 2010 (see ONS, 2011). This decomposition tells us that the likely impact of the change to the formulae used in the RPI would be to reduce it by about 0.9 percentage points.

The CPI's omission of most housing costs had the largest effect on the difference in CPI and RPI between 2005 and 2009, and the effect of housing tends to track the total difference between CPI and RPI closely. This is mainly because the formula effect is fairly stable and small, whereas the impact of omitted housing costs fluctuates quite dramatically (such as the abrupt switch from a low of -1.5 percentage points in August 2007 to a peak of +2.8 percentage points in April 2009). This change in the contribution of housing largely reflects a substantial reduction in mortgage interest costs that took place in 2009 (which fell 42% as measured by the RPI). This was due to the onset of the financial crises which caused official interest rates to fall to 0.5%. In 2011 and 2012, the contribution of housing costs to the overall gap was essentially zero, reflecting the fact that these housing costs increased at roughly the same rate as the RPI as a whole. In the long run, however, housing costs have tended to rise more quickly than other

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prices meaning that their omission from the CPI has tended to reduce CPI inflation relative to RPI. The Office for Budget Responsibility estimates that in the long run, housing costs will reduce CPI by around 0.5 percentage points compared to the RPI (Miller, 2011).

Other differences between the CPI and RPI (population, weighting and other coverage differences) generally push the CPI measure higher than the RPI, by an average 0.5 percentage points over the period considered.

2.3 Differences between RPI and CPI when measuring household level inflation

It is possible that in some years some household groups may have a higher inflation rate than others according to the RPI-based measure, but the reverse could be true when we consider the CPI-based measure. This could arise because of the methodological differences between the measures described above having different effects for different group. Two main possibilities stand out.

Firstly, the CPI omits the majority of housing costs, which means that other expenditure items are weighted relatively more heavily than in RPI. Households who devoted more of their budgets to these goods could see quite different RPI and CPI inflation rates depending on how fast housing costs were changing relative to the prices of other goods.

Secondly, the use of a geometric mean for particular goods in the CPI means that inflation rates will differ between the CPI and the RPI. The differences may not be constant across goods, and will be largest for those items with larger amounts of price dispersion and which make greater use of the geometric mean. This could affect the inflation experience of the lower income relative to higher income households for instance. If CPI inflation for luxuries were lower than RPI inflation, then this would reduce the CPI inflation rate of the higher income households relative to the lower income ones.

3. Data and methods

3.1 Data description

The data we use is the LCFS between 2001 and 2010.[13] The LCFS is conducted annually and takes a cross sectional sample of approximately 6,000 households. These households record all expenditure in an expenditure diary over a two-week period, and are interviewed about their family characteristics, income, and spending on larger items over a longer period of time. Several hundred separate expenditure categories are recorded, with all observations converted into weekly averages.

Throughout this paper, we exclude households in Northern Ireland as the energy market there is different from that in England, Scotland and Wales. [14] All data are weighted to take account of the fact that certain types of households are systematically more or less likely to respond to the survey.[15]

3.2 Estimating household measures of inflation

In order to identify the differences between the inflation experiences of different groups of the population we need to construct measures of inflation at the household level. We calculate two measures, one based on the CPI basket of goods and services and prices, and one based on the RPI basket and prices. These will henceforth be referred to as our "CPI- and RPI- based measures". For each household we calculate how much of their total income they spend on each of the 'sections' that are used to classify goods in the two indices.[16] These budget shares are then multiplied by the price changes reported by the ONS (as measured by either the RPI or the CPI) and then added up to give an inflation rate for that household over the past year. Further details can be found in Section 3 of Levell

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[13] Data for 2001 only covers the final 3 quarters of the year. Data covering the first quarter of 2001 and earlier is not organised according to COICOP classifications and so difficult to match to the groups used in the CPI.

[14] In addition, note that in the 2008 LCFS data, there is an error in the calculation of water rates for Scotland. For this year, we match in data from Scottish Water and use information on council tax band to impute the data. Applying this imputation method to years in which there are no errors suggests that our results are robust to using this approach.

[15] See ONS (2010), *Living Costs and Food Survey: User Guide Volume A*.

[16] There are 84 sections in the CPI and 71 in the RPI.

and Oldfield (2011). The only difference here is that we also calculate inflation rates using CPI spending categories and price indices as well as RPI ones.

Appendix A gives a comparison of our average inflation rates with the ONS's published indices and some reasons why we would expect them to differ. Budget shares for more aggregated spending categories in 2009 are presented in Appendix B.

As noted in Section 2.3, there are essentially two important reasons why the gap between high and low income households might be different when looking at household inflation experiences using RPI- and CPI-based measures: housing costs and the formula effect. To assess the importance of omitted housing costs in explaining differences between RPI and CPI-based inflation measures across groups, we use the data to construct a measure of RPI inflation that excludes these same costs (MIPs, council tax, building insurance and ground rent).[17] We call this RPI-LH ('RPI Less Housing'). This new index is more comparable to the CPI in terms of coverage, but will still differ from the CPI because of the formula effect and other smaller differences in coverage. We can therefore attribute remaining differences between the RPI-LH measure and the CPI-based measure to these other effects. Since non-housing coverage differences are quite minor, any residual is likely to be largely due to the formula effect.

4. Household inflation experiences

In this Section, we examine how average household-level inflation rates have varied across different groups for different inflation measures. Section 4.1 looks at how inflation rates have varied over the income distribution. To compare different income groups, we first sort the population each year in ascending order by equivalised income.[18] We then divide it into equally sized groups called 'quintiles' (if split into 5), and 'deciles' (if split into 10). Having calculated an inflation rate for each household, we can then take averages across different

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[17] An additional housing cost, 'depreciation', is included in the RPI but not the CPI. We do not have data on how this varies across individual households so it is already excluded from our household-level RPI measure.

[18] This adjusts household incomes to take account of family size and economies of scale involved in sharing accommodation. Larger families would require a larger income than smaller households to attain the same standard of living, and so their equivalised incomes will be smaller (reflecting the fact that they are poorer than a look at their actual incomes would suggest). We equivalise using the McClements scale (McClements, 1977).

income groups. Section 4.2 presents results similar to these taking averages across pensioner and non-pensioner households.

4.1   Household inflation experiences over the income distribution

Figure 4.1 shows the average annual RPI and CPI-based inflation rates over the whole period (2001 to 2010) broken down by income decile. For both of our measures, lower income households experienced higher average rates of inflation than higher income households. As would be expected, all income groups experienced lower inflation as measured by the CPI. The differences seem fairly consistent across the income distribution. In all deciles, the average RPI-based inflation rate is around a third higher than the average CPI-based inflation rate. The CPI-based measure does not, however, tell a noticeably different story about the pattern of average inflation across income deciles over this period.

**Figure 4.1 Average household inflation by income decile, 2001–2010**
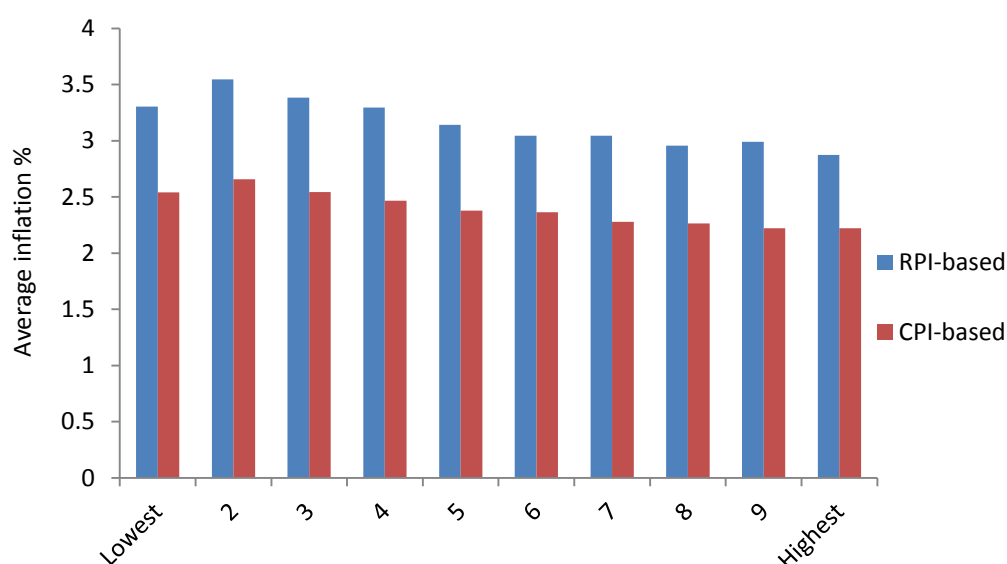
Source: Authors' calculations from the LCFS and ONS price data

Figure 4.1 does not tell us anything about how CPI and RPI inflation measures varied by income from year to year. Simply because higher income households experienced lower inflation on average than the lower income households across the whole period does not necessarily mean this was true in every year. Furthermore, trends in RPI and CPI-based measures may look different across income groups over time. To examine this more closely, Figure 4.2 compares the year-by-year average inflation rates for the top and bottom quintiles for our CPI (left-hand panel) and RPI (right-hand panel) based measures.

CPI-based inflation was on average greater for lower income households than higher income households in all years, except 2010. The gap varies from year to year. There was almost no difference in average CPI inflation rates in 2002, but the gap was 1.2 percentage points in 2008.

The RPI-based measure, on the other hand, shows far more variation. Households in the top quintile had, on average, higher inflation than those in the bottom quintile in 2003, 2004, 2005, 2007 and 2010.

Figure 4.2 Average household inflation by income quintile, RPI-based measure and CPI-based measure
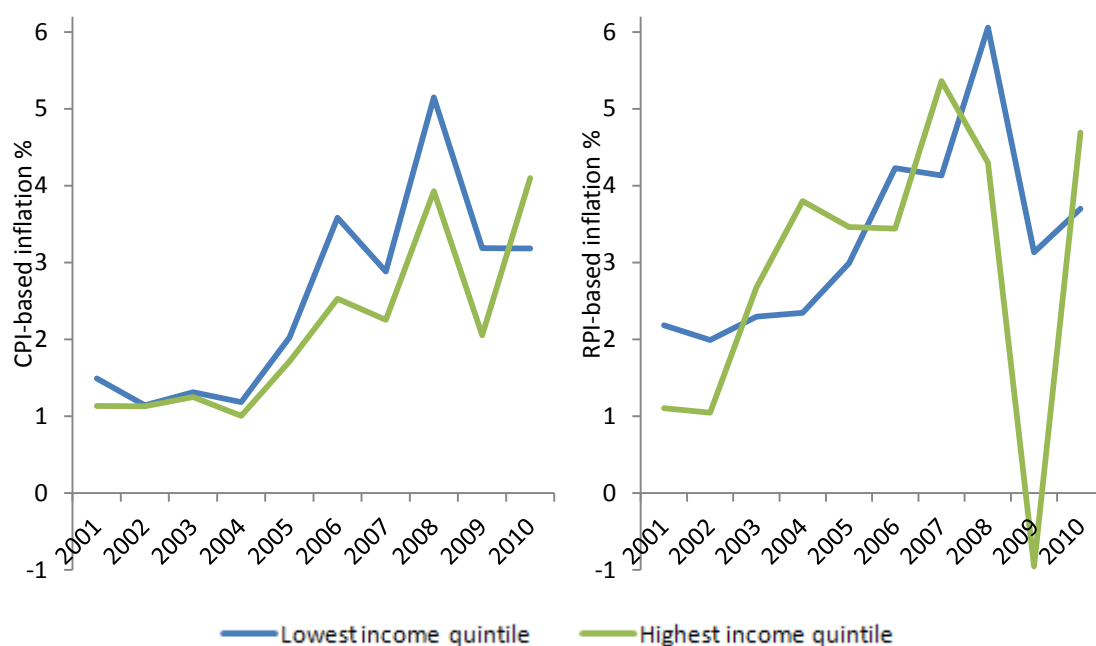
Source: Authors' calculations from the LCFS and ONS price data

The most prominent feature of the RPI-based results is the sudden fall in 2009, which was largely driven by a fall in housing costs as discussed earlier. This resulted in far larger fall in the average inflation rate in the top quintile (falling by 5.3 percentage points, from 4.3% in 2008 to -1.0% in 2009) than in the bottom quintile (falling by 3 percentage points from 6.1% to 3.1%). This divergence is not visible for our CPI based measure, where all groups experienced a similar reduction in average inflation rates of about 2 percentage points between 2008 and 2009.

4.1.1 Explaining differences between the CPI and RPI measures

What explains the differences in inflation rates over time between the CPI and the RPI-based measures? As described earlier, we control for the influence of

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housing costs by looking at how our average RPI-LH measure for the different income groups compares to the CPI measure.

The RPI-LH for the top and bottom income quintiles is shown in Figure 4.3. It is immediately clear that trends in inflation for the two groups look much more similar to those we saw for our CPI-based measure. With the exception of the years 2003 and 2010, the lowest income quintile experienced consistently higher average inflation than the highest income quintile with the difference peaking in 2008. This is very similar to the trends observed for the CPI-based measure. For both groups, the RPI-LH measure is consistently higher than the CPI measure, by on average 0.5 percentage points.

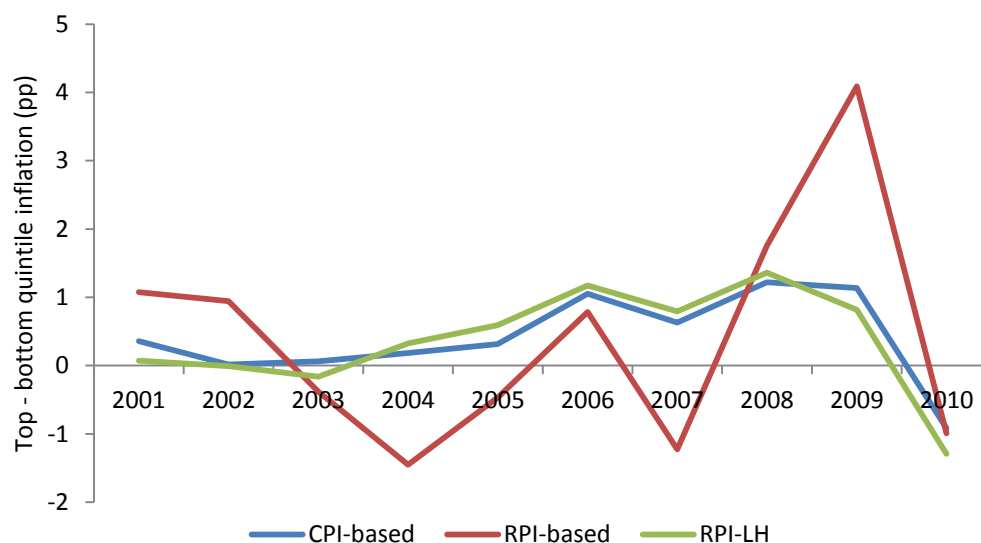**Figure 4.3 Average household inflation by income quintile, RPI–LH measure**
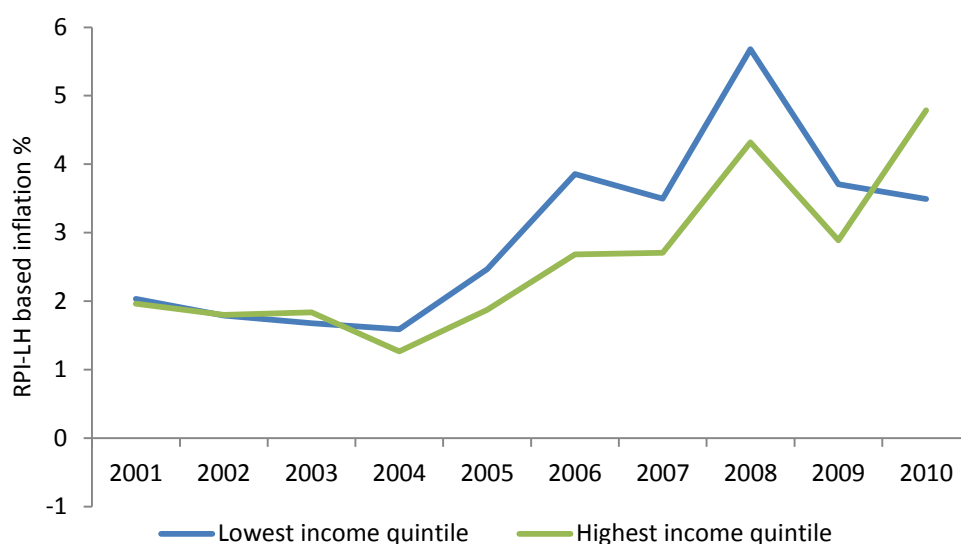
Source: Authors' calculations from the LCFS and ONS price data

Figure 4.4 shows the differences between the average inflation rates of the top and bottom income quintile under all three inflation measures. In absolute terms, the gap for the RPI-LH measure is very similar to the gap for the CPI measure (though since the CPI measure is lower on average, this represents a proportionally bigger difference using the CPI).

These findings suggest that once differences in the coverage of housing costs between RPI and CPI are accounted for, remaining differences (largely the formula effect described above) do little to explain the gap in inflation experiences between high income and low income households. In other words, the formula effect has a broadly similar impact on luxuries and necessities.

Figure 4.4 Differences between top and bottom income quintiles, RPI-based measure, CPI-based measure and RPI-LH based measure

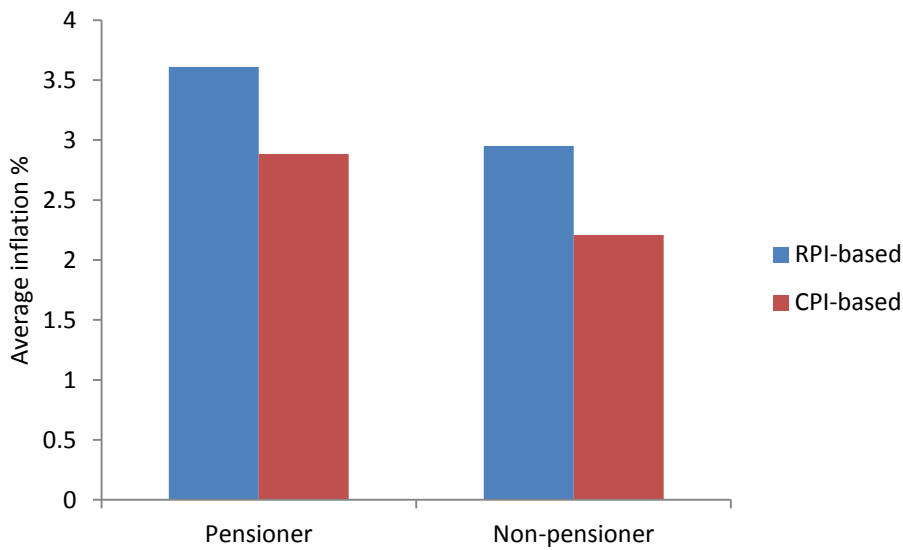Source: Authors' calculations from the LCFS and ONS price data

Another interesting point to emerge from Figure 4.4 is that the average difference between the RPI inflation rates of high and low income households was roughly zero up until 2008. Had we stopped our analysis in 2007, then patterns of average inflation across income groups shown in Figure 4.1 would have looked quite different for our RPI and CPI measures. Between 2001 and 2007, the top quintile experienced slightly higher average RPI inflation than the bottom quintile (3.0% compared to 2.9%). For CPI inflation, the figures were 1.6% and 2.0% respectively.

4.2   Household inflation experiences by pensioner status

Here we present some additional results on the inflation experiences of pensioners and non-pensioners according to our CPI and RPI-based measures. A pensioner household is defined as a household whose head is of pensionable age (i.e. if the household head is female and aged 60 or more, or male and aged over 65).

Figure 4.5 looks at how average inflation rates over the whole period have differed between pensioners and non-pensioners under both our measures. Both groups experienced higher average RPI-based inflation than CPI-based inflation over the period and the difference was similar for both groups (roughly 0.7 percentage points).
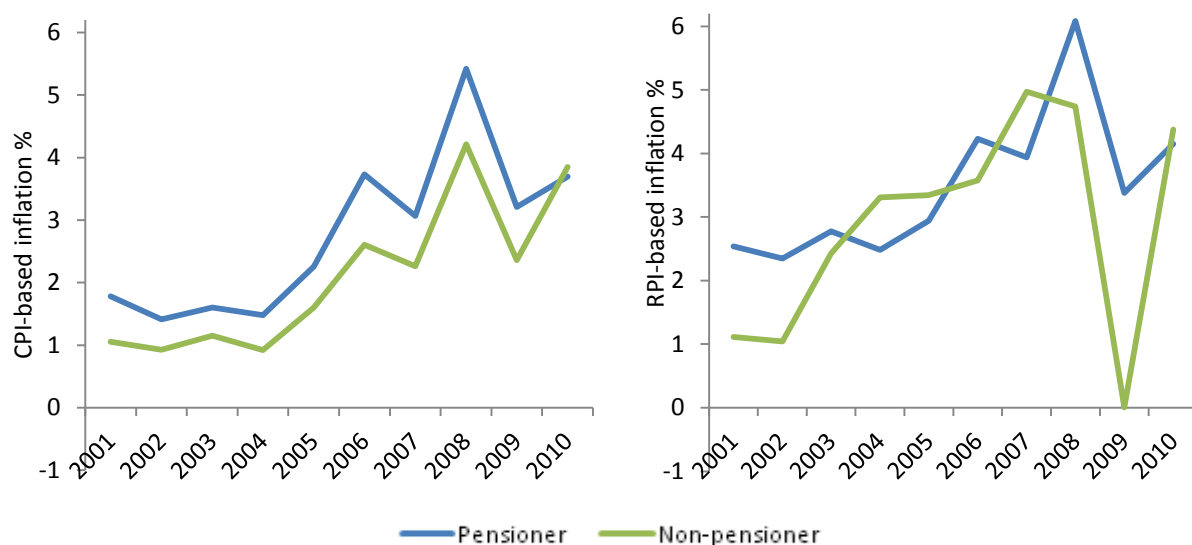
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Figure 4.5 Average household inflation by pensioner status, 2001–2010

Source: Authors' calculations from the LCFS and ONS price data

Figure 4.6 shows the average CPI and RPI-based measures over time for pensioners and non-pensioners. The pattern looks similar to that for different income groups. The CPI shows a steady divergence: pensioners had higher average CPI based inflation than non-pensioners for all years except 2010. However, according to the RPI non-pensioners actually had higher inflation in the years 2004, 2005, 2007 and 2010. As with the comparison for different income groups, there is large divergence in 2009, as the average inflation rates of non-pensioners fell dramatically while the average inflation of pensioners did not. This was due to the sharp reductions in mortgage interest costs in that year (which is a much less important element of pensioners' budgets).
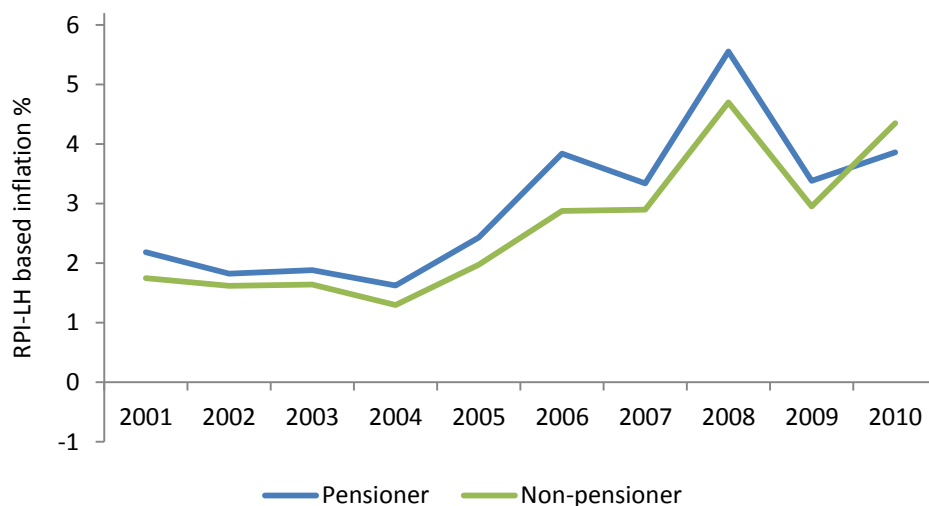
Figure 4.6 Average household inflation by pensioner status, RPI-based measure and CPI-based measure

Source: Authors' calculations from the LCFS and ONS price data

Figure 4.7 shows the RPI-LH measure for pensioners and non-pensioners. This looks much more similar to the CPI-based measure over time.

Figure 4.7 Average household inflation by income quintile, RPI-LH measure
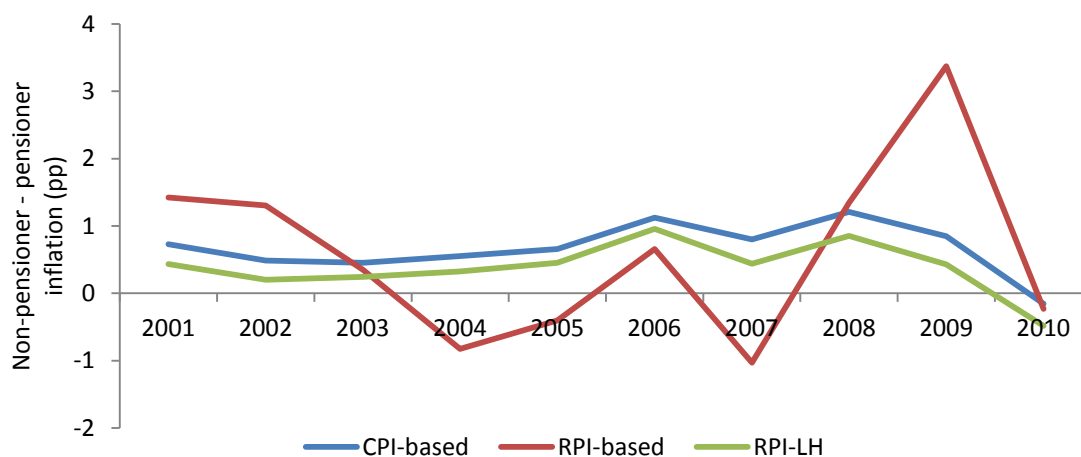

Source: Authors' calculations from the LCFS and ONS price data

Figure 4.8 shows the differences between pensioners and non-pensioners for the three indices. As we saw before, once housing costs are taken out of the RPI, there is little difference between the gap given by the CPI-based measure and the gap given by the RPI-LH measure. This suggests that other differences such as the

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formula effect play only a limited role in explaining differences in the gaps between pensioners and non-pensioners for our RPI and CPI-based indices (as we had found for high and low income households).

Figure 4.8 Differences between pensioner and non-pensioner households, RPI-based measure, CPI-based measure and RPI-LH based measure

Source: Authors' calculations from the LCFS and ONS price data

5. Conclusion

In this paper, we have examined the differences in average household-level inflation household groups, using both CPI- and RPI-based definitions. The CPI based index was generally lower than the equivalent RPI-based index, reflecting the tendency of the CPI to give lower estimates of inflation than the RPI.

Looking year-by-year, the CPI-based measure gave a very different impression of the pattern of relative inflation rates to our RPI-based measure across income groups and across pensioners and non-pensioners. The CPI measure was consistently higher for lower income and pensioner households (except in 2010). The RPI measure was actually more often than not larger for higher-income and non-pensioner households, though with some years when low-income and pensioner households experienced substantially higher rates.

By constructing a measure of the RPI excluding the housing costs not covered by the CPI, we could examine how important these costs were in driving differences between the two indices. Trends in this 'RPI-LH' measure across income and pensioner groups looked much more similar to those based on the CPI, though the RPI-LH gave consistently higher inflation rates. This implies that year-to-year differences between our CPI and RPI measures in the *relative* inflation experiences of different groups of households were primarily due to changes in

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housing costs. Other differences between the RPI and CPI (such as the formula effect) did not systematically affect any one group more than the other. This suggests that if, the formula effect were eliminated, then this would affect the level of average RPI-based measures of inflation for different groups of households, but wouldn't have much effect on the gap between them. There is therefore little reason to be concerned that previous findings concerning households' relative inflation experiences using the measures based on the RPI would need to be reconsidered.

Appendix A: Comparisons of our inflation rate to published measures

In this appendix we compare our household measures of inflation with the official RPI and CPI indices published by the ONS. Figures A.1 and A.2 show averages of our household-level inflation indices and the official CPI and RPI over time. We take two different averages. The first is a 'plutocratic' mean, which is a weighted average giving higher weights to households which spend more (which effectively weights each *pound spent* the same). The second is a 'democratic' mean, which weights all *households* equally.

Both democratic and plutocratic averages of household inflation track the RPI and CPI reasonably well. The notable exception is the 2009 RPI, when our plutocratic average household measure was 0.9 percentage points higher than the RPI and our democratic average was 1.6 percentage points higher. The plutocratic averages tend to track the official measures more closely. This is unsurprising, as the official RPI and CPI figures are plutocratic measures. This is because they derive their weights from economy-wide expenditure, meaning those households who spend more contribute more to the average weight.

Figure A.1 Comparison of average CPI-based household inflation and CPI
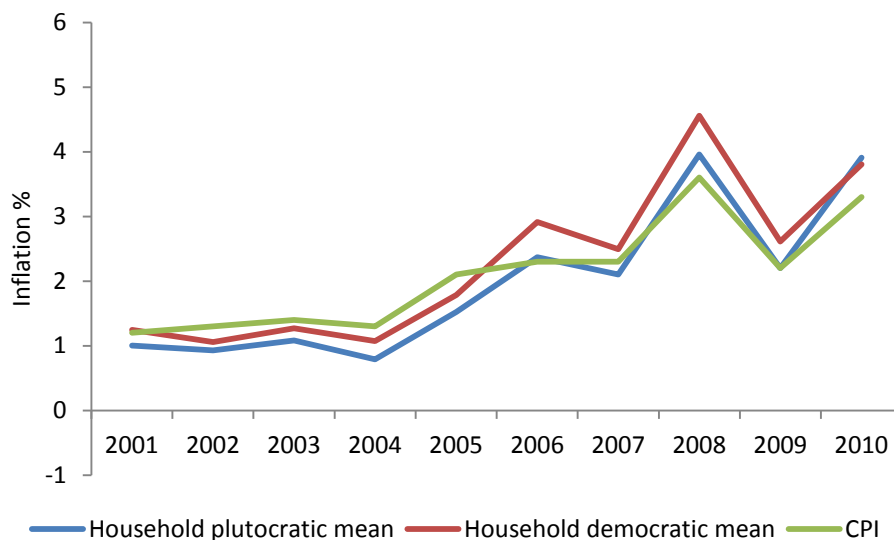
Source: Office for National Statistics; Authors' Calculations from the LCFS

Figure A.2 Comparison of average RPI-based household inflation and RPI
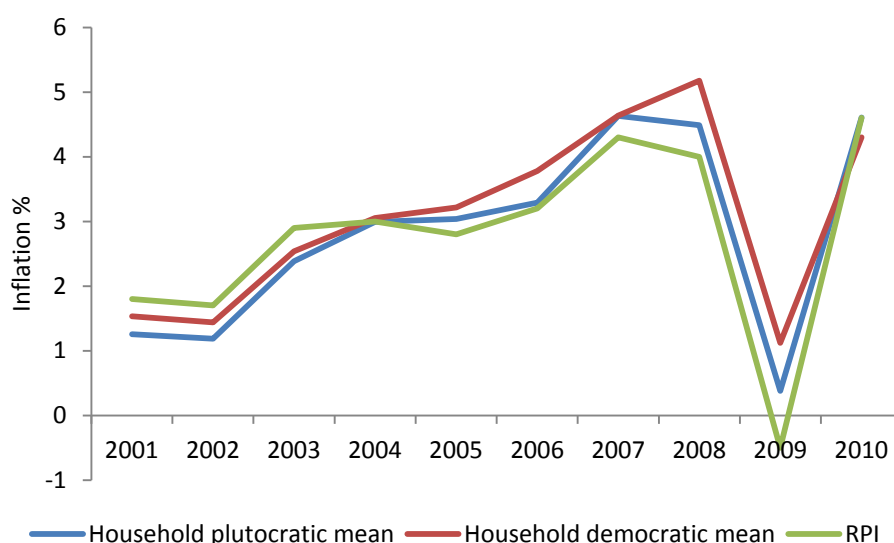
Source: Office for National Statistics; Authors' Calculations from the LCFS

In calculating our estimates of RPI and CPI, we use the same price data as the ONS. This means that, by definition, the difference between our estimates and the official inflation rates are caused by our choice of weights (w_{hm}^s in equation 2). Our weights will be different to the ONS weights for several reasons.

Averaging

In this analysis we will use a democratic mean and not a plutocratic average (which is implicitly used in the calculation of the official RPI and CPI). This is because there is no reason to want to weight higher-spending households more heavily when comparing inflation rates across groups as we do in our analysis. The impact of choosing a democratic over plutocratic mean is that poorer households are weighted relatively more heavily in our household-level averages, and so necessities will be given more weight in the calculation of overall inflation.

Depreciation

The RPI includes the costs of housing depreciation. This is the single most heavily weighted item of expenditure in the RPI basket (weighted 5.6% in 2012). Our estimate of RPI does not include depreciation as it is not available in the LCFS. This will cause the relative weights in our index to differ from those in the official RPI.

Data

Unlike our household-level estimates, neither the RPI nor CPI relies solely on the LCFS. The RPI supplements expenditure data from the LCFS with data from other sources. Expenditure on tobacco, confectionery, soft drinks and alcohol is often under-reported in the LCFS and so RPI weights for these items are calculated using the Household Final Consumption Expenditure (HHFCE) from the National Accounts.[19] The CPI primarily uses expenditure data from Household Final *Monetary* Consumption Expenditure (HFMCE) of the National Accounts.[20]

Seasoning

A final reason for the divergence between our average inflation measures and the published indices concerns the timing of spending that is used to derive weights in the ONS measures. Spending data for the calculation of price indices is often only available with a significant lag, whereas price data can be collected and put to use relatively quickly. This means that in order to produce timely measures of inflation, the ONS must rely on spending data that is out of date. In the RPI, the weights for 2010 inflation rates, for instance, are calculated using spending data covering the period July 2008 to June 2009.[21] In theory, the weights for price changes between 2009 and 2010 should be based only on expenditure in 2009 (the 'reference period'). In the CPI, weights are determined using spending as reported in the December National Accounts (so for instance 2010 inflation rates would use spending patterns in the 2009 National Accounts to determine the weights). However, the National Accounts are themselves based in part on out of date LCFS expenditure data, and so in practice the CPI suffers from a similar problem to the RPI. This mismatch in the timing between expenditures and prices is referred to as 'seasoning'. Our inflation measures, by contrast, do not use seasoned weights, but rather weights from the appropriate reference period in each year.

Figure A.3 shows the differences between our plutocratic weights - or LCFS budget shares - and the official weights for the 12 groups (aggregated from 84

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[19] See chapter 6 of ONS (2012b).

[20] HFMCE is a subset of HHFCE. HFMCE excludes - among other things - imputed expenditure for owner occupiers among other items included in HHFCE.

[21] See section 6.5 of ONS (2012b).

sections) that make up the CPI. Because of seasoning and differences in data, we wouldn't expect these weights to be the same.

Figure A.3 Comparison of CPI weights and LCFS plutocratic budget shares, 2010
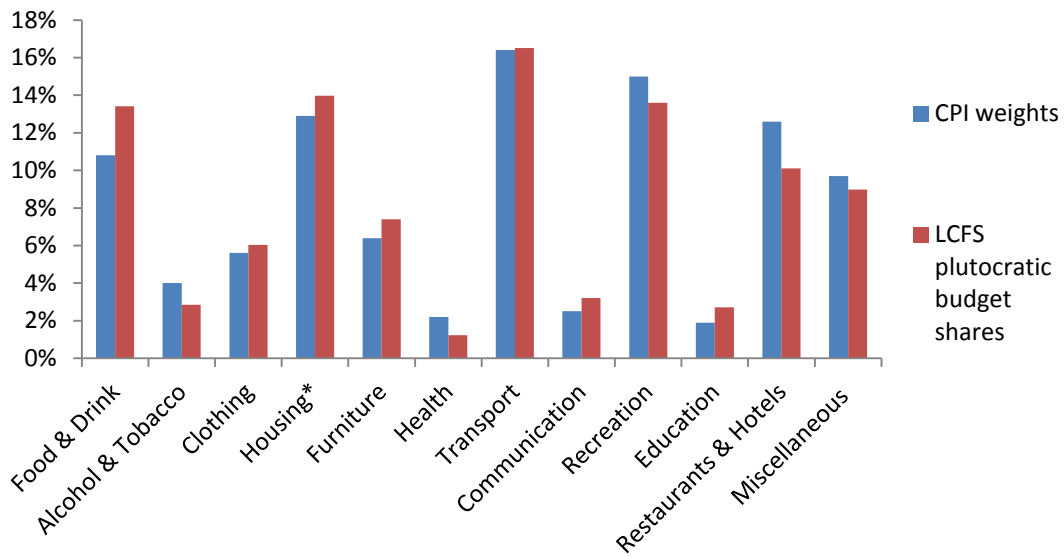
Source: Office for National Statistics; Authors' Calculations from the LCFS
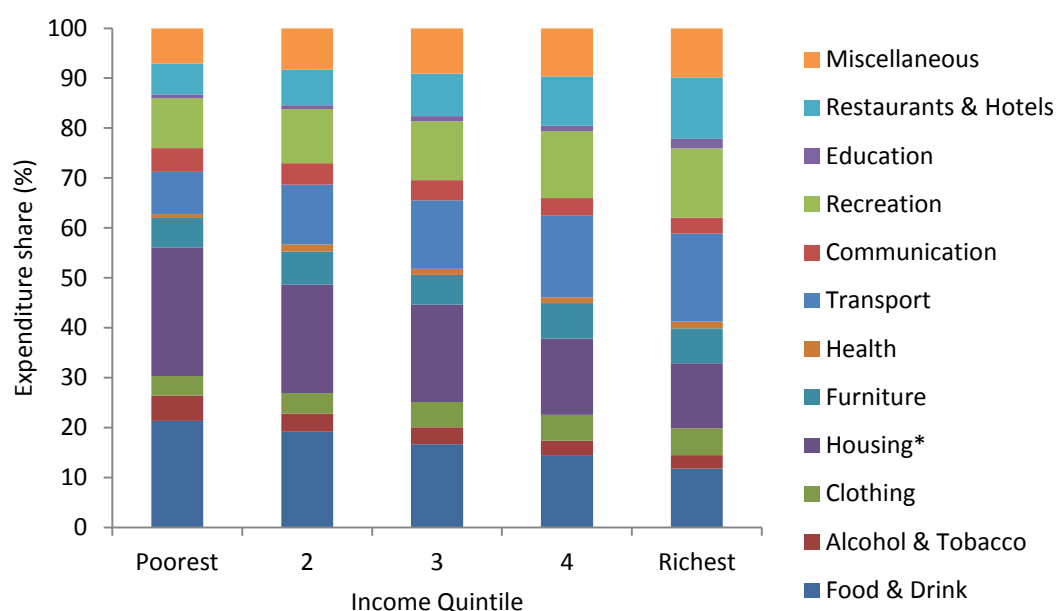
*Housing in CPI includes only rent, expenditure on repairs and utility bills

Appendix B: Spending patterns across income groups

In this appendix we look at how spending patterns vary between different income groups.

Figure B.1 shows average household budget shares across the 12 CPI expenditure categories by income quintile in 2010. There are some important differences across income groups. The budget shares of housing, food and alcohol and tobacco are decreasing in income, indicating that these are economic necessities. Expenditure shares of recreation, clothing, restaurants and hotels and travel are all increasing in income, making these luxuries.

**Figure B.1 LCFS expenditure shares for CPI sections in 2010, by income quintile**

 Source: Authors' calculations from the LCFS
*Housing in CPI includes only rent, expenditure on repairs and utility bills
Incomes are equivalised using the McClements Scale.

Figure B.2 shows the same for RPI expenditure categories. Lower income households spend more of their budgets on food and domestic fuel. Higher income households spend more on motoring and leisure goods and services.

Figure B.2 LCFS expenditure shares for RPI sections in 2010, by income quintile
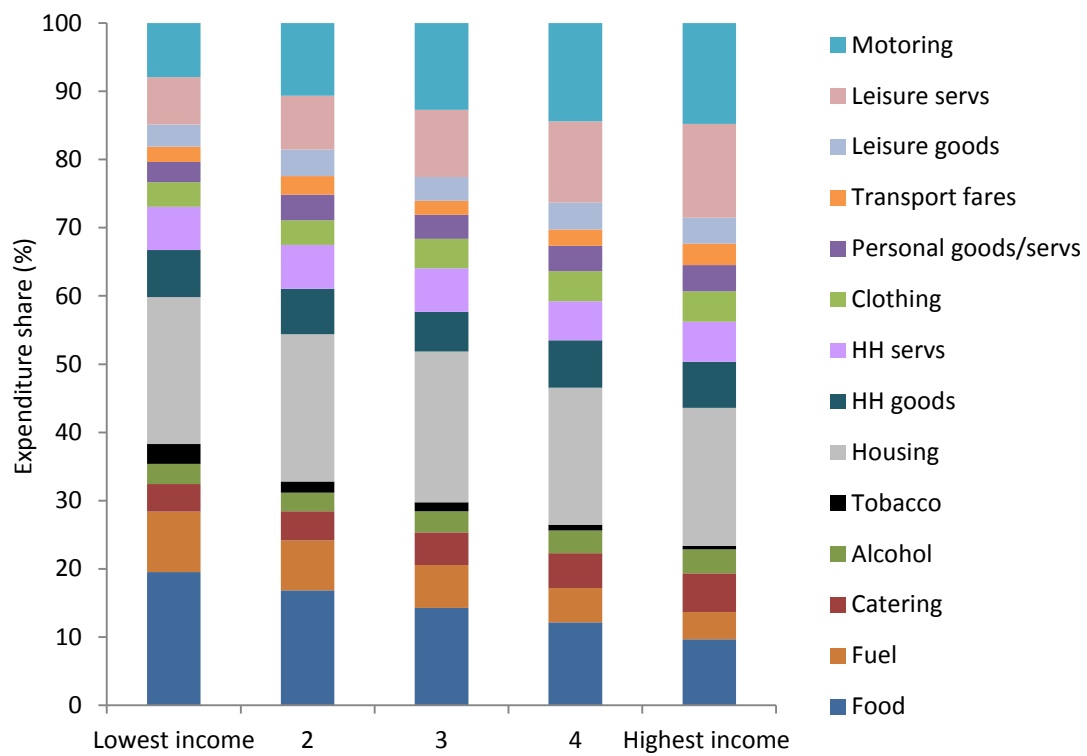
Source: Authors' calculations from the LCFS
Incomes are equivalised using the McClements Scale.

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