

# Monitoring Review

Monitoring Review 2/15  
March 2015

## ***Measuring 'Real' values: Taking account of price changes over time in statistical analysis***

### **Summary**

Deflators are used widely in the production of official statistics within government, and in analysis using official statistics outside government, to remove the effects of changes in prices from a time series. This enables statistics to be compared across time in 'real terms'. The Office for National Statistics (ONS) collects a huge volume of data on prices and these are used, alongside other information, to produce many aggregate series that are used as deflators. This is a complex process as prices data are collected from many people – producers, consumers, retailers and traders – and aggregated in different ways for different purposes and perspectives. Experienced users debate long and hard about the underpinning formulae to use when aggregating these deflator series, and inexperienced users may need some expert guidance on how to choose the best series for their particular purpose.

This short report investigates why deflators are important in the production of official statistics (Chapter 1), what statistics are available for use as deflators (Chapter 2), and how their use could be improved (Chapter 3). In addition, Annex A is illustrative of the sorts of questions fuller, more formal guidance from producers should address to help improve the use of deflators.

### ***Main findings and recommendations***

#### **Taking account of price changes is important.**

When comparing statistics over time, taking account of price changes is important as it informs our analysis of how government spends its money, how government policy is evaluated and how well-off we feel. For example, it is an essential part of:

- Tracking changes in poverty over time;
- Determining rail fare changes; and
- Analysing real terms healthcare spending over time.

Failing to take account of price changes can lead to misleading conclusions.

**There are lots of ways of taking account of price changes and it is a complicated landscape.**

There is a lot of choice in how you remove the effects of price changes from a time series with numerous deflators available. It is unlikely that any one deflator will be perfect, but it is important to choose the most appropriate one for the task in hand.

**There is good work in progress to ensure that deflators are the best they can be and we support this work.**

We welcome and fully support the commitment to continuous improvement, meeting user needs and user engagement demonstrated by the ongoing deflator improvement work, including the contributions from:

- The National Statistics Quality Review of the National Accounts and Balance of Payments conducted by Dame Kate Barker and Art Ridgeway and published in July 2014, which focused on the quality of the deflators produced through the National Accounts process<sup>1</sup>; and
- The UK Consumer Price Statistics review conducted by Paul Johnson, which focused on the range and composition of consumer price statistics<sup>2</sup>.

**At present guidance on the use of deflators is diffused and dispersed.**

We recognise that there is a wide range of guidance published about deflators. However, this can be hard to access quickly and some of the information is out of date. Additionally there is limited information on the range of deflators available and limited advice on how to choose from that range.

<sup>1</sup> National Statistics Quality Review: National Accounts and Balance of Payments, 8 July 2014, Available at: <http://www.ons.gov.uk/ons/rel/naa1-rd/national-statistics-quality-review/-nsqr--series--2--report-no--2--review-of-national-accounts-and-balance-of-payments/index.html>

<sup>2</sup> UK Consumer Price Statistics: A Review, January 2015. Available at: <http://www.statisticsauthority.gov.uk/reports---correspondence/current-reviews/range-of-prices-statistics.html>

## Recommendations

We recommend that:

- i. ONS review the availability of methodological information, including strengths and limitations, for all deflators that it publishes and commit to a work plan for updating the information available.
- ii. ONS produce an accessible deflator summary document, distilling and updating existing documentation, to advise users on the full range of deflators available, including a detailed list of factors to consider when deciding which deflator to use, and links through to deflator specific guidance and more technical deflator methodological information. Annex A is illustrative of the sorts of questions fuller, more formal guidance from the ONS should address.
- iii. HMT provide links to further information on alternative deflators alongside the GDP deflator guidance on gov.uk<sup>3</sup>.

<sup>3</sup> HM Treasury publishes a GDP deflator series using ONS GDP deflator data released as part of the Quarterly National Accounts release (at the end of each quarter) and whenever the OBR updates its GDP deflator forecasts (usually twice a year). It is calculated for different periods, such as calendar and financial years, current and constant price GDP data

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## Chapter 1: Why take account of price changes?

- 1.1 In this Chapter we set out why using deflators to take account of price changes is important when you are comparing statistics over time. We also highlight how this process is often an important feature of political and economic dialogue. Firstly we introduce some useful deflator terms.

### *Introduction to deflator terminology*

- 1.2 Statistics are typically published in current prices (also called nominal prices) as they reflect the actual money value of transactions. These current price data play a key role in statistical analysis, such as providing industry weights (or shares) of the overall economy.
- 1.3 A deflator is often applied to these current price data to remove the effects of pure changes in prices to give a volume series (also known as chained volume measures, constant prices or real measures) to enable real terms comparison. Taking account of pure price changes enables us to understand and explain real change over time.
- 1.4 Some key terms are explained in the box below. The glossary of terms at Annex D explains some more technical concepts you may come across in relation to deflators.

### **What is inflation and deflation?**

Inflation is commonly thought of as an increase in prices for goods and services. Rises in the prices of things households buy are referred to as consumer price inflation. However, price inflation might also affect businesses buying raw materials or importing goods and services.

Deflation is the opposite of inflation and is commonly thought of as a decrease in prices for goods and services. Deflation occurs when the inflation rate falls below 0 (often referred to as negative inflation).

### **What is a deflator?**

A deflator is a value that seeks to remove the effects of pure changes in price from a time series, i.e. it allows the change in the volume of goods and services to be measured. The resultant series can be used to express a given time series or data set in real terms, i.e. after the effect of pure price changes has been removed.

Pure price changes remove quality changes from the price series – as the key aim of volume measurement is to keep quality constant. Changes in quality should be measured as a volume change and not a price change.

### **What is a price index and an implied deflator?**

Price indices are often used as deflators. Price indices are generally based on the weighted average of a specific basket of products or services, or one good or service, in relation to a defined base period (i.e. a point in time used as a reference point for comparison with other periods).

An implied deflator is a series which shows the implied change in average prices for a variable by dividing the current price series by the volume series.

Sources: [ONS Glossary of Economic Terms](#) & [House of Commons Library 'Statistical literacy guide: How to adjust for inflation'](#)

### Using deflators: a worked example

You have spending figures on x for 2011 to 2014 in current prices, and the relevant index series data for each of these years:

Year	Spending on x (£)	Index series
2011	650	95.423
2012	820	97.234
2013	850	100.000
2014	900	101.648

#### Producing a volume (constant price or real terms) series

Q. How would you create a volume (constant price or real terms) series so that all spending figures were available in 2014 prices?

A. To produce a volume series, divide each value of x in the series by the value of the index series for that year, and then multiply by the index value for the year that you wish to be the reference year, i.e. for 2011 you would calculate  $(650/95.423) \times 101.648 = £692.40$

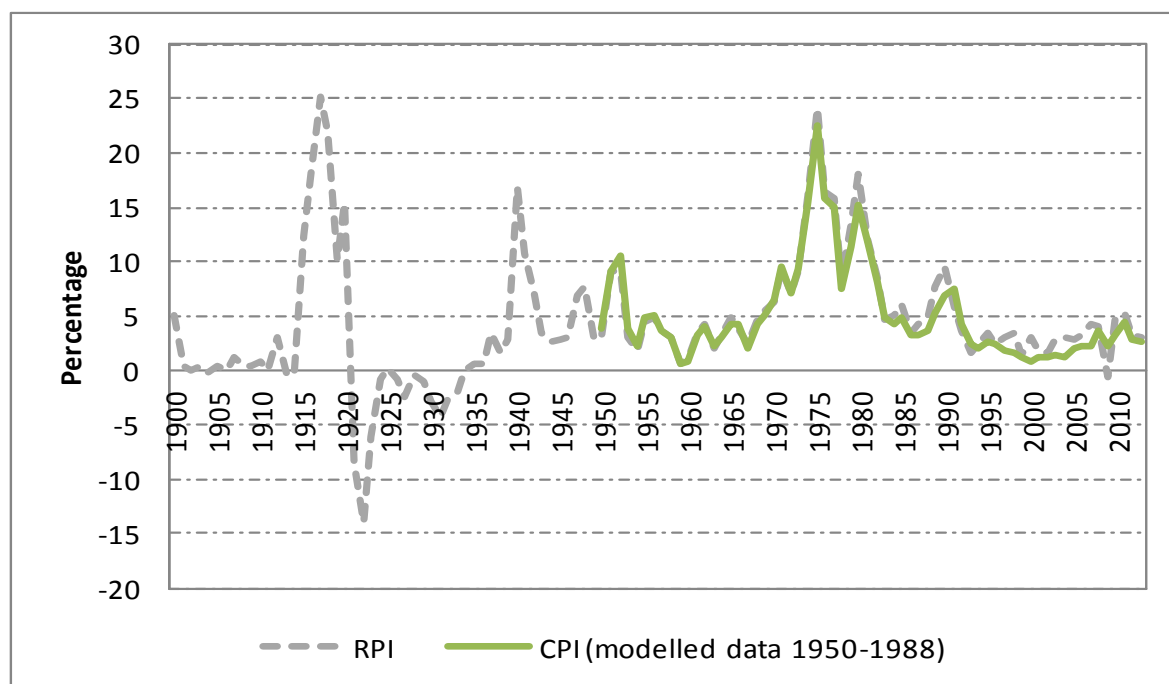
Year	Spending on x (£)	Index series	Real spending (in 2014 prices, £)
2011	650	95.423	692.40
2012	820	97.234	857.22
2013	850	100.000	864.01
2014	900	101.648	900.00

For more worked examples see the HM Treasury [How to use the GDP deflator series: practical examples](#).

## Enabling comparisons over time

- 1.5 Taking account of price changes is important when comparing statistics over time. For example, as shown in Figure 1.1, the prices faced by consumers and households vary over time. In some years prices have increased compared to the same time the previous year (this is shown by an inflation rate above 0) and in other years prices have decreased compared to the previous year (shown by an inflation rate below 0). However since the mid-1930s the inflation rate has been generally positive which means that prices have been increasing year-on-year (with the exception of a slight blip in 2009 in the Retail Prices Index (RPI) series).

**Figure 1.1: Inflation rate 1900-2013 (based on the Consumer Prices Index (CPI) and the Retail Prices Index (RPI))**



Sources:

1. RPI data sourced from [Consumer Price Inflation Time Series Dataset](#)
2. CPI data (1989-2013) sourced from [Consumer Price Inflation Time Series Dataset](#)
3. CPI data (1950-1988) sourced from [Modelling a Back Series for the Consumer Price Index, 1950 - 2011](#)

- 1.6 Not adjusting for price changes can lead to misleading conclusions being reached if you are looking to reflect the real change over time. For example, the Guardian stated in July 2013 that the Bond movie 'Skyfall' was the highest grossing UK film of all time<sup>4</sup>. However this story, which is accurate when looking at the nominal data and films released in the UK between 1975 and 2012, cannot be sustained if comparisons are made using real data over the same time period. The British Film Institute's annual Statistical Yearbook 2013 (which was the reported source for the story) calculated that, taking account of price changes, 'Titanic' was the highest grossing film released at the UK box office between 1975 and 2012<sup>5</sup>. Adjusting for prices equates to measuring the volume of tickets sold – which is the measure of interest in this example.

### ***It is a feature of political and economic dialogue***

- 1.7 Calculating real values, as opposed to nominal values, is an important part of economic and political dialogue. Official statistics are generally collected in current prices (i.e. nominal values). For example, HM Treasury uses the GDP deflator to estimate public sector

<sup>4</sup> <http://www.theguardian.com/film/2013/jul/23/skyfall-highest-grossing-film-uk-box-office>

<sup>5</sup> British Film Institute Statistical Annual Yearbook 2013. Available at: <http://www.bfi.org.uk/sites/bfi.org.uk/files/downloads/bfi-statistical-yearbook-2013.pdf>



expenditure in real terms<sup>6</sup>. This enables the public to see whether public spending on, often debated and controversial, areas like education, health and social protection is decreasing or increasing once the effects of price changes are removed. As another example, the Department for Work and Pensions (DWP) uses RPI in its calculation of the absolute low poverty line<sup>7</sup>, which is used to determine the number of households (and children) living in absolute poverty.

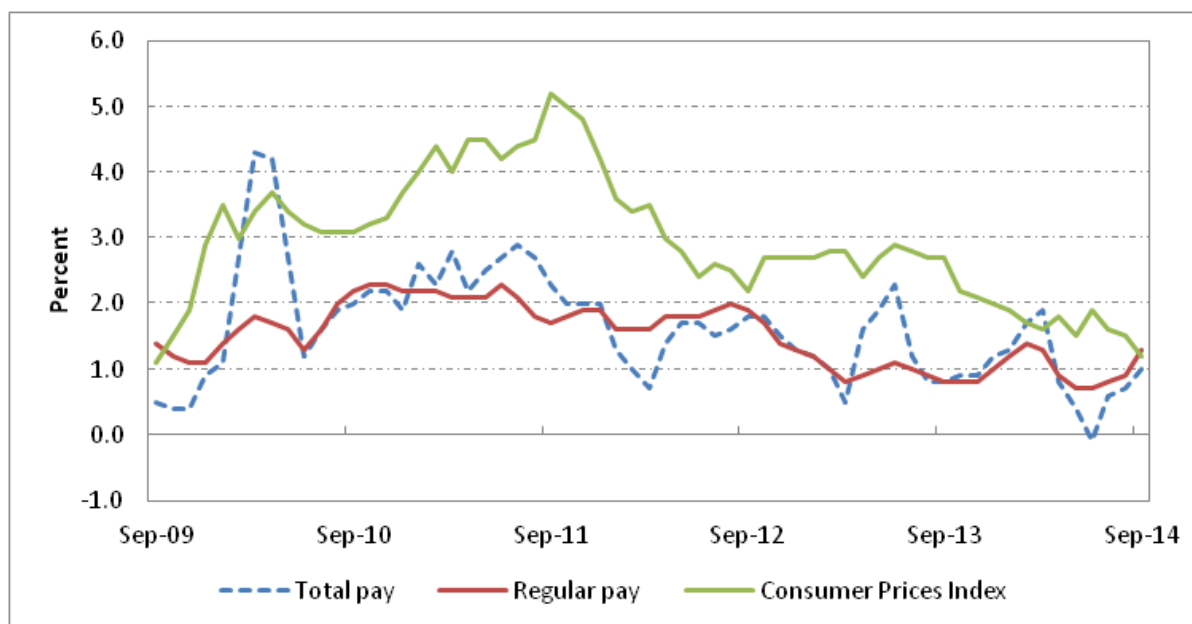
- 1.8 Inflation (i.e. increasing prices) also often features in cost of living discussions as it can erode real incomes and reduce people's capacity to spend. When incomes are increasing at a slower rate than the inflation rate, or decreasing faster than prices, individuals may be less able to purchase as much of the same goods and services as they previously could. This is, however, dependent on the extent to which individuals may be able to or likely to change what they buy, such as substituting a more expensive apple for a cheaper banana.
- 1.9 The UK Statistics Authority has considered the coherence and accessibility of official statistics on income and earnings.<sup>8</sup> As shown below there are a number of these statistics available. Figure 1.2 shows that, in general over the past five years, the inflation rate has been higher than average weekly earnings growth, as measured using average weekly earnings data, although things do seem to be converging recently. Figure 1.3 shows that when earnings, as measured by the Annual Survey of Hours and Earnings, are deflated to take account of price changes, on average, earnings were higher in 2009 compared with the following five years. However, it is important to note that other factors, such as the composition of the labour market (e.g. changes in the number and relative proportions of people in low wage jobs), will also affect how average earnings vary over time.

<sup>6</sup> Public Spending Statistics release. Available at: <https://www.gov.uk/government/statistics/public-spending-statistics-release-november-2014>

<sup>7</sup> Households below average income (HBAI): 1994/95 to 2012/13. Available at: <https://www.gov.uk/government/statistics/households-below-average-income-hbai-199495-to-201213>

<sup>8</sup> <http://www.statisticsauthority.gov.uk/assessment/monitoring/monitoring-reviews/monitoring-review-1-2015---the-coherence-and-accessibility-of-official-statistics-on-income-and-earnings.pdf>

**Figure 1.2: Average earnings and consumer prices annual growth rates, September 2009-September 2014**

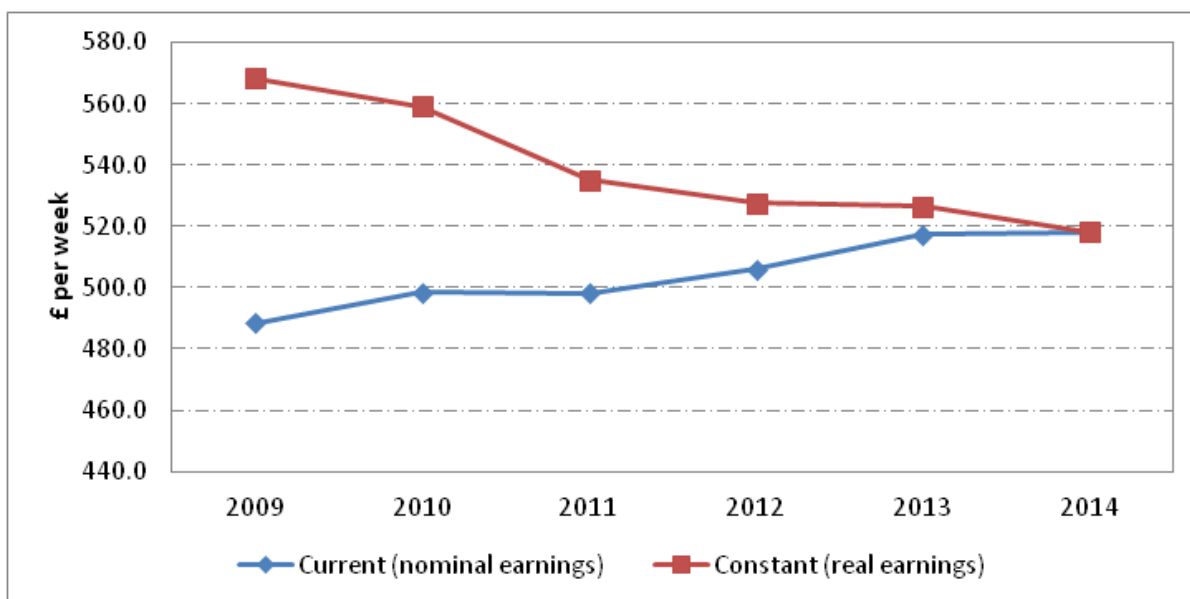


Source: [ONS UK Labour Market. November Release.](#)

**Notes:**

1. This chart shows monthly estimates for the Consumer Prices Index (CPI) from September 2009 to September 2014 and three month average estimates for Average Weekly Earnings (AWE) from July-September 2009 to July-September 2014. The CPI values are based on the 12 month rate.
2. The CPI series is for the United Kingdom and is compiled from prices data based on a large and representative selection of individual goods and services. The AWE series are for Great Britain and are sourced from the Monthly Wages and Salaries Survey.
3. The AWE series are seasonally adjusted. The CPI series is not seasonally adjusted.
4. Average Weekly Earnings measures money paid to employees in Great Britain in return for work done, before tax and other deductions from pay. The estimates do not include earnings of self-employed people. Estimates are available for both total pay (which includes bonuses) and for regular pay (which excludes bonus payments). The estimates are not just a measure of pay settlements as they also reflect compositional changes within the workforce.

**Figure 1.3: Median full-time gross weekly earnings in current and constant (2014) prices, UK, April 2009 to April 2014**



Source: [Annual Survey of Hours and Earnings \(ASHE\) 2014 Provisional Results](#) - Office for National Statistics  
Notes:

1. Employees on adult rates, pay unaffected by absence.
2. Full-time defined as employees working more than 30 paid hours per week (or 25 or more for the teaching professions).
3. CPI figures are based on the All Items Consumer Prices Index of inflation for April.
4. 2014 data are provisional.
5. Figures rounded to one decimal place.

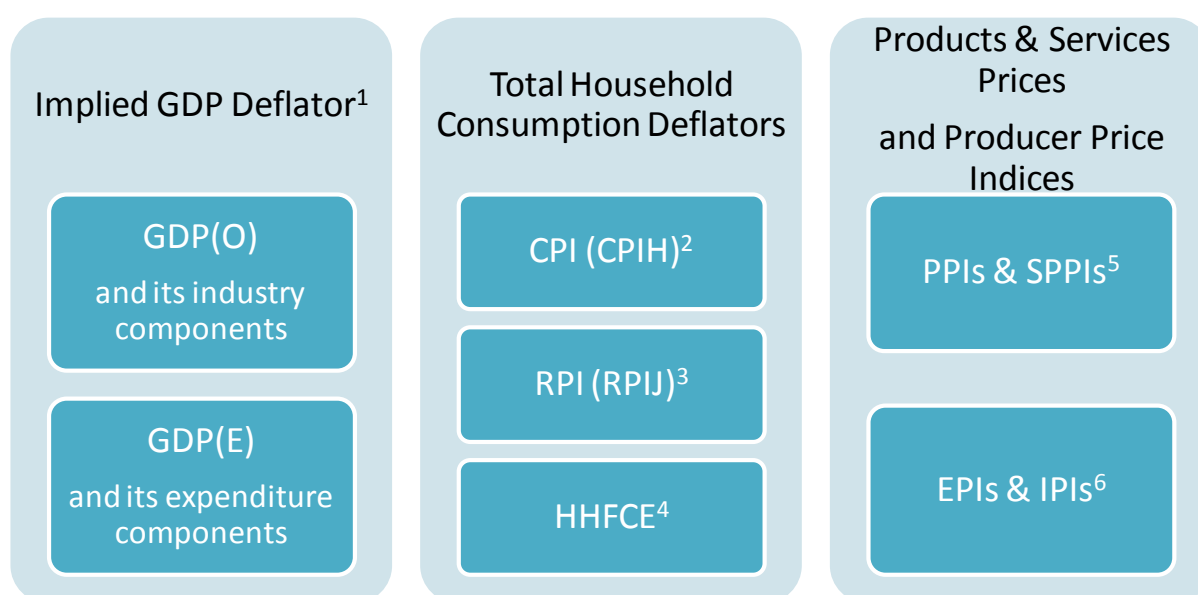
## Summary

1.10 When comparing statistics over time, taking account of price changes is important as it informs our analysis of how government spends its money, how government policy is evaluated and how well-off we feel. Failing to take account of price changes can lead to misleading conclusions. In Chapter 2 we say more about the deflators you can use to remove the effects of price changes from a time series.

## Chapter 2: What can be used to take account of price changes?

- 2.1 In this Chapter we set out some of the main deflators that can be used to remove the effects of price changes from a time series, including some examples of where they are used in practice (see Annex B for examples of how deflators are used by some of the users that fed into this review).
- 2.2 This Chapter is not meant to provide a complete list of all available deflators but an introduction to some of the main groups of deflators available. Figure 2.1 highlights the broad types of deflators covered in this Chapter.

**Figure 2.1: Examples of the types of deflators available in the UK**



Notes:

1. GDP = Gross Domestic Product; GDP can be estimated in the three ways: the production or output approach (GDP(O)), the income approach (GDP(I)) and/or the expenditure approach (GDP(E)). GDP(I) is available in nominal terms but there is no deflator provided
2. CPI = Consumer Price Index; CPIH = a measure of consumer price inflation that includes owner occupiers' housing costs
3. RPI = Retail Price Index; RPIJ = an improved variant of the RPI which is calculated using formulae that meet international standards
4. HHFCE = Household Final Consumption Expenditure deflator
5. PPIs = Producer Price Indices; SPPIs = Service Producer Price Indices
6. EPIs = Export Price Indices; IPIs = Import Price Indices

### **GDP Deflator (the implied price deflator)**

- 2.3 One commonly used deflator is the GDP implied deflator. GDP is a measure of the economic activity produced by a country or region. Therefore, the GDP deflator can be viewed as a measure of general inflation in the domestic economy or an implied price deflator. The GDP deflator is referred to as an implied price deflator because it is derived from the estimate of

total GDP in both nominal (current price) and real (volume or constant price) prices, both of which are estimated using a variety of methods.

$$\text{GDP Deflator} = \text{Nominal (current price) GDP} / \text{Real (volume or constant price) GDP} * 100$$

- 2.4 HM Treasury publishes a GDP deflator series using ONS GDP deflator data released as part of the Quarterly National Accounts release (at the end of each quarter) and whenever the OBR updates its GDP deflator forecasts (usually twice a year). It is calculated for different periods, such as calendar and financial years, current and volume GDP data<sup>9</sup>.
- 2.5 The UK GDP deflator series is highlighted by HM Treasury as more appropriate for deflating public expenditure series (in comparison to consumer price indices such as CPI) due to its wider coverage. HM Treasury uses the GDP deflator to estimate public sector expenditure in volume terms for each spending sector (such as health, education and defence etc)<sup>10</sup>.
- 2.6 The Office for Budget Responsibility (OBR) primarily uses deflators in its forecasts (particularly in forecasting nominal GDP). The OBR forecasts the expenditure components of UK GDP in volume terms together with forecasts of the component deflators and therefore forecasts current price GDP, using the most recent National Accounts data as a starting point<sup>11</sup>.

### ***Total household consumption deflators***

- 2.7 From a UK total household consumption perspective, there are various deflators available. Most high profile of these are the aggregate consumer price indices such as the Consumer Prices Index (CPI), CPIH, (a measure of consumer price inflation that includes owner occupiers' housing costs), the Retail Prices Index (RPI) and RPIJ (a variant of the RPI which is calculated using formulae that meet international standards). These indices can be thought of as capturing the average price movement of the basket of goods and services purchased by the household sector<sup>12</sup>.
- 2.8 CPI and RPIJ are both designated as National Statistics<sup>13</sup>. RPI was de-designated as a National Statistic in 2013 as the formulation of the RPI fails to meet international standards<sup>14</sup>.

<sup>9</sup> GDP deflators at market prices, and money GDP. Available at:

<https://www.gov.uk/government/publications/gdp-deflators-at-market-prices-and-money-gdp-march-2013>

<sup>10</sup> Public Spending Statistics release. Available at: <https://www.gov.uk/government/statistics/public-spending-statistics-release-november-2014> & GDP deflators at market prices, and money GDP.

Available at: <https://www.gov.uk/government/publications/gdp-deflators-at-market-prices-and-money-gdp-march-2013>

<sup>11</sup> Economic and Fiscal Outlook. Available at: <http://budgetresponsibility.org.uk/economic-fiscal-outlook-december-2014/>

<sup>12</sup> Consumer Price Indices: Technical Manual (2014 Edition). Available at:

<http://www.ons.gov.uk/ons/rel/cpi/consumer-price-indices---technical-manual/2014/index.html>

<sup>13</sup> Designation as National Statistics means that the statistics comply with the Code of Practice (Available at: <http://www.statisticsauthority.gov.uk/assessment/code-of-practice/index.html>). The Code

CPIH had its National Statistics status discontinued in August 2014 pending work by ONS to investigate and improve the method for measuring owner occupiers' housing costs in this index<sup>15</sup>.

- 2.9 Both CPI and RPI are often used when deflating household income or expenditure data. For example, as mentioned in Chapter 1, the Department for Work and Pensions (DWP) uses RPI to deflate its Households Below Average Income series (HBAI)<sup>16</sup>. HBAI is a key source of data and information about the household income distribution which is used by a range of users including government statisticians, academics, journalists and research organisations to examine topics such as income inequality, poverty, the distributional impacts of fiscal policies and understanding the income profile of vulnerable groups. Following the de-designation of RPI as a National Statistic in 2013<sup>17</sup>, the use of RPI for another year was recommended given the lack of immediate alternatives with appropriate Before Housing Costs (BHC) and After Housing Costs (AHC) variants, and to provide a consistent series whilst awaiting any relevant recommendations from the forthcoming Johnson Review for consideration<sup>18</sup>. Annex 4 of the 2012/13 HBAI publication presents trends in income and absolute low income using alternative inflation measures, CPIH, RPIJ and CPI<sup>19</sup>.
- 2.10 An alternative total household consumption deflator is the implied deflator for Household Final Consumption Expenditure (HHFCE) derived as part of the National Accounts. The HHFCE deflator, unlike the CPI and RPI, is not a pure price index. It is derived (at the end of the estimation process) as the value at current prices divided by the value of the volume measure for the same products, expressed in index number form. In practice, a large proportion of the indices used to deflate components of HHFCE are compiled from component indices of the CPI<sup>20</sup>. Additionally, information on spending patterns, which

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is wide-ranging. Designation can be interpreted to mean that the statistics: meet identified user needs; are produced, managed and disseminated to high standards; and are explained well.

<sup>14</sup> RPI UK Statistics Authority Statement. March 2013. Available at:

<http://www.statisticsauthority.gov.uk/news/statement---retail-prices-index---14-march-2013.pdf>

<sup>15</sup> <http://www.statisticsauthority.gov.uk/reports---correspondence/correspondence/letter-from-sir-andrew-dilnot-to-john-pullinger-14082014.pdf>

<sup>16</sup> Households below average income (HBAI): 1994/95 to 2012/13. Available at:

<https://www.gov.uk/government/statistics/households-below-average-income-hbai-199495-to-201213>

<sup>17</sup> <http://www.statisticsauthority.gov.uk/assessment/assessment/assessment-reports/assessment-report-246---the-retail-prices-index.pdf>

<sup>18</sup> DWP, Statistical Notice Changes to the Households Below Average Income (HBAI) statistics, April 2014. Available at:

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/307007/hbai-statistical-notice-april-2014.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/307007/hbai-statistical-notice-april-2014.pdf)

<sup>19</sup> DWP, Households below average income statistics: 1994/95 to 2012/13, July 2014. Available at:

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/325416/households-below-average-income-1994-1995-2012-2013.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/325416/households-below-average-income-1994-1995-2012-2013.pdf)

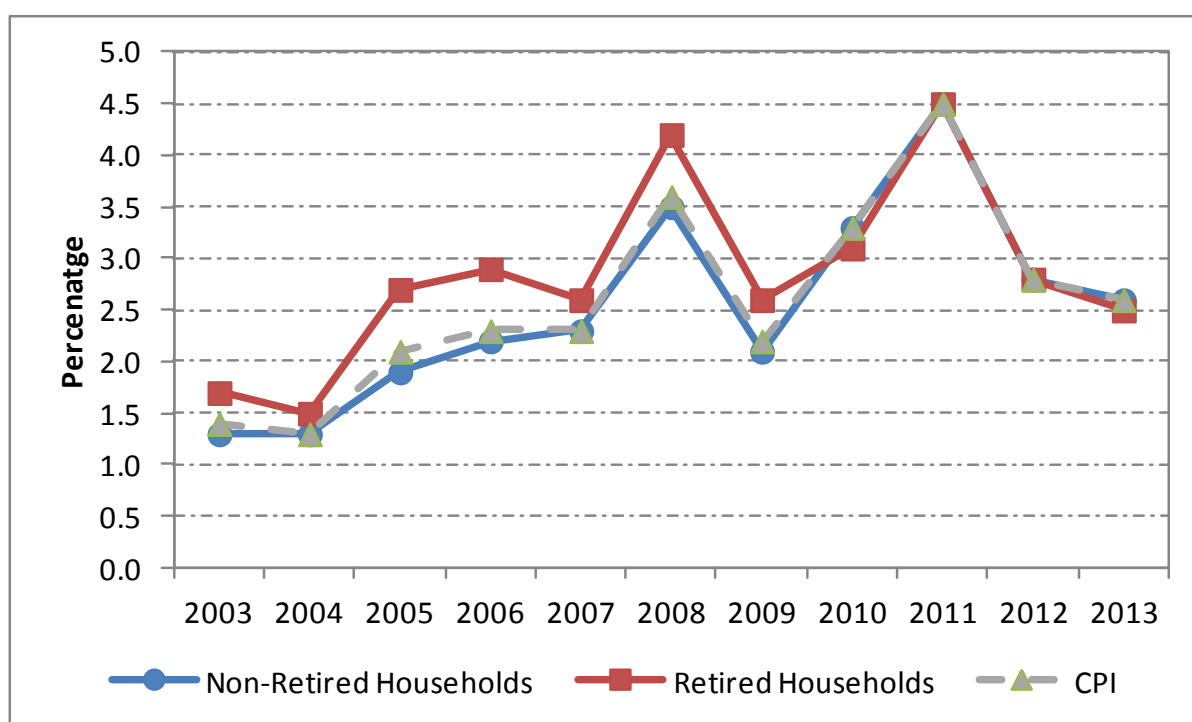
<sup>20</sup> For more information on this see the Consumer Price Indices Technical Manual. Available at:

<http://www.ons.gov.uk/ons/guide-method/user-guidance/prices/cpi-and-rpi/cpi-technical-manual/consumer-price-indices-technical-manual--2014.pdf>

underlie the CPI and CPIH weights, largely comes from the household expenditure component of the UK National Accounts<sup>21</sup>.

- 2.11 CPI, CPIH, RPIJ (RPI) and the HHFCE deflators can all be thought of as capturing the average price movements experienced by the household sector. However, as no two households spend their money in exactly the same way each household's or person's experience of inflation will be different. ONS analysed the inflation rates experienced by different types of households in the UK between 2003 and 2014 and concluded that the rate of inflation experienced by different types of household has varied markedly since 2003<sup>22</sup>. Figure 2.2 uses data from this report and illustrates the differing inflation rates across this period for retired and non-retired households.

**Figure 2.2: Annual inflation rates for retired and non-retired households, CPI, %**



Source: [Variation in the inflation experience of UK households: 2003 – 2014, ONS, December 2014](#) (Table 5.4)

- 2.12 The UK Consumer Price Statistics review, conducted by Paul Johnson, has sought to provide some clarity over what consumer price statistics are required to meet user needs. One of its recommendations is that ONS should develop an annual analytical publication that produces inflation indices as experienced by a range of different household types. The review also recommends that appropriate advice on what income measures these analytical

<sup>21</sup> Consumer Prices Index and Retail Prices Index, Updating Weights, 2014. Available at: <http://www.ons.gov.uk/ons/guide-method/user-guidance/prices/cpi-and-rpi/cpi-and-rpi-updating-weights/2014.pdf>

<sup>22</sup> Variation in the inflation experience of UK households: 2003 – 2014, ONS, December 2014, Available at: <http://www.ons.gov.uk/ons/rel/elmr/variation-in-the-inflation-experience-of-uk-households/2003-2014/index.html>



indices can be compared to should be provided<sup>23</sup>. More information on this review and how it relates to deflators is included in Chapter 3.

## ***Products and services prices and producer price indices***

- 2.13 From a business perspective there are a number of price indices which reflect changes in the prices faced by producers and purchasers of goods and services. These are Producer Price Indices (PPIs) and Service Producer Price Indices (SPPIs).
- 2.14 PPIs are based on the prices of products bought and sold by UK manufacturers and encompass:
- Producer Price Indices (PPIs) which measure changes in factory gate prices (output price indices) for UK based producers and change in the prices of materials and fuels bought by UK manufacturers for processing (input price indices).
  - Export Price Indices (EPIs) which measure the change in the prices of goods manufactured in the UK but destined for export markets.
  - Import Price Indices (IPIs) which measure change in the prices of goods and raw materials imported into the UK by UK manufacturers as inputs into the manufacturing process.
- 2.15 Service Producer Price Indices (SPPIs) measure changes in the prices received for selected services provided by UK businesses to other UK businesses and to the government. For example there is an accountancy services SPPI.
- 2.16 Producer Price Indices (PPIs) and Service Producer Price Indices (SPPIs) are based on the weighted average of a specific basket of products/services, or one good or service (in relation to a defined base period). These can then be aggregated to give price indices for broad product groupings, such as Manufacturing, Banking and Professional Scientific & Technical Activities. These can also be further aggregated to calculate deflators for the production and services industries. Currently ONS estimates that the SPPIs which it publishes cover 55% to 60% of the total service sector at industrial level.

## **Implied Industry deflators**

- 2.17 The UK National Accounts use the production and services product deflators along with other deflator series to derive volume estimates. GDP(O) is the key system within National Accounts for producing deflators. GDP(O) takes the industry based current price data and breaks it down into product data using the domestic output matrix from the Supply and Use Tables. The current price product series are then deflated by the product deflators and then aggregated back up to the industry level. Therefore, each industry deflator is made up of the products that each industry produces. This is a complex process involving techniques such as annual chainlinking to aggregate series by changing annual weights. For further

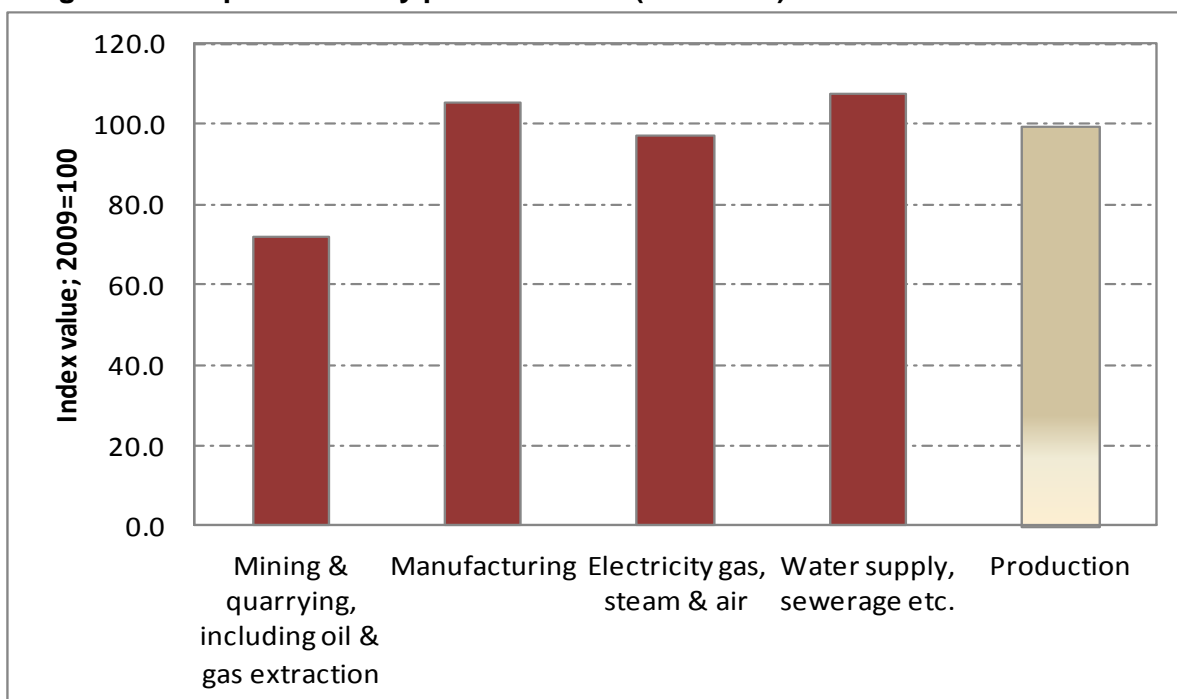
<sup>23</sup> UK Consumer Price Statistics: A Review, January 2015. Available at:  
<http://www.statisticsauthority.gov.uk/reports---correspondence/current-reviews/range-of-prices-statistics.html>



information see the definition of Chained Volume Measures in the Glossary of terms (Annex D).

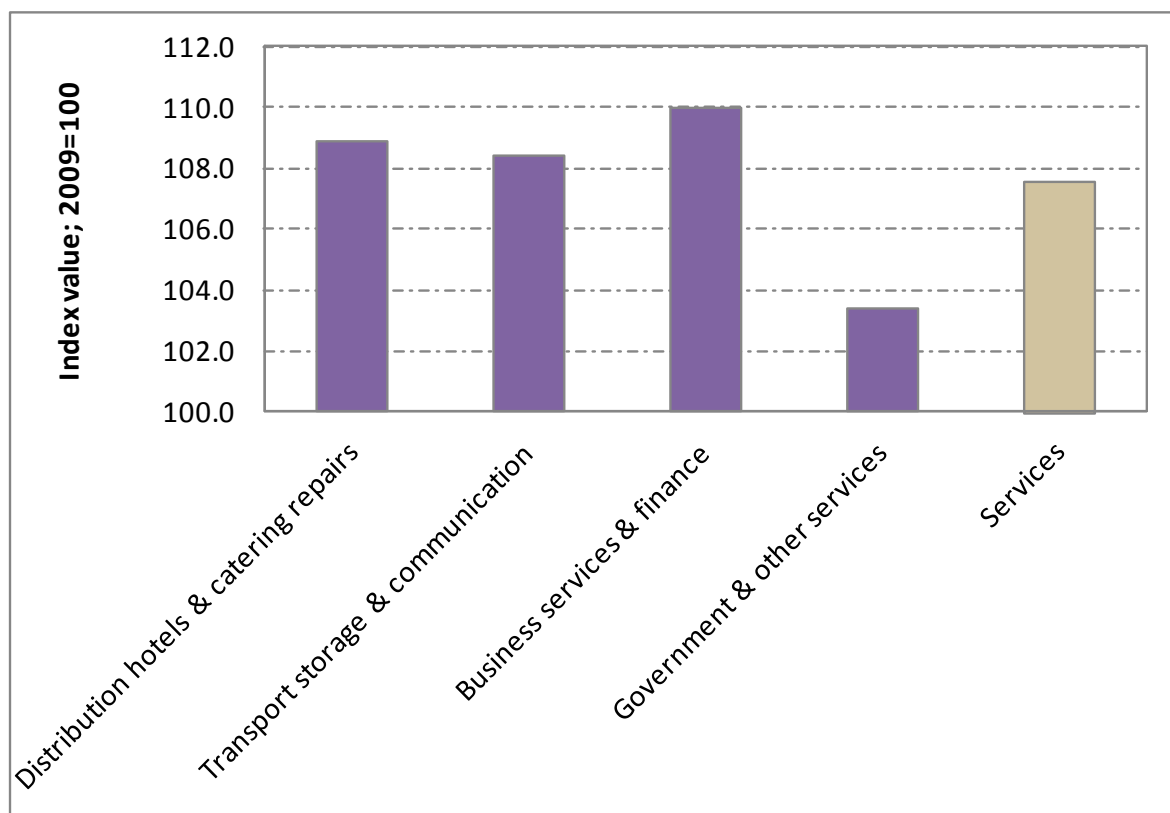
- 2.18 These National Accounts implied industry deflators, derived from the estimates of current price and volume estimates for each industry, should be used with some caution. The current price industry data comes from the Supply and Use Tables and is balanced on an industry and product basis. In a separate process GDP(O) balance volume data to derive a single measure of GDP. These adjustments are not applied together and as a result the implied deflators reflect balancing rather than realistic price movements. This process should be improved when ONS moves to calculating Supply and Use Tables in Previous Year Prices, where the current price and volume data will be consistently balanced.
- 2.19 In Figures 2.3 and 2.4 we show differences within the broad production and services industrial groupings (using the National Accounts implied deflators) to illustrate differing experiences of price changes across industries. For example mining & quarrying (including oil and gas extraction) has experienced decreasing prices in 2013 relative to 2009 (value < 100), whereas water supply and sewerage has experienced increasing prices (value > 100). These differences suggest that the relevant industry deflator may be more appropriate for some analysis. However, there are also trade-offs to be made and these should also be considered before deciding on the most appropriate deflator. For example, users considering deflating estimates at industrial detail level need to decide which deflators to choose between those from the National Accounts or from the relevant product prices indices dependent on the analysis they are seeking to undertake. These trade-offs, and the sorts of questions fuller, more formal guidance from producers should address to help improve the use of deflators, are discussed briefly in Annex A.

**Figure 2.3: Implied Industry price deflators (2013 data) – Production industries**



Source: Table 1.1.6 [National Accounts Q2 2014](#)

**Figure 2.4: Implied Industry price deflators (2013 data) – Services industries**



Source: Table 1.1.6 [National Accounts Q2 2014](#)

## **Deflators for countries and regions of the UK**

- 2.20 The wide range of deflators available to users at the UK level is not generally available for the constituent countries and regions within the UK. Focusing on the categories above:
- GDP deflators (based on the output approach) can be derived for some regions and countries within the UK. For example, for the Scottish and Northern Ireland economies it can be derived from official statistics publications<sup>24</sup>. Output deflators for most industrial sectors of the Welsh economy can be derived from official statistics publications and these component figures are classified as National Statistics<sup>25</sup>. However, the Welsh Government does not produce an output index for the whole of the services sector, and therefore no total economy (GDP) estimates exist. Similar data are not available for English regions.

<sup>24</sup> Scottish Government Economy Statistics. Available at: <http://www.scotland.gov.uk/Topics/Statistics/Browse/Economy>. Northern Ireland Economy Statistics. Available at: [http://www.detini.gov.uk/index/what-we-do/deti-stats-index/economic\\_output\\_statistics/gross\\_value\\_added.htm](http://www.detini.gov.uk/index/what-we-do/deti-stats-index/economic_output_statistics/gross_value_added.htm)

<sup>25</sup> Welsh Government Economy Statistics. Available at: <http://wales.gov.uk/statistics-and-research/?topic=Business+and+economy&lang=en>

- b. There are no regional consumer price indices (or regional implied deflators for HHFCE) available as official statistics.
- c. Producer price indices for regions and countries within the UK are not available; instead UK price indices are conventionally used as a proxy. These UK price indices are used at a detailed industrial level to deflate the regional sales estimates before weighting by the appropriate regional value added to give the appropriate published aggregate sectors and the whole economy values.

2.21 Some users told us that they have a strong interest in the differences between regional prices and implied deflators – in particular between the countries of the UK, and, within England, how London differs from the other regions. As interest in sub-UK and regional analysis increases, there may be an increased focus on the availability of regional prices, which in turn can then be used to develop improved regional deflators. This need should be monitored by producers of deflators and factored into decisions alongside resource considerations.

## **Summary**

2.22 There is a lot of choice in how you remove the effects of price changes from a time series with numerous deflators available. It is unlikely that any one deflator will be perfect, but it is important to choose the most appropriate one for the task in hand. In Chapter 3 we discuss what producers of deflators can do to improve the use of deflators and to help users navigate this complex landscape.

## Chapter 3: What producers of deflators can do to improve the use of deflators

- 3.1 In this final Chapter, we evaluate the availability and accessibility of deflator advice and guidance to help users to use deflators and recommend how producers of deflators can improve this advice. We will also discuss ongoing work to improve the quality and range of deflators to ensure deflators continue to meet user needs.

### ***Improving the accessibility and availability of deflator documentation and advice***

- 3.2 To enable users to make informed choices about how best to take account of price changes and to successfully navigate the deflator landscape they need to have accessible information on the methods used to calculate individual deflators, understand the range of deflators available, and have the tools to enable them to decide which deflator is the most appropriate for their analysis. We analyse the extent to which this is provided below.
- 3.3 Useful information about deflators and associated methods is available. However, some of this information is often hard to find, especially as it appears in ad hoc publications, and can be out of date. Some examples of the guidance available are as follows:
- Guidance on the GDP deflator, including how it is calculated and when it should be used, is provided by the Treasury<sup>26</sup>. Information on the quality and methodology of GDP, which is used to calculate the GDP deflator, is included on the ONS website<sup>27</sup>.
  - From a consumer prices perspective, information on the methods used to calculate consumer price indices, including an overview of and comparisons with some alternative economy-wide household deflators, such as the Household Final Consumption Expenditure (HHFCE), is included in the Consumer Price Indices: Technical Manual (2014 Edition)<sup>28</sup> which is readily accessible from the Consumer Price Inflation monthly release<sup>29</sup>.
  - Detailed methodological information for General Government Final Consumption Expenditure (GGFCE), a component of GDP which can also be used as a deflator is available (see Annex D for more information about GGFCE). However, it was difficult to find, and until October 2014<sup>30</sup>, the most recent document available was from 2002<sup>31</sup>.

<sup>26</sup> GDP deflators at market prices, and money GDP. Available at: <https://www.gov.uk/government/publications/gdp-deflators-at-market-prices-and-money-gdp-march-2013>

<sup>27</sup> GDP Quality and Methodology Information. Available at: <http://www.ons.gov.uk/ons/guide-method/method-quality/quality/quality-information/economy/summary-quality-report-for-gross-domestic-product-gdp-.pdf>.

<sup>28</sup> Available at: <http://www.ons.gov.uk/ons/rel/cpi/consumer-price-indices---technical-manual/2014/index.html>

<sup>29</sup> Consumer Price Inflation Monthly release. Available at: <http://www.ons.gov.uk/ons/rel/cpi/consumer-price-indices/index.html>

<sup>30</sup> Government Implied Deflators Explained. Available at: <http://www.ons.gov.uk/ons/guide-method/method-quality/specific/economy/national-accounts/articles/2011-present/government-implied-deflators-explained.pdf>

- 3.4 Further technical detail on the compilation of deflators, and how methods have developed over time, is also provided by ONS. The article "Deflation of Short-term Output Indicators"<sup>32</sup> focuses on deflators and the deflation process for the output approach to measuring gross domestic product (GDP(O)) and component series. It provides details of classification of industries and products and details on how product deflators are compiled and how implied deflators are derived. The article "Deflation improvements in the UK National Accounts"<sup>33</sup> sets out how, for Blue Book 2011, deflation methods were brought into line with international best practice. And the two articles "Methodology Notes: Annual chain-linking"<sup>34</sup> and "The GDP implied deflator"<sup>35</sup> provide details on how volume measures are aggregated and implied deflators derived.
- 3.5 However, an overview of all the main deflators provided by official bodies, such as the ONS, is not available for users. Additionally, where guidance on individual deflators, such as the GDP deflator on the Treasury webpage<sup>36</sup>, is provided it often does not explain or link to guidance on alternative deflators. This may be why users often revert to 'generic' deflators such as the GDP deflator or Consumer Prices Index (CPI).
- 3.6 The provision of tools to help users decide which deflator to use is also fairly limited. Some guidance is provided for consumer prices indices in the Consumer Price Indices Technical Manual (2014 Edition)<sup>37</sup>, but is not available across the wider range of deflators. We recognise that providing a definitive list of what deflator to use in which circumstance is unfeasible as in most circumstances there is unlikely to be a perfect single answer. Instead most decisions will require trade-offs. However, providing tools and guidance to enable users to understand what to consider when deciding which deflator to use, as well as ensuring the methodological information for each deflator is available, would help users in their decision-making.
- 3.7 Accessing deflator documentation and advice from the website can be difficult. Partly this was due to limited guidance on the range of deflators available and guidance to help inform user choice on which deflator to use which we mentioned earlier. Partly this was due to the website, which is an area that ONS is continuing to work on and develop, and is outside the scope of this review. However, users we spoke with as part of this review, echoing the responses to the National Statistics Quality Review: National Accounts and Balance of

<sup>31</sup> General Government Consumption at Constant Prices, 2002. Available at: <http://www.ons.gov.uk/ons/guide-method/method-quality/specific/economy/public-sector-finance/general-government-consumption-at-constant-prices.pdf>

<sup>32</sup> <http://www.ons.gov.uk/ons/guide-method/method-quality/specific/economy/output-approach-to-gdp/methods-and-sources/deflation.pdf>

<sup>33</sup> <http://www.ons.gov.uk/ons/guide-method/method-quality/specific/economy/national-accounts/articles/deflation-improvements-in-the-uk-national-accounts.pdf>

<sup>34</sup> [www.ons.gov.uk/.../methodological-note--annual-chain-linking.pdf](http://www.ons.gov.uk/.../methodological-note--annual-chain-linking.pdf)

<sup>35</sup> [www.ons.gov.uk/.../methods-explained--the-gdp-implied-deflator.pdf](http://www.ons.gov.uk/.../methods-explained--the-gdp-implied-deflator.pdf)

<sup>36</sup> GDP deflators at market prices, and money GDP. Available at: <https://www.gov.uk/government/statistics/gdp-deflators-at-market-prices-and-money-gdp-march-2013>

<sup>37</sup> Available at: <http://www.ons.gov.uk/ons/rel/cpi/consumer-price-indices---technical-manual/2014/index.html>

Payments<sup>38</sup>, were complimentary about the service they received on contacting ONS statisticians directly.

### ***Improving the quality and range of available deflators***

- 3.8 Deflators are constantly evolving and improving. For example, the measurement of prices in the service sector in UK has been evolving since they were first developed in 1990. This has included an expansion in the coverage of the services sector so that the SPPIs now published cover 55-60 per cent of the service sector at the industry level<sup>39</sup>. ONS is also committed to improving SPPIs further (see the following box for more detail). Additionally, in the SPPI statistical bulletin published in February 2014, following a period of consultation, development and assurance, ONS included previously experimental<sup>40</sup> industry indices in the aggregate SPPI<sup>41</sup>.

#### **Improvements to Service Producer Price Indices (SPPIs)**

Currently the Service Turnover Survey (STS) provides the weights for different service industries within the aggregate Services Producer Prices Index (SPPI). Additionally the STS is used to work out which industries produce which products in order to build a sampling frame for collecting price information on a product basis. The STS collects both a business' service turnover and its total turnover. Where the data are found to be of sufficient quality, the STS sales are used to weight the industry into the top level aggregates. Where the data quality was not sufficient, data from the Annual Business Survey (ABS) are used.

The most common method used to collect a price from its source is through a survey. Currently the sampling frame for the surveys used for many of the SPPIs, e.g. Rail Freight, is the Inter-Departmental Business Register (IDBR). However, the number of respondents is sometimes very small. For example, for the Sound Recording and Music Publishing SPPI the number of UK businesses that supply price quotes is seven (each respondent may provide more than one quote).

To both improve the quality of the data used for weighting the aggregate SPPI and to improve the response rates across the individual SPPIs, the STS is being improved. The plan is to increase the sample size of the STS from 8,000 to 20,000 and to increase the frequency of collection from 5-yearly to every 2-3 years. The first improved STS was dispatched in July 2014 with the next one due to be dispatched in January 2016. The results are published following closedown and analysis several months later.

<sup>38</sup> National Statistics Quality Review: National Accounts and Balance of Payments, 8 July 2014, Available at: <http://www.ons.gov.uk/ons/rel/naa1-rd/national-statistics-quality-review/-nsqr--series--2--report-no--2--review-of-national-accounts-and-balance-of-payments/index.html>

<sup>39</sup> Service Producer Price Index, November 2014. Available at: <http://www.ons.gov.uk/ons/rel/ppi2/services-producer-price-indices/quarter-3-2014/index.html>

<sup>40</sup> <http://www.statisticsauthority.gov.uk/news/assessment-and-designation-of-experimental-statistics.html>

<sup>41</sup> <http://www.ons.gov.uk/ons/rel/ppi2/services-producer-price-indices/the-development-of-price-indices-for-professional-business-services--cargo-handling-and-storage-and-warehousing--quarter-3-2013/experimental-sppis-q3-2013-article.html>

- 3.9 We summarise two current areas of work which are focused on improving the quality and the range of deflators in the following sections.

### **National Accounts deflator quality improvements**

- 3.10 The UK National Accounts provide an integrated description of all economic activity within the economic territory of the UK. This incorporates production and consumption of goods and services by households, businesses, and government. One of the key outputs of this work is the value and volume of Gross Domestic Product and from which the GDP Implied Price Deflator can be derived. Within the National Accounts there are also other well-known statistics produced, these include Household Final Consumption Expenditure (HHFCE) which was mentioned in Chapter 2 as an example of where an alternative household level deflator can be derived by comparing the real and nominal estimates.
- 3.11 The recent National Statistics Quality Review of the National Accounts and Balance of Payments<sup>42</sup> includes a set of recommendations which aim to improve the quality of deflators produced through the National Accounts process. Included within this are recommendations that ONS should review the deflators and deflation process for Gross Fixed Capital Formation (GFCF) and that ONS should develop double deflation measures based on the development of Supply Use Tables (SUT) at Previous Year Prices (PYP).

#### **What is Double Deflation?**

Gross Value Added is defined as the value generated by any unit engaged in production and the contributions of individual sectors or industries to gross domestic product. It is measured at basic prices, excluding taxes less subsidies on products. To produce this in volume terms, both inputs and outputs should be deflated, which is known as double deflation.

Source: [ONS Blue Book 2014 Glossary](#)

- 3.12 ONS has welcomed the recommendations and suggestions from the National Statistics Quality Review of the National Accounts and Balance of Payments. In its response to the review, ONS states that 'all 46 recommendations and suggestions have been accepted either wholly or in part.'<sup>43</sup>
- 3.13 In addition to the recommendations and suggestions in this review, ONS has also identified a wider programme of work to improve deflators. Included within this wider programme of work, is the work to improve SPPIs further, improvements to trade prices and improvements to General Government Final Consumption Expenditure (GGFCE).

<sup>42</sup> National Statistics Quality Review: National Accounts and Balance of Payments, 8 July 2014, Available at: <http://www.ons.gov.uk/ons/rel/naa1-rd/national-statistics-quality-review/-nsqr--series--2--report-no--2--review-of-national-accounts-and-balance-of-payments/index.html>

<sup>43</sup> ONS Response to the National Statistics Quality Review of National Accounts and Balance of Payments. January 2015. Available at: <http://www.ons.gov.uk/ons/guide-method/method-quality/quality/quality-reviews/list-of-current-national-statistics-quality-reviews/ons-response-to-national-statistics-quality-review-of-national-accounts-and-balance-of-payments.pdf>



3.14 ONS is developing a National Accounts Deflator strategy to pull together all these strands of work with a view to improving the way deflators are used in National Accounts<sup>44</sup>.

### UK Consumer Price Statistics: A Review

3.15 The UK Consumer Price Statistics review, commissioned by the UK Statistics Authority and conducted by Paul Johnson, was set up to consider what changes are needed to the range of consumer price statistics produced for the UK to best meet current and future user needs<sup>45</sup>. Consumer price statistics, which include CPI (CPIH) and RPI (RPIJ), are often used to remove the effects of price changes from a time series.

3.16 The review recommendations include<sup>46</sup>:

- ONS should move towards making CPIH its main measure of inflation. In the meantime, the CPI should continue to be the main measure of inflation;
- Government and regulators should move towards ending the use of the RPI as soon as practicable and, where they decide to keep using it, the Authority should ask them to set out clearly and publicly their reasons for doing so;
- ONS should develop an annual analytical publication that produces inflation indices as experienced by a range of different household types, along with appropriate advice on what income measures these analytical indices can be compared to; and
- ONS should consult on discontinuing RPIJ. ONS should continue to publish an estimate of the “formula effect” between the RPI and the main measure of inflation.

3.17 Additionally, the review includes a number of detailed recommendations which relate to improving the quality of these statistics and improving the methodological information that users have around these measures. For example, it recommends reviewing the Living Costs and Food Survey which directly informs weights in RPI and RPIJ and indirectly informs weights in CPI and CPIH. It also recommends that ONS improve its commentary on the weights tables that accompany RPI and CPIH so it explains why weights differ and/or move in different directions.

3.18 The UK Statistics Authority expects to launch a formal public consultation in the summer of 2015 and to make a final response to the recommendations included in this review report later in 2015<sup>47</sup>.

<sup>44</sup> ONS Response to the National Statistics Quality Review of National Accounts and Balance of Payments. January 2015. Available at: <http://www.ons.gov.uk/ons/guide-method/method-quality/quality/quality-reviews/list-of-current-national-statistics-quality-reviews/ons-response-to-national-statistics-quality-review-of-national-accounts-and-balance-of-payments.pdf>

<sup>45</sup> Johnson Review of the Range of Prices Statistics: Terms of Reference: <http://www.statisticsauthority.gov.uk/reports---correspondence/current-reviews/Review-of-Range-of-Price-Statistics---Terms-of-Reference.doc>

<sup>46</sup> UK Consumer Price Statistics: A Review, January 2015. Available at: <http://www.statisticsauthority.gov.uk/reports---correspondence/current-reviews/range-of-prices-statistics.html>

<sup>47</sup> UK Consumer Price Statistics: A Review. News Release. 8 January 2015. Available at: <http://www.statisticsauthority.gov.uk/news/news-release---uk-consumer-price-statistics-a-review.pdf>



## Summary

- 3.19 We welcome and fully support the commitment to continuous improvement, meeting user needs and user engagement demonstrated by the ongoing deflator improvement work, including the contributions from:
- The National Statistics Quality Review of the National Accounts and Balance of Payments conducted by Dame Kate Barker and Art Ridgeway and published in July 2014<sup>48</sup>; and
  - The UK Consumer Price Statistics review conducted by Paul Johnson<sup>49</sup>
- 3.20 We recommend that this work is augmented by improving the usability and accessibility of deflator statistics.
- 3.21 We recognise that there is a wide range of guidance published about deflators. However, this can be hard to access quickly and some of the information is out of date. Additionally there is limited information on the range of deflators available and limited advice on how to choose from that range.
- 3.22 We recommend that:
- i. ONS review the availability of methodological information, including strengths and limitations, for all deflators that it publishes and commit to a work plan for updating the information available.
  - ii. ONS produce an accessible deflator summary document, distilling and updating existing documentation, to advise users on the full range of deflators available, including a detailed list of factors to consider when deciding which deflator to use, and links through to deflator specific guidance and more technical deflator methodological information. Annex A is illustrative of the sorts of questions fuller, more formal guidance from the ONS should address.
  - iii. HMT provide links to further information on alternative deflators alongside the GDP deflator guidance on gov.uk.

<sup>48</sup> National Statistics Quality Review: National Accounts and Balance of Payments, 8 July 2014, Available at: <http://www.ons.gov.uk/ons/rel/naa1-rd/national-statistics-quality-review/-nsqr--series--2--report-no--2--review-of-national-accounts-and-balance-of-payments/index.html>

<sup>49</sup> UK Consumer Price Statistics: A Review, January 2015. Available at: <http://www.statisticsauthority.gov.uk/reports---correspondence/current-reviews/range-of-prices-statistics.html>

## Annex A: Examples of questions to consider when choosing a deflator

During the course of the review, those we have spoken with, users, producers and the steering group<sup>50</sup>, have provided an insight into some of the questions to consider when deciding which deflator to use. We summarise these questions in this Annex. This is not intended as an exhaustive list but a summary of some the considerations mentioned during the course of the review, which can feed into the implementation of the following recommendation:

*ONS produce an accessible deflator summary document, distilling and updating existing documentation to advise users on the full range of deflators available, including a detailed list of factors to consider when deciding which deflator to use, and links through to deflator specific guidance and more technical deflator methodological information.*

### **Does the analysis require a deflator?**

There are many ways of presenting time series information to show how figures change over time on a comparable basis. Series are typically presented either in comparison with another series over time or deflated to remove the effects of price changes over time. Consideration of the nature of the question to be answered can help the analyst to determine whether they need to deflate. If users do need to deflate, it can also help determine the type of deflator which may be more appropriate. Taking the example of healthcare spending, the following table demonstrates the different measures which may be relevant depending on the question being asked.

**Figure A.1: Healthcare spending example analysis questions**

Question	Potential measure to consider
What proportion of our nation's output do we spend on healthcare?	Healthcare spending as % of GDP.
How much do we spend on healthcare in relation to our population size?	Healthcare spending per capita (proportion of population). This is useful for inter and intra national comparisons.
How much has our government spent on healthcare in comparison to other public sector services?	Healthcare spending in current prices compared to other public sector services (such as education and defence spending) in current prices.
How has government spending in real terms on healthcare changed over the past five years in comparison to other government spending (e.g. education)?	Healthcare spending in real terms (deflated using the GDP deflator) over the past five year compared to other government spending also deflated using the GDP deflator.

<sup>50</sup> UK Statistics Authority Steering Group for Monitoring Review: The Use of Deflators in Official Statistics Publications. Terms of Reference. Available at: <http://www.statisticsauthority.gov.uk/assessment/monitoring/monitoring-reviews/review-outlines/deflators-monitoring-review-steering-group--term-of-reference.pdf>

Has the volume of healthcare provided by the public sector risen over the past five years? Or are the spending changes just due to changes in prices?

Healthcare spending in real terms (deflated using a healthcare sector deflator if available) over the past five years.

## ***What are the characteristics, strengths and limitations of the available deflators?***

As set out in Chapter 2 there are a variety of deflators available to use. To choose the most appropriate deflator to use, analysts should identify relevant deflators and evaluate their relative strengths and limitations to help decide which is the most appropriate.

Some examples of the types of characteristics users may want to consider are:

- The coverage of the statistics. For example, as shown in Figure C.2, the Household Final Consumption Expenditure (HHFCE) implied deflator differs from the CPI and CPIH measures. These differences are explained by the different methodologies, coverage and assumptions used for each<sup>51</sup>. For example, HHFCE includes Financial Intermediation Services Indirectly Measured (FISIM), which is a measure of the implicit fees that banks and other financial intermediaries charge depositors and borrowers through interest rate differentials, and estimated rent imputed to owner-occupiers (see Annex D: Glossary for more information). These components are not included in CPI and in a study ONS carried out in 2012 were found to be the main contributing factors to the difference between CPI and the HHFCE implied deflator<sup>52</sup>.
- The timeliness of the statistical publications. For example, HHFCE is only produced quarterly, whereas CPI and CPIH are produced monthly.
- The possible extent of revisions. For example, GDP figures (and so the GDP implied deflator) are subject to revisions following each quarterly publication, at the end of the year when the National Accounts are compiled, and when the next set of annual data becomes available (in line with the National Accounts Revisions policy). In comparison CPI, CPIH and RPIJ are revisable in theory, but revisions only occur under exceptional circumstances.
- Whether a more specific and appropriate deflator exists. For example, implied price deflators are available for a range of industrial groups as well as the more generic GVA and GDP implied deflators. Therefore if users are interested in taking account of price changes in a production industry they may want to explore if the price changes faced by this industry differ from the overall economy and if so would the more specific production industry deflator be more appropriate to use for deflation.

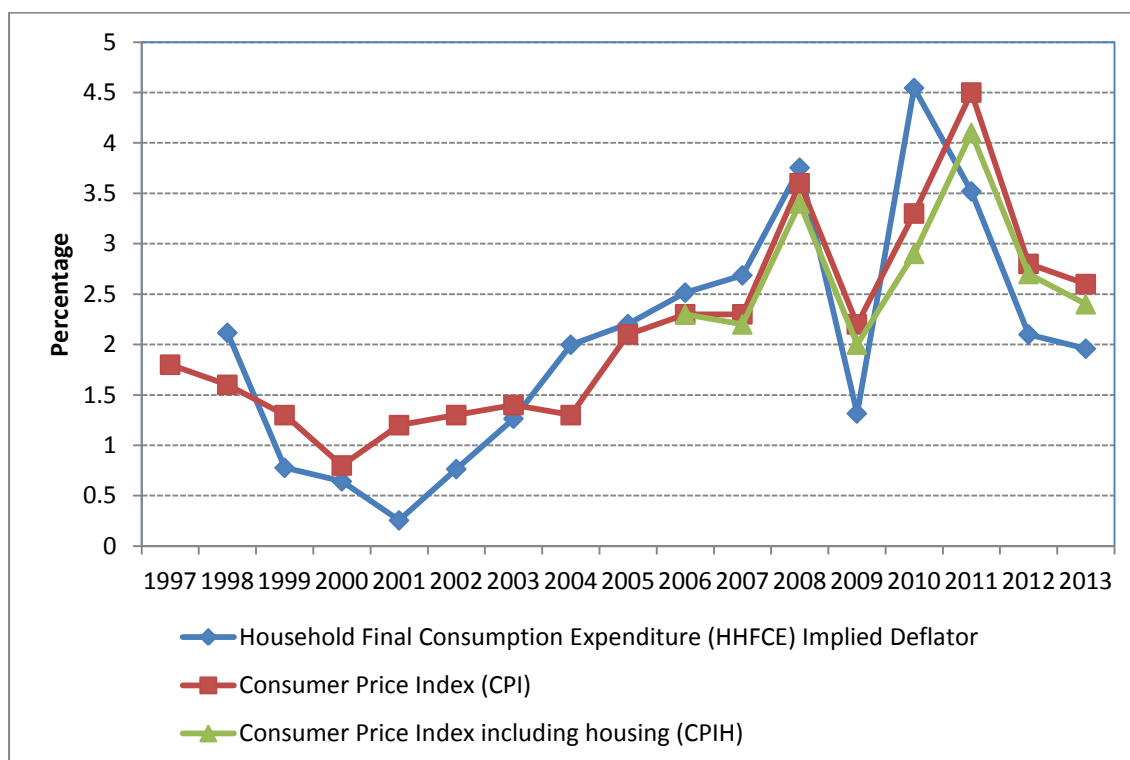
<sup>51</sup> More information is included in the Consumer Price Indices: Technical Manual (2014 Edition). Available at: <http://www.ons.gov.uk/ons/rel/cpi/consumer-price-indices---technical-manual/2014/index.html>

<sup>52</sup> ONS Reconciliation of the differences between the Consumer Price Index and the Implied Price Deflator. Available at: <http://www.ons.gov.uk/ons/rel/cpi/the-reconciliation-of-the-differences-between-the-consumer-price-index-and-the-implied-price-deflator/index.html>

- For some more specific analyses of a detailed series (such as an industrial sector or type of household) a number of prices series may need to be combined to reflect the coverage and nature of the series. There are techniques, such as chainlinking, that may be adopted to allow users to adhere to best practice.

Users should expect to find guidance and advice about deflators provided by the producers of these statistics. This guidance will include the methods used, assumptions made and any quality issues to consider. The Code of Practice for Official Statistics sets out what producers of National Statistics, which many deflators are, are required to do to ensure: that the range of official statistics meets the needs of users; that the statistics are produced, managed and disseminated to high standards; and that the statistics are well explained. This includes the information and guidance that producers should make available for users. If users cannot find the information, they can contact the statistician responsible for the statistic. This person should be, and is usually, identified in the statistical publication.

**Figure A.2: Comparison of CPI, CPIH and HHFCE (average year-on-year change)**



**Sources and Notes:**

- Implied HHFCE deflator data from [Consumer Trends Q2 2014](#) (Table OGSDN; Total expenditure)
- CPI, CPIH and RPI from [Consumer Price Inflation Time Series Dataset, October 2014](#)
- CPI data from data series D7G7
- CPIH from data series L550. Annual percentage growth data is only available from 2006
- All data are non-seasonally adjusted data; average annual percentage change

### ***What trade-offs need to be considered?***

Often users will have to make a trade-off between deflators (and their characteristics). For example, a more specific index or implied deflator, like an industrial implied deflator, may be more relevant for some analysis in comparison to the more generic GVA and GDP implied deflators, however it may also be more volatile or more subject to variability due to small sample sizes. Additionally, if you are comparing household inflation across Europe, CPI may be the most appropriate, when compared with CPIH or RPI, in terms of comparability as CPI is calculated according to European Regulations to allow 'like-for-like' comparisons of inflation rates across EU Member States. However, CPI does not include owner occupiers' housing costs (which CPIH and RPI do include) and as stated by ONS "With housing costs accounting for approximately ten per cent of households' consumption expenditure (based on expenditure estimates in the UK's National Accounts), the continued absence of OOH within the CPI is a weakness."<sup>53</sup> An additional consideration is that CPI is designated as a National Statistic<sup>54</sup>, whereas RPI was de-designated as a National Statistic in 2013 as the formulation of the RPI fails to meet international standards<sup>55</sup>. CPIH had its National Statistics status discontinued in August 2014 pending work by ONS to investigate and improve the method for measuring owner occupiers' housing costs in this index<sup>56</sup>.

<sup>53</sup> Introducing the New CPIH Measure of Consumer Price Inflation. Available at: <http://www.ons.gov.uk/ons/guide-method/user-guidance/prices/cpi-and-rpi/introducing-the-new-cpih-measure-of-consumer-price-inflation.pdf>

<sup>54</sup> Designation as National Statistics means that the statistics comply with the [Code of Practice](#). The Code is wide-ranging. Designation can be interpreted to mean that the statistics: meet identified user needs; are produced, managed and disseminated to high standards; and are explained well.

<sup>55</sup> RPI UK Statistics Authority Statement. March 2013. Available at: <http://www.statisticsauthority.gov.uk/news/statement---retail-prices-index---14-march-2013.pdf>

<sup>56</sup> <http://www.statisticsauthority.gov.uk/reports---correspondence/correspondence/letter-from-sir-andrew-dilnot-to-john-pullinger-14082014.pdf>

## Annex B: Examples of users and uses of deflators

User	Deflator(s)	Example use of deflator(s)
Department for Work and Pensions (DWP): Households Below Average Income Team	<p>Variants of RPI:</p> <ul style="list-style-type: none"> <li>• All items excluding council tax-for Before Housing Costs (BHC) statistics;</li> <li>• All items excluding housing costs – for After Housing Costs (AHC) statistics</li> </ul>	<p>DWP's statistical report '<a href="#">Households Below Average Income (HBAI)</a>' presents information on living standards in the United Kingdom, and gives annual estimates of the number and percentage of people living in low-income households. Figures are also provided for children, pensioners, working-age adults and individuals living in a family where someone is disabled.</p> <p>HBAI has historically used variants of the Retail Prices Index (RPI) to adjust for inflation, primarily to present income in the latest year's prices, and to adjust the absolute low income threshold to the year in question.</p> <p>Following the de-designation of RPI as a National Statistic, and as advised in the Statistical Notice published in April 2014, an HBAI Technical Advisory Group (TAG) recommended that the HBAI publication should continue to use variants of RPI as the measure of inflation for the 2012/13 publication without change. To supplement this, they recommended that the publication should also show key BHC figures using other inflation measures in an Annex.</p> <p>The use of RPI for another year was recommended given the lack of immediate alternatives with appropriate BHC and AHC variants, and in order to provide a consistent series whilst awaiting any relevant recommendations from the forthcoming Johnson Review for consideration. Annex 4 of the 2012/13 HBAI publication presents trends in income and absolute low income using alternative inflation measures.</p>
Professor Jonathan Haskel (Imperial College, London)	Industry-level deflators for output and capital assets (such as software and R&D deflators) and US Bureau of Labor deflators	Deflators are used in his work to measure UK productivity.

House of Commons Library (HCL )	CPI, RPI, GDP and GVA deflators from the National Accounts and the Annual Business Survey	<p>HCL uses deflators to convert data in nominal terms into real terms. Some examples include:</p> <ul style="list-style-type: none"> <li>• average earnings,</li> <li>• public expenditure (in general and by department and function),</li> <li>• estimating real terms growth in regional GVA, and</li> <li>• previous/future benefit levels in today's prices</li> </ul> <p>HCL also use deflators to help MPs check the progress of government commitments on spending. For example, the Government's commitment to increase health spending in real terms over the term of the current Parliament.</p> <p>For indicators such as public expenditure, output by industry (from the National Accounts or Annual Business Survey), or regional GVA (income approach), HCL use the deflators in the National Accounts (GDP/GVA deflators). For indicators that are more closely related to standards of living or household income HCL use consumer price indices (such as CPI or RPI) to deflate – this includes analysis of real wages and benefit/pension levels in real terms (including forecasts).</p>
Office for Budget Responsibility (OBR)	GDP(E) deflators, including the consumption deflator (based on the OBR CPI forecast) , investment deflators, , implied government consumption deflator and export/import deflators	<p>OBR primarily uses deflators in its forecasts (particularly in forecasting nominal GDP). The OBR forecasts the expenditure components of UK GDP in both constant (volume) and current prices and therefore forecasts the associated deflators, using the most recent National Accounts data as a starting point.</p>

## Annex C: List of users who contributed to this review

As part of the monitoring review process we have considered the views of users. We approached some known and potential users of the set of statistics, and we invited comments via an open note on the Authority's website which we publicised on StatsUserNet. This process is not a statistical survey, but it enables us to gain some insights about the use of deflators produced by official bodies. We are aware that responses from users may not be representative of wider views, and we take account of this in the way that we prepare our reports.

The Monitoring review team received 13 responses from the user consultation. The respondents were grouped as follows:

- Government (5)
- Research and academia (5)
- Commercial (3)

A small steering group was also set up to provide expert advice to the Monitoring team at key stages of the review<sup>57</sup>.

<sup>57</sup> UK Statistics Authority Steering Group for Monitoring Review: The Use of Deflators in Official Statistics Publications. Terms of Reference. Available at:  
<http://www.statisticsauthority.gov.uk/assessment/monitoring/monitoring-reviews/review-outlines/deflators-monitoring-review-steering-group--term-of-reference.pdf>



## Annex D: Glossary of terms

### Base Period

A point in time used as a reference point for comparison with other periods

### Basic Prices

Basic prices reflect the amount received by the producer for a unit of goods or services minus any taxes payable plus any subsidy receivable on that unit as a consequence of production or sale (that is the cost of production including subsidies). As a result the only taxes included in the basic price are taxes on the production process – such as business rates and any vehicle excise duty paid by businesses – which are not specifically levied on the production of a unit of output. Basic prices exclude any transport charges invoiced separately by the producer.

### Chained Volume Measures (CVM)

Chained volume measures are time series which measure GDP in real terms (that is excluding price effects). Series are calculated in the prices of the previous year and in current price and all of these two-year series are then "chain-linked" together. The advantage of the chain-linking method is that the previous period's price structure is more relevant than the price structure of a fixed period from further into the past.

### Constant Price (KP) Series

These series have the effects of inflation removed by holding prices throughout the series at the level in a chosen base year (also known as real terms series). For National Accounts purposes this term is now obsolete. It was used in National Accounts up to 2003 when annual chainlinking was introduced and was replaced by the term chained volume measure (see above).

### Consumer Prices

Prices paid by purchasers. They include transport costs, trade margins and taxes (unless the taxes are deductible by the purchaser from their own tax liabilities).

### Consumer Price Indices

A measure of the price level in the economy based on the prices of a collection of goods which are designed to reflect the consumption basket of the average consumer.

CPI, CPIH, RPI and RPIJ are all consumer price indices. They are each compiled using the same underlying prices data, however due to differences in the methodologies of RPI and CPI, such as the formulae used and definitions of what is in the basket, they each produce slightly different inflation rates.

Further information on the methods used to construct the CPI, CPIH, RPI and RPIJ, including differences in these methods, can be found in the [Consumer Price Indices Technical Manual](#).

## Consumer Prices Index (CPI)

The CPI is a measure of consumer price inflation produced to international standards and in line with European regulations. Internationally, the CPI is known as the Harmonised Index of Consumer Prices (HICP). HICPs are calculated in each Member State of the European Union according to rules specified in a series of European regulations developed by the European Commission (Eurostat) in conjunction with the EU Member States. Eurostat released figures for the Harmonised Index of Consumer Prices (HICP) for the month of October 2014 for EU Member States, together with an EU average, on 14 November 2014. A summary of the latest European data is available from Eurostat's database tables. Further information on HICP for the European Union, Euro area and other EU Member States is available from [Eurostat's HICP web page](#).

The CPI is the inflation measure used in the Government's target for inflation and is a National Statistic.

Further information on the methods used to construct the CPI can be found in the [Consumer Price Indices Technical Manual](#).

## CPIH

CPIH was launched in early 2013 as a measure of UK consumer price inflation that includes Owner Occupiers' Housing (OOH) costs. These are the costs of housing services associated with owning, maintaining and living in one's own home. OOH does not include costs such as utility bills and minor repairs and maintenance which are already included in the index. CPIH uses an approach called rental equivalence to measure OOH. Rental equivalence uses the rent paid for an equivalent house as a proxy for the costs faced by an owner occupier. In other words this answers the question "how much would I have to pay in rent to live in a home like mine?" for an owner occupier.

Further information on the methods used to construct CPIH can be found in the [Consumer Price Indices Technical Manual](#).

## Current Price (CP) Series

These series include the effects of inflation.

## Deflation

Definition 1 - Deflation is the opposite of inflation and is commonly thought of as a decrease in prices for goods and services. Deflation occurs when the inflation rate falls below 0 (often referred to as negative inflation).

Definition 2 - Deflation also refers to the process of removing price changes for a current price series to derive a volume series.

## Deflator

A deflator is a value that allows for the effects of changes in price (inflation) to be removed from a time series, i.e. it allows the change in the volume of goods and services to be

measured. The resultant series can be used to express a given time series or data set in real terms, i.e. by removing price changes.

### **Double Deflation**

Method for calculating value added by industry chained volume measures, which takes separate account of the differing price and volume movements of input and outputs in an industry's production process.

### **Economically Significant Prices**

These are prices whose level significantly affects the supply of the good or service concerned. Market output consists mainly of goods and services sold at 'economically significant' prices, while non-market output comprises those provided free or at prices that are not economically significant.

### **Export Producer Prices**

See Producer Prices.

### **Factory Gate Prices**

Also known as output prices, are the prices of goods sold by UK manufacturers. It includes costs such as labour, raw materials and energy, as well as costs such as interest on loans, site maintenance or rent.

### **Financial Intermediation Services Indirectly Measured (FISIM)**

FISIM is an acronym for Financial Intermediation Services Indirectly Measured. It represents the implicit charge for the service provided by monetary financial institutions paid for by the interest differential between borrowing and lending rather than through fees and commissions.

### **Gross domestic product (GDP)**

The total value of output in the economic territory. It is the balancing item on the production account for the whole economy. Domestic product can be measured gross or net. It is presented in the accounts at market (or purchasers') prices.

### **GDP(O), GDP(E), GDP(I)**

There are three different methods of calculating gross domestic product (GDP) – a measure of economic activity. In theory, these three measures should equal each other. GDP (O) is the sum of all production activity with the economy (the output approach) together with taxes less subsidies on products (see definition of Gross Value Added). GDP(E) is the sum of all final expenditures by the economy (the expenditure approach). GDP(I) is the sum of all income generated by production within the economy (the income approach). More information on these measures is provided by ONS in the [GDP Quality and Methodology Information Paper](#).

## GDP Implied Price Deflator

The GDP deflator (implied price deflator) differs from most price indices in that it encompasses all domestically produced goods and services, rather than a specific sub-set. Additionally, there are no explicit weights assigned to each good/service instead this is implicitly determined by the relative value of each good/service to economic production.

## General Government Final Consumption Expenditure (GGFCE)

General Government Final Consumption Expenditure (GGFCE) is aggregated from the cost elements (compensation of employees, procurement and fixed capital consumption), net of market sales and output for own final use, for each of the separate government services: health, education, public administration, defence, etc. More information on GGFCE and government implied deflators is available from [Government Implied Deflators Explained](#).

## Gross Value Added (GVA)

The value generated by any unit engaged in production and the contributions of individual sectors or industries to gross domestic product. It is measured at basic prices, excluding taxes less subsidies on products.

## Household Final Consumption Expenditure (HHFCE)

The expenditure on those goods and services used for the direct satisfaction of individual needs or the collective needs of members of the community, as distinct from their purchase for use in the productive process. It may be contrasted with actual final consumption, which is the value of goods consumed but not necessarily purchased by that sector.

## Implied Deflator

An implied deflator is a series which shows the implied change in average prices for a variable by dividing the current price series by the real or volume series.

## Import Producer Prices

See Producer Prices.

## Index number

Index numbers are used to measure changes and simplify comparisons. The Office for National Statistics (ONS) produces index numbers principally in the field of economics. Economists are interested in how changes in the monetary value of economic transactions can be attributed to changes in price (to measure inflation) and changes in quantity (to measure sales volume or economic output). Index numbers typically measure these changes over time. More information is available from the [ONS website](#).

## Inflation

Inflation is commonly thought of as an increase in prices for goods and services. Rises in the prices of things households buy are referred to as consumer price inflation. However, price inflation might also affect businesses buying raw materials or importing goods and services.

## **Inflation rate**

The rate of change of the average price of goods and services.

## **Imputed rental (Household Final Consumption Expenditure (HHFCE))**

In the National Accounts, owner occupiers are deemed to be unincorporated businesses producing housing services, which they then consume. This consumption is a component of Household Final Consumption Expenditure.

The main reason for this imputation treatment is to minimise distortions to the consumption figures which would otherwise arise when there were changes in housing tenure, for example from rented to owner-occupied.

The principle involved is to impute a rental value for an owner-occupied property, which is the same as the rental that would be paid for a similar property in the private rented sector. The imputed rent methodology calculates rent for owner occupiers and rent-free dwellings.

More information is available from the [ONS website](#).

## **National Accounts**

An integrated description of all economic activity within the economic territory of the UK, including activity involving both domestic units (i.e. individuals and institutions resident in the UK) and external units (those resident in other countries). These are produced in line with international guidance set-out in the [System of National Accounts \(SNA\) 2008](#) and [European System of National and Regional Accounts \(ESA\) 2010](#).

## **Non-seasonally adjusted**

A series which includes seasonal or calendar effects.

## **Price Index/Indices**

Price indices are often used as deflators. Price indices are generally based on the weighted average of a specific basket of products/ services, or one good or service, in relation to a defined base period.

A price index can be used to measure inflation in a number of ways. One way is to look at how the index has changed over a year. This is calculated by comparing the price index for the latest month with the same month a year ago. The figure calculated is known as the 12-month inflation rate.

## **Producer Prices**

The prices faced by producers. The input price is the cost of goods bought by UK manufacturers for use in manufacturing. The output price (factory gate price) is the price of goods sold by UK manufacturers.

## Producer Price Indices (PPI, SPPI, IPI and EPI)

Producer Price Indices (PPIs) and Services Producer Price Indices (SPPIs) are often used to deflate total output on a product basis within National Accounts

- Producer Price Indices (PPIs) measure changes in factory gate prices (output price indices) for UK based producers and change in the prices of materials and fuels bought by UK manufacturers for processing (input price indices).
- Export Price Indices (EPIs) measure the change in the prices of goods manufactured in the UK but destined for export markets.
- Import Price Indices (IPIs) measure changes in the prices of goods and raw materials imported into the UK by UK manufacturers as inputs into the manufacturing process.
- Service Producer Price Indices (SPPIs) measure changes in the prices received for selected services provided by UK businesses to other UK businesses and to the government. For example there is an accountancy services SPPI.

## Purchasers' prices

See consumer prices.

## Retail Price Index (RPI), RPI (X), RPI (Y), and RPI (J)

The RPI is the most long-standing measure of inflation in the United Kingdom but it is no longer designated as a National Statistic. Unlike the CPI, it incorporates housing costs. RPI (X) excludes mortgage payments. RPI (Y) is adjusted for changes in interest rate and indirect taxes. RPI (J) uses an alternative calculation method for some prices that is in line with international standards and is a National Statistic. Due to differences in the methodologies and coverage of RPI and CPI, they each produce slightly different inflation rates.

Further information on the methods used to construct these indices can be found in the [Consumer Price Indices Technical Manual](#).

## Seasonal Adjustment

A widely used technique for removing seasonal or calendar effects, such as trading days, Easter or bank holidays, from time series data. A seasonally adjusted series is when regular seasonal or calendar effects have been removed.

## Service Producer Prices

See Producer Prices.