Deflation improvements in the UK National Accounts

Steve Drew *Office for National Statistics*

Summary

As part of wider developments to improve the quality of the UK National Accounts, ONS will introduce two key improvements to the methods by which volume estimates of gross domestic product (GDP) are calculated in the Blue Book 2011 consistent Quarterly National Accounts release, which will be published on 5 October 2011. The first will be the harmonisation of the deflators used across the accounts. The second is replacement of Retail Price Index (RPI) series with Consumer Price Index (CPI) series in forming the deflators.

This article sets out how these changes will affect the components of the UK National Accounts. It also explains how this will bring the UK methods into line with international best practice and improve the coherence of volume measures within the UK National Accounts, as well as assisting international comparability.

Context

The volume growth of GDP – sometimes referred to as the real growth rate - is one of the most important economic indicators. Changes in current price GDP between any two periods can be caused either by a price change or a change in the volume of economic activity or a combination of the two. For many purposes, it is important to know which. By removing the effect of price change, the volume change can be derived. The process of deflation, which removes the effect of price changes, is used for this purpose. Algebraically:

$$\text{volume index} = \text{current price index} / \text{price index} \times 100$$

As previously announced in Everett (2010), ONS has been working on system changes to improve the quality of the National Accounts. The introduction of the new systems will coincide with the move to the revised Standard Industrial Classification (SIC) and Classification of Products by Activity (CPA), the details of which were set out in Hughes et al. (2009).

One of the main focal points of the system re-development has been improving the consistency of methods across each component within National Accounts. A key area of improvement concerns the approach to deflation. The aim has been to ensure that the methodology complies with international best practice and guidance. Currently, this is most fully set out on the Handbook on

Price and Volume Measures in National Accounts (Eurostat 2001). The Handbook sets out the following desirable properties for deflators:

1. Completeness – in terms of the deflator relating to all of the component to be deflated
2. Valuation – output should be deflated at basic prices and final consumption expenditure at purchasers' prices
3. Quality change – where relevant, changes in quality should be reflected in the volume estimate
4. Conceptual consistency – deflators should be consistent with national accounting concepts

More specifically, the Handbook implies:

- The deflators which are used should be consistent across the range of the national accounts. While this may seem an obvious statement of best practice, as set out below, it has not hitherto been the case for the UK National Accounts
- Where relevant and available, producer price indices constitute ideal deflators for market output
- For both conceptual reasons and to help international comparability, the Harmonised Index of Consumer prices (HICP) should be used wherever possible to deflate consumer spending

The rest of the article sets out how this agenda is being taken forward in the UK National Accounts. Further details of the changes are set out in the Annexes.

A new consistent approach to deflation in the National Accounts

Hitherto, a range of existing price indices have been used to construct deflators for the components of GDP:

- Consumer prices, currently RPI series
- Producer Prices, which include Producer Prices for goods for the domestic market (PPI), Producer Prices for goods for export (EPI), Producer Prices for goods that are imported (IPI) and Services Producer Prices (SPPI) - there is no separation of domestic output and export in SPPI
- Other deflators which are either from specific sources to deflate specific products (such as agriculture or construction), or more general deflators which are used where specific price indices are not available (such as Average Weekly Earnings (AWE) and the Financial Times Stock Exchange (FTSE) index)

These price indices have been used to construct deflators for the components of the output measure of GDP. Similar price indices have been separately combined to provide deflators for the

expenditure components of GDP. While efforts have been made to avoid egregious problems, this approach leaves open the possibility of significant inconsistencies between the output and expenditure measures of GDP. This is clearly undesirable.

Accordingly, in future, rather than a piecemeal approach to deflation in different systems, consistency will be established by having a common gateway for deflators through the short-term output based measure of GDP, referred to as GDP(O). In general, the GDP(O) system will hold the source deflators and produce domestic output deflators for the 112 products, which the National Accounts now identify (for reference, these products are set out in Annex D). These series will be used as the basis for the deflators in the majority of other systems, and thus ensure improved consistency between the output and expenditure deflators.

There will be four main exceptions:

- Household Final Consumption Expenditure (HHFCE) will use the CPI price series
- Gross Fixed Capital Formation (GFCF) will also use the IPI to deflate expenditure on imported capital goods and capital services
- Trade in Goods will use the EPI and IPI to deflate exports and imports respectively
- Trade in Services will also use deflators from other sources where the GDP(O) deflators are not appropriate

Diagrammatically, the new approach is set-out in Figure 1.

Figure 1 **New flow of deflators through the National Accounts**

More details of these changes are set out in Annex A.

Replacement of deflators based on the RPI with ones based on the CPI

Where goods and services are provided to, and consumed by households, a relevant price index needs to be used to deflate the relevant current price series. As noted above, the RPI has traditionally been used for this purpose, for many years being the only one available. However, CPI has a number of advantages over the RPI for this purpose, as discussed below, and the international guidance is clear that the CPI should be using in preference.

The first advantage concerns coverage. The UK National Accounts relate to the whole economy and all households. Similarly, the CPI is designed to relate to all private and institutional households and foreign visitors to the UK. It is thus well fitted for use in the National Accounts. By contrast (see the Consumer Price Indices Technical Manual (ONS, 2010a)), the RPI relates only to private households. Within those, it excludes ones whose income is within the top four per cent of all households, as well as pensioner households which derive more than three-quarters of their income from state pensions and benefits. The RPI is thus not as well suited for National Accounts needs.

Secondly, the CPI takes its weights from the breakdown of household monetary expenditure component of the National Accounts. By construction, therefore, its weighting structure meets the National Accounts' needs. By comparison, the weights for the RPI are derived from a separate household budget survey, the Living Costs and Food Survey; these weights differ, to a degree, from those in the National Accounts.

Third, the RPI and its methodology are unique to the UK. There is no guarantee of consistency with similar national price indices produced for other countries. By contrast, the CPI is produced according to a harmonised methodology across the EU. Its use is therefore likely to improve international consistency between GDP volume estimates.

Finally, the formula used to compute the CPI is predominantly based on a geometric mean whereas the RPI is computed as an arithmetic mean of price movements. This means that the RPI takes no account of substitution between similar products when one becomes relatively more expensive than others. It is unable to allow for consumers economising on the product becoming relatively dear and purchasing more of those which have become relatively cheap. By contrast, the CPI's formula does allow it to have regard to such substitution. In this sense, the CPI has a more economically rational basis than does the RPI. Annex C has further discussion of the formula differences.

For all of these reasons, ONS proposes to follow the course set out in the international best practice guidance and move towards deflators based on the CPI. This is also consistent with the course already followed for the calculation of the Retail Sales Index (RSI). The methodology for the RSI was updated in May 2009 (see McLaren, 2009) and its deflation has since then also been based on the CPI, in the light of the same considerations as are set out above.

Annex B to this paper sets out the details of the changes that will be made.

The impact of the changes

When the Quarterly National Accounts consistent with Blue Book 2011 is published in early October 2011, a series of articles will be published for the main National Accounts aggregates setting out:

- The identifiable impact of the SIC change
- Effects of changes to methods and data sources
- An analysis of revisions from the previously published datasets

Identifying the effects of the move towards deflators based on the CPI will be an important part of this.

Conclusion

As previously announced, the UK National Accounts will harmonise the use of deflators across the accounts as well as replacing RPI series with CPI series as deflators. The former change should improve the coherence of volume measures in the UK National Accounts. The latter change also has a number of advantages and aligns UK methods with those in other EU countries, thereby improving the comparability of data.

Acknowledgements

The author would like to thank Gary Brown, Gareth Clancy, Glenn Everett, Pete Lee, Sanjiv Mahajan, Craig McLaren, Darren Morgan, Jamie Pritchard, Andrew Walton and Rich Wild who provided much of the detail provided within this paper.

Contact information

steve.drew@ons.gov.uk 01633 456119

References

European Commission (2010). Commission Regulation 715/2010, OJ L 210, p. 1 11.8.1997
Available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:210:FULL:EN:PDF>

Eurostat (2001). *Handbook on price and volume measures in National Accounts*, Available at:
http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=KS-41-01-543

Everett G (2010). 'Plans for Blue Book 2010', *Economic and Labour Market Review*, April 2010, Volume 4, No 4, pp 54-55. Available at: <http://www.statistics.gov.uk/cci/article.asp?id=2408>

Everett G (2011). 'Content of Blue Book 2011', *Economic and Labour Market Review*, April 2011, Volume 5, No 4, pp 87-85. Available at: <http://www.statistics.gov.uk/articles/elmr/elmr-apr11-everett.pdf>

Hughes J, James G, Evans A and Prestwood D (2009). 'Implementation of Standard Industrial Classification 2007: December 2009 update', *Economic and Labour Market Review*, December 2009, Volume 3, No 12, pp 51-55. Available at: <http://www.statistics.gov.uk/cci/article.asp?id=2341>

Jenkins C, Jones T and Pegler K (2010). *Developments in Services Producer Price Indices*, Non-journal article, ONS.
Available at: <http://www.statistics.gov.uk/CCI/article.asp?ID=2394>

Jenkins C and Papa A (2011). *The Development of Price Indices for Professional Business Services and Cargo Handling*, Non-journal article, ONS. Available at:
<http://www.statistics.gov.uk/CCI/article.asp?ID=2695>

McLaren C (2009). *Information paper: Changes to the Retail Sales methodology*, Non-journal article, ONS.
Available at: <http://www.statistics.gov.uk/cci/article.asp?ID=2186>

Office for National Statistics (2002). *UK Price and Volume (ESA95) Inventory*. Available at:
http://www.statistics.gov.uk/downloads/theme_economy/PVInventory.pdf

Office for National Statistics (2003). *The New Inflation Target: The Statistical Perspective*.
Available at: <http://www.statistics.gov.uk/statbase/product.asp?vlnk=10913>

Office for National Statistics (2007). *Statistics on Trade in Goods, National Statistics Methodological Series No. 36*.
Available at: http://www.statistics.gov.uk/downloads/theme_other/FinalGSSMethodspaper.pdf

Office for National Statistics (2010a). *Consumer Price Indices Technical Manual*. 2010 Edition.
Available at: <http://www.statistics.gov.uk/statbase/product.asp?vlnk=2328>

Office for National Statistics (2010b). *Producer Prices October 2010 Statistical Bulletin*, Available at: <http://www.statistics.gov.uk/pdfdir/ppi1110.pdf>

Office for National Statistics (2010c). *GDP(O) Source Data consistent with Blue Book 2010*, Available at: <http://www.ons.gov.uk/about-statistics/user-guidance/ios-methodology/source-data/index.html>

Pike R and Drew S (2002). 'Experimental Monthly Index of Services', *Economic Trends*, No. 583, June 2002

Available at: www.statistics.gov.uk/articles/economic_trends/ET_June02_Rob_Pike.pdf

Walton A, Youll R and Hunt C (2008). *Impact of methodological changes to the Index of Production*, Non-journal article, ONS.

Available at: <http://www.statistics.gov.uk/cci/article.asp?id=2015>

Annex A: Further detail on the systematic change in deflation methodology

The move to improve the consistency of deflators implicitly means that there will be changes to deflator methods across the board. This annex discusses:

- Recent changes to the classification used for EPI and IPI
- Changes to the major output and expenditure components of GDP

Changes to EPI and IPI

The UK has historically collected and published import and export price series according to trade classifications of goods and services. The IPI was collected and published on a Standard International Trade Classification (SITC) basis and the EPI according to the Combined Nomenclature (CN). However, in November 2010, the UK began to publish all producer prices according to the CPA 2008 (see ONS, 2010b for more information). This brings the EPI and IPI classification in line with the other producer price series as well as meeting the core requirements of National Accounts.

GDP(O), Index of Production and Index of Services

Excluding changes to use CPI series, the source of deflators remains largely the same within the short-term output systems. However, the method with which deflators are applied will change. At present, the output of each industry is deflated by an industry deflator. For the industries covered by the Index of Production (mining and quarrying, manufacturing and utilities) an industry deflator is derived by weighting together the main products supplied by that industry. For these industries the main 20 products are used for each industry – this is explained in more detail in Walton et al. (2008). For services most industries are deflated by the main product. Whilst most industries supply products other than their dominant product, this approach assumes that the price movements of these products move in the same way.

Under the new system, product deflators are weighted together for each industry using the balanced product breakdown from the Supply and Use Tables. This improved method will ensure that the resultant industry deflator reflects all the products produced by that industry.

Gross Fixed Capital Formation

In the current GFCF system, capital expenditure is deflated by industry and uses deflators that weight together the producer prices by product. As capital items can either be produced domestically or imported, the price series are a combination of PPI and IPI series.

In the new system, deflation will take place on a product basis using the product deflators from the GDP(O) system. However, for the capital goods that are imported, IPI series will also be used. As with the current system, the effective industry deflators are combined using weights that reflect the capital expenditure for that industry. For services, as import prices are not available, the GDP(O) product deflators are used on their own.

Changes in inventories

As with GFCF, changes in inventories will also use the GDP(O) deflators to deflate on a product basis. The full details of the deflators currently used by industry and type of inventory can be found in the Price and Volume Inventory (ONS, 2002). This will mean that the widespread use of RPI series for the other industries will be improved with more specific deflators.

Trade in Goods

The outputs of the Trade in Goods system are published on two separate classifications. The SITC classification is the focus of the main release but the system also produces data on a CPA basis for the main national accounts. The underlying current price data is collected by HMRC at the 8-digit level. The current approach is to trim the classification to the 6-digit level and deflate the series using detailed EPI and IPI series which are classified to the trade classifications.

The new system uses the concept of building blocks. Essentially, in order to meet the dual-coded requirements of the system, building blocks have been created which intersect the 3-digit CPA level and the 2-digit SITC level. It is at this level where deflation occurs, and the data are then aggregated up the different product hierarchies.

As with the current approach, coverage is not complete for either the IPI or EPI series. National Accounts have historically developed standard methods in order to fill the gaps. This is explained in full in ONS (2007), and the same principles have been applied to the new set of deflators.

Trade in Services

Throughout the Index of Services development programme (Pike & Drew, 2002) deflation methods were harmonised with Trade in Services wherever practicable. The current system uses a mixture of:

- RPI series
- weight modified and exchange rate adjusted CPI series (denominated in foreign currency) (WMCPI)
- productivity adjusted AWE series
- external price series (such as sea freight indices)
- deflators from other National Accounts systems

At Blue Book 2011, Trade in Services will use deflators from GDP(O) and HHFCE wherever relevant, but will still use a number of specific deflators where necessary. Table A1 illustrates deflator usage by exports and imports from Blue Book 2011.

Table A1 Deflator usage in Trade in Services from Blue Book 2011

Trade Direction		Deflator	%
Exports	Trade in Services deflators		46%
	GDP(O) deflators		39%
	HHFCE deflators		14%
Imports	Trade in Services deflators		82%
	GDP(O) deflators		18%

Other systems

For Non-Profit Institutions Serving Households (NPISHs), all deflators will be picked up from GDP(O) from Blue Book 2011. For General Government Final Consumption Expenditure (GGFCE), most deflators used in GGFCE will be picked up from the GDP(O) system. For HHFCE, there are no further changes beyond the move to use CPI series.

Annex B: Further detail on the change to deflators based on the CPI rather than the RPI

Currently, the RPI is used most significantly as part of GDP(O) and HHFCE. In this section we will focus on these two systems in order to understand current usage and set-out the changes which will be introduced. Table B1 shows which other National Accounts outputs will also be affected as a consequence. Note that many of these systems will pick up GDP(O) deflators from Blue Book 2011, rather than simply replace their RPI series with CPI. This is covered in Annex A of this article.

Table B1 RPI usage by National Accounts Components

NA Component	RPI used %	% of GDP	Details
GDP(O)	18%	100%	Full details provided in this article
HHFCE	65%	62%	Full details provided in this article
NPISH	40%	2%	The RPI excluding mortgage interest payments (RPIX) used generally, apart from education and capital consumption
GGFCE	7%	22%	Around four-fifths of output is estimated using direct (activity- or labour-based) measures for which no deflation is required. The remainder is estimated indirectly by deflating expenditure, within which procurement is deflated using a mix of RPI/RPIX and PPI indices. Currently, around four per cent of GGFCE relates to Central Government expenditure that is deflated using RPIX and three per cent to Local Government.
Trade in Services	18%*	n/a	Used for approximately 18 per cent of export services and not used for imports (based on 2009 data from the 2010 Pink Book). Three main areas of services use RPI: <ul style="list-style-type: none"> • Transportation services (RPI excluding housing) • Travel (Detailed RPI series weighted by expenditure by visitors to the UK) • Royalties and license fees (RPI excluding housing)
Changes in inventories	55%	n/a	Used to deflate retail, part of motor trades and other industries. As a proportion of the total level of inventories, these industries accounted for 55 per cent at the end of 2009. <ul style="list-style-type: none"> • Retail - detailed RPI series weighted by sales • Motor trades - RPI for motor vehicles • Other industries - RPI
Gross Fixed Capital Formation	2%	17%	Only used in a very limited way to deflate artistic originals

* Applicable to exports of services only

Please see the UK Price and Volume (ESA95) Inventory (ONS, 2002), for more information.

GDP percentages relate to the 2008 current price levels as published in Blue Book 2010 (Table 1.2). Note that some aggregates are net figures, so a percentage has not been provided.

Unless noted RPI usage percentages come from the Price and Volume Inventory Annexes

GDP(O)

GDP(O) compiles short-term volume estimates of Gross Value Added (GVA) using output based measures. Typically, the monthly turnover data for an industry is deflated by an industry deflator that reflects the predominant products produced by that industry. In this respect, RPI series are used in three main ways as a deflator within GDP(O):

- detailed RPI price series are used to deflate industry output where the goods and services produced are consumed in some proportion by households
- RPI excluding mortgage interest payments and indirect taxes (RPIY) is used to deflate industry output where no specific prices series are available – it is usual practice in the UK to combine RPIY equally with the relevant AWE series
- RPI series are also implicitly used where GDP(O) uses data from HHFCE

Table B2 provides the breakdown of deflators usage by GVA weight in GDP(O).

Table B2 Breakdown of deflator usage in GDP(O)

Consumer price used	GVA share
Top level RPIY series	5.4%
Low-level RPI series	10.5%
RPI series used via HHFCE	2.5%
Total proportion of GDP(O) which just uses RPI	18.4%
CPI series via RSI	5.4%
Low-level CPI series	0.3%
Total proportion of GDP(O) which just uses CPI	5.7%
Total proportion of GDP(O) which uses consumer prices (either RPI or CPI)	24.0%
Producer Price Indices (covering PPI, EPI and IPI)	21.7%
Services Producer Price Indices	9.7%
Average Weekly Earnings	7.4%
Other deflators (Agriculture Price Index, FTSE, Department for Business Innovation & Skills series)	13.6%
Direct volume measures	23.6%
Total	100%

These proportions are based on Blue Book 2010 GVA weights for 2006. Sub-totals and totals in italics.

Overall, almost a quarter of GDP(O) is deflated using a consumer price in some shape or form. Full details of the deflators used in GDP(O) can be found on the ONS website (see ONS, 2010c). We will now look at each of the five scenarios given at Table B2 in turn.

CPIY replacing the use of RPIY

Whilst the coverage of producer prices in the manufacturing sector is comprehensive and well established, the collection and publishing of SPPI series is a relatively recent development. As a result, the UK is in an ongoing process of developing the SPPI across the service sector (see Jenkins et al, 2010 for more details). To date 32 series are published on a regular basis, with five new series published on an experimental basis in June 2011 (Jenkins & Papa, 2011), but this still leaves a number of significant services with no specific or appropriate deflator to use.

Since National Accounts need a deflator for each product, alternative approaches are required. As part of the development of the Index of Services in the early 2000s, the deflation methods for the service sector were thoroughly reviewed and the approach of combining RPIY equally with the Section level AWE (adjusted for productivity) was ratified. This method assumes that output prices for service sector products are driven by labour costs and other general changes in goods and services. Typically, this combined deflator is used where there is no, or very little, business to consumer activity. For Blue Book 2011, we will be replacing the RPIY element with the CPI excluding the effects of indirect taxation (CPIY).

Replacement of low-level RPI series

The most common use of RPI series is where specific price indices are used to deflate output. Where possible, RPI series at the published level are used, but when that is not possible, lower level series or combinations of lower level series are used. Examples are provided in Table B3.

Table B3 **Examples of current RPI usage in GDP(O)**

Type	CPA	Description	Current deflator
Top-level RPIY series	74.11	Legal activities	RPIY weighted equally with AWE for Section K adjusted for changes in productivity
Low-level RPI series	63.30	Activities of travel agencies and tour operators	RPI for UK and foreign holidays
RPI series via HHFCE	92.6/92.72	Sporting and recreational activities	HHFCE implied deflator for Recreational and Sporting Activities

In updating these series to CPI, there is a basic issue that the classification systems used by RPI and CPI are different. CPI uses a standard international classification system that is consistent with the system used in the National Accounts - Classification of Individual Consumption by Purpose (COICOP), whereas the RPI uses a bespoke UK specific classification. In replacing the current series with CPI, published level CPI series were used wherever possible, but for ten products, bespoke series have been compiled. This is where a published COICOP series is not specific enough for the product in question, and the underlying data are robust enough to support lower level indices. Examples for each are given in Tables B4 and B5.

Table B4 Examples of how RPI series will be replaced by CPI series

This table shows, for comparable products between CPA 2002 and CPA 2008 (the current and new product classifications), the RPI series that are currently being used and the replacement CPI series.

Description	CPA Codes	Deflator
Restaurant and mobile food serving services	CPA 2002: 55.3	RPI: Weighted mean of: 1. RPI: Licensed restaurants 2. RPI: Unlicensed restaurants & cafes 3. RPI: Takeaway food shops
	CPA 2008: 56.1	CPI: 11.1.1 - Restaurants, cafes etc
Sea and coastal passenger water transport	CPA 2002: 66.10/1	RPI: Sea fares
	CPA 2008: 50.11	CPI: 07.3.4 - Sea and inland waterways
Creative, arts and entertainment services	CPA 2002: 92.31	RPI: Entertainment and other
	CPA 2008: 90	CPI: 09.4 - Recreational and cultural services
Hairdressing and other beauty treatment services	CPA 2002: 93.03	RPI: Hairdressing
	CPA 2008: 96.03	CPI: 12.1.1 - Hairdressing salons and personal grooming establishments

Where the COICOP classification is too general for the product being deflated in CPA, bespoke CPI series have been constructed by extracting items out of the COICOP group for National Accounts. These bespoke CPI series are listed below.

Table B5 Bespoke CPI series

CPA Code	COICOP Code	Details
49.1	CPI for 07.3.1	Excluding London Transport & other underground/Metro fares only
49.31	CPI for 07.3.1 CPI for 07.3.2	London Transport & other underground/Metro fares only & Excluding house removals and taxi and minicab fares
49.32	CPI for 07.3.2	Taxi and minicab fares only
52.21-3.CPI	CPI for 07.2.4	Car park charges only
55.2-9	CPI for 09.6	UK holidays only
59.CPI	CPI for 09.4.2	Cinema admission only
77.1	CPI for 07.2.4	Car and van hire only
77.2	CPI for 09.4.2	DVD rental and TV rental only
85.5.CPI	CPI for 07.2.4	Driving school lesson only
96.03	CPI for 12.7	Basic funeral cremation only

Users should also note that there are two cases where GDP(O) will continue to use RPI series. These are for estate agent fees and trade union subscriptions. This is due to the CPI not covering these products at present.

RPI series via HHFCE

For industries such as rental on dwellings, recreational services and services provided to households, the most appropriate source for measuring output comes from HHFCE. Given that the switch to CPI covers all of the accounts, GDP(O) will implicitly pick up these CPI series from HHFCE.

CPI series via Retail Sales Index

Similar to the HHFCE indicators, the output for the retail industry is taken from the RSI. As explained earlier, RSI introduced CPI series in May 2009 and implicitly these were then used in GDP(O). Therefore, the more general update will have no impact for the measurement of retail output.

Purchasers' price versus basic price

For GDP(O), users may note that a price index valued at purchasers' prices is used to deflate a basic price National Accounts concept. National Accounts should adjust the purchasers' price index to take account of changes in trade and transport margins as well as changes in the rates of taxes and subsidies on products. Therefore, in these circumstances, GDP(O) uses prices valued at purchasers' prices as a proxy for the basic price. Within the GDP(O) system a specific adjustment is used to correct consumer prices and has been used to adjust out the effects of the recent VAT changes. The adjustments are made using intelligence from the Consumer Prices team. For further information on this issue please see Eurostat (2001, chapter 3.1.1.1).

Household Final Consumption Expenditure

Compared with GDP(O), the changes which will be introduced at Blue Book 2011 are more straightforward. As HHFCE uses the COICOP classification, it is not affected by the changes to the SIC and CPA classifications.

In the current system, HHFCE estimates are compiled from 256 low-level series. It is at this level where deflation currently takes place and therefore requires detailed deflators. At present the HHFCE system uses detailed item level price series from the RPI. Under the new system design, deflation will use CPI series at the published 4-digit COICOP level. Whilst more detailed price deflators are conceptually preferable, the decision to deflate at the 4-digit level is based on the grounds of data quality. An example of this change can be seen in Table B6.

Table B6 Example of change to deflation for HHFCE

As an example of the change to using CPI deflators, this table shows the current breakdown of the first COICOP group 01.1.1 – Bread and cereals.

Current breakdown of 01.1.1		Breakdown of 01.1.1 from Blue Book 2011	
COICOP	Description	COICOP	Description
01.1.1	Bread and cereals	01.1.1	Bread and cereals
01.1.1N1	Rice	01.1.1N1	Bread, cakes & non-chocolate biscuits
01.1.1N2	Bread and non-chocolate biscuits	01.1.1N2	Chocolate biscuits
01.1.1N3	Chocolate biscuits	01.1.1N3	Cereals & cereal products
01.1.1N4	Pasta products		
01.1.1N5	Pastry-cook products		
01.1.1N6	Cereals		
01.1.1N7	Cereal products		
<i>Deflation is currently done at the lower level with individual RPI series for each product</i>		<i>Deflation will be done at the 01.1.1 level using the CPI for 01.1.1</i>	

The full breakdown of deflators currently used in HHFCE can be found in the UK Price and Volume Inventory (ONS, 2002). Where applicable, published level RPI series are used to deflate products. However, more commonly, lower level item indices are weighted together to provide composite indices that match the level required for COICOP deflation. The weights used in this index construction are the corresponding HHFCE estimates for the previous calendar year. The approach to deflation can be approximated to taking the CPI components and weights and using an arithmetic mean to calculate aggregate price series instead of using a geometric mean.

The two following tables summarise the deflator usage within HHFCE. Table B7 shows the usage at the top-level, and Table B8 the breakdown by the main COICOP categories.

Table B7 Breakdown of current consumer price usage in HHFCE

Consumer price used	Expenditure share
Item level RPI series – RPI series below published level	53.4%
Published level RPI series	11.6%
Total proportion of HHFCE which uses consumer prices	65.0%
Other deflators or direct volume	35.0%

These proportions are based on Blue Book 2010 current price estimates for 2008.

Table B8 **HHFCE current deflation method by COICOP group**

COICOP Code	Description	Consumer Price Deflator %	Deflation methods
01	Food and non-alcoholic beverages	100%	Item level RPI series
02	Alcoholic beverages and tobacco	43%	Published level RPI series and direct volume series
03	Clothing and footwear	100%	Item level RPI series and published level RPI series
04	Housing, water, electricity, gas and other fuels	30%	Item level RPI series, published level RPI series and direct volume series
05	Furnishings and household goods	100%	Item level RPI series
06	Health	73%	Item level RPI series, direct volume series and other deflators
07	Transport	51%	Item level RPI series, direct volume series and other deflators
08	Communication	100%	Item level RPI series
09	Recreation and culture	100%	Item level RPI series and published level RPI series
10	Education	100%	Published level RPI series
11	Restaurants and hotels	66%	Item level RPI series, direct volume series and other deflators
12	Miscellaneous goods and services	49%	Item level RPI series, published level RPI series, direct volume series and other deflators

These proportions are based on Blue Book 2010 current price estimates for 2008.

Annex C: The “formula effect”

A geometric mean is mainly used in the CPI (for around 70 per cent of the index) to combine individual prices at the first stage of aggregation whereas the RPI uses arithmetic means. As a general mathematical result, the geometric mean of a given set of values is always lower than that of an arithmetic mean that is based on the average of price relatives (AR) approach, except when those values are all equal (there is then no difference). An estimate based on the ratio of averages (RA) form of the arithmetic mean can, though, be lower than one based on the geometric mean. AR and RA are both used in the RPI whereas where a geometric mean is not used in the CPI, only the RA approach is used.

The scale of the difference of the results produced using the geometric mean and arithmetic mean approaches depends on the dispersion of the price relatives (i.e. the ratio of the current period and base period prices); as the variance of the price relatives increases, so does the difference between the geometric mean and arithmetic mean results.

A breakdown of the differences between the CPI and RPI, including the impact of the formula effect, is provided each month in Table 4 in the consumer price indices statistical bulletin. The latest data can be found on the ONS website.

Box Illustration of formula effect

Denoting the arithmetic and geometric mean functions as $a(x)$ and $g(x)$ respectively, in the case of 2 values, x_1 and x_2 , the functions are defined as follows:

$$a(x) = (x_1 + x_2)/2$$

$$g(x) = \sqrt{x_1 \cdot x_2}$$

$$\text{so } a(x) = (\sqrt{x_1^2} + \sqrt{x_2^2} + 2\sqrt{(x_1 \cdot x_2)} - 2\sqrt{(x_1 \cdot x_2)})/2$$

$$a(x) = g(x) + (\sqrt{x_1} - \sqrt{x_2})^2/2$$

Since the final term on the right-hand side is always greater than or equal to zero, it follows that the arithmetic mean of two values is always greater than the geometric mean except where the two values are equal.

Source: The New Inflation Target: the Statistical Perspective. ONS (2003)

Annex D: National Accounts classification of industries and products under SIC 2007 and CPA 2008

Under SIC 2007, it has been agreed to compile the National Accounts by reference to annual Supply and Use Tables identifying 114 industries and 114 products. However two of these groupings are outside the UK production boundary and are not normally included in the presentation of the UK National Accounts. Therefore, whilst there are 114 industries and products defined in the classification, only 112 are actually included in the UK National Accounts.

This new breakdown includes an expansion in the level of detail in the service sector. Users should note that this level will be applied consistently across nearly all National Accounts outputs. The following table relates to the industry classification, the product classification is exactly the same except that the description describes the products rather than the activities.

The table also shows how the 114 level relates to the breakdown required under the revised European System of Accounts Transmission Programme, which governs the data requirements for EU Member States. These are the A3, A10, A21, A38 and A64 columns within the table below. More information on the definitions of these levels can be found in European Commission (2010).

SIC 2007 Codes	Description	A3	A10	A21	A38	A64
01	Crop and animal production, hunting and related service activities	1	1	A	A	1
02	Forestry and logging	1	1	A	A	2
03	Fishing and aquaculture	1	1	A	A	3
05	Mining of coal and lignite	2	2	B	B	4
06	Extraction of crude petroleum and natural gas	2	2	B	B	4
07	Mining of metal ores	2	2	B	B	4
08	Other mining and quarrying	2	2	B	B	4
09	Mining support service activities	2	2	B	B	4
10.1	Processing and preserving of meat and production of meat products	2	2	C	CA	5
10.2-3	Processing and preserving of fish, crustaceans, molluscs, fruit and vegetables	2	2	C	CA	5
10.4	Vegetable and animal oils and fats	2	2	C	CA	5
10.5	Dairy products	2	2	C	CA	5
10.6	Grain mill products, starches and starch products	2	2	C	CA	5
10.7	Bakery and farinaceous products	2	2	C	CA	5
10.8	Other food products	2	2	C	CA	5
10.9	Prepared animal feeds	2	2	C	CA	5
11.01-6	Alcoholic beverages	2	2	C	CA	5
11.07	Soft drinks; production of mineral waters and other bottled waters	2	2	C	CA	5
12	Tobacco products	2	2	C	CA	5
13	Textiles	2	2	C	CB	6
14	Wearing apparel	2	2	C	CB	6

SIC 2007 Codes	Description	A3	A10	A21	A38	A64
15	Leather and related products	2	2	C	CB	6
16	Wood and products of wood and cork, except furniture; Articles of straw and plaiting materials	2	2	C	CC	7
17	Paper and paper products	2	2	C	CC	8
18	Printing and reproduction of recorded media	2	2	C	CC	9
19	Coke and refined petroleum products	2	2	C	CD	10
20A	Industrial gases, inorganics and fertilisers (all inorganic chemicals) - 20.11/13/15	2	2	C	CE	11
20B	Petrochemicals - 20.14/16/17/60	2	2	C	CE	11
20C	Dyestuffs, agro-chemicals - 20.12/20	2	2	C	CE	11
20.3	Paints, varnishes and similar coatings, printing ink and mastics	2	2	C	CE	11
20.4	Soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations	2	2	C	CE	11
20.5	Other chemical products	2	2	C	CE	11
21	Basic pharmaceutical products and pharmaceutical preparations	2	2	C	CF	12
22	Rubber and plastic products	2	2	C	CG	13
23OTHER	Glass, refractory, clay, porcelain, ceramic, stone products - 23.1-4/7-9	2	2	C	CG	14
23.5-6	Cement, lime, plaster and articles of concrete, cement and plaster	2	2	C	CG	14
24.1-3	Basic iron and steel	2	2	C	CH	14
24.4-5	Other basic metals and casting	2	2	C	CH	15
25OTHER	Fabricated metal products, excluding weapons and ammunition - 25.1-3/5-9	2	2	C	CH	16
25.4	Weapons and ammunition	2	2	C	CH	16
26	Computer, electronic and optical products	2	2	C	CI	17
27	Electrical equipment	2	2	C	CJ	18
28	Machinery and equipment n.e.c.	2	2	C	CK	19
29	Motor vehicles, trailers and semi-trailers	2	2	C	CL	20
30.1	Building of ships and boats	2	2	C	CL	21
30.3	Air and spacecraft and related machinery	2	2	C	CL	21
30OTHER	Other transport equipment - 30.2/4/9	2	2	C	CL	21
31	Furniture	2	2	C	CM	22
32	Other manufacturing	2	2	C	CM	22
33.15	Repair and maintenance of ships and boats	2	2	C	CM	23
33.16	Repair and maintenance of aircraft and spacecraft	2	2	C	CM	23
33OTHER	Rest of repair; Installation - 33.11-14/17/19/20	2	2	C	CM	23
35.1	Electric power generation, transmission and distribution	2	2	D	D	24
35.2-3	Gas; distribution of gaseous fuels through mains; Steam and air conditioning supply	2	2	D	D	24
36	Water collection, treatment and supply	2	2	E	E	25
37	Sewerage	2	2	E	E	26

SIC 2007 Codes	Description	A3	A10	A21	A38	A64
38	Waste collection, treatment and disposal activities; materials recovery	2	2	E	E	26
39	Remediation activities and other waste management services	2	2	E	E	26
41	Construction of buildings	2	3	F	F	27
42	Civil engineering	2	3	F	F	27
43	Specialised construction activities	2	3	F	F	27
45	Wholesale and retail trade and repair of motor vehicles and motorcycles	3	4	G	G	28
46	Wholesale trade, except of motor vehicles and motorcycles	3	4	G	G	29
47	Retail trade, except of motor vehicles and motorcycles	3	4	G	G	30
49.1-2	Rail transport	3	4	H	H	31
49.3-5	Land transport services and transport services via pipelines, excluding rail transport	3	4	H	H	31
50	Water transport	3	4	H	H	32
51	Air transport	3	4	H	H	33
52	Warehousing and support activities for transportation	3	4	H	H	34
53	Postal and courier activities	3	4	H	H	35
55	Accommodation	3	4	I	I	36
56	Food and beverage service activities	3	4	I	I	36
58	Publishing activities	3	5	J	JA	37
59	Motion picture, video and TV programme production, sound recording and music publishing activities	3	5	J	JA	38
60	Programming and broadcasting activities	3	5	J	JA	38
61	Telecommunications	3	5	J	JB	39
62	Computer programming, consultancy and related activities	3	5	J	JC	40
63	Information service activities	3	5	J	JC	40
64	Financial service activities, except insurance and pension funding	3	6	K	K	41
65.1-2	Insurance and reinsurance, except compulsory social security	3	6	K	K	42
65.3	Pension funding	3	6	K	K	42
66	Activities auxiliary to financial services and insurance activities	3	6	K	K	43
68.1-2	Buying and selling, renting and operating of own or leased real estate, excluding imputed rental	3	7	L	L	44
68.2IMP	Imputed rental	3	7	L	L	44
68.3	Real estate activities on a fee or contract basis	3	7	L	L	44
69.1	Legal activities	3	8	M	MA	45
69.2	Accounting, bookkeeping and auditing activities; Tax consultancy	3	8	M	MA	45
70	Activities of head offices; Management consultancy activities	3	8	M	MA	45
71	Architectural and engineering activities; Technical testing and analysis	3	8	M	MA	46
72	Scientific research and development	3	8	M	MB	47
73	Advertising and market research	3	8	M	MC	48
74	Other professional, scientific and technical activities	3	8	M	MC	49

SIC 2007 Codes	Description	A3	A10	A21	A38	A64
75	Veterinary activities	3	8	M	MC	49
77	Rental and leasing activities	3	8	N	N	50
78	Employment activities	3	8	N	N	51
79	Travel agency, tour operator and other reservation service and related activities	3	8	N	N	52
80	Security and investigation activities	3	8	N	N	53
81	Services to buildings and landscape activities	3	8	N	N	53
82	Office administrative, office support and other business support activities	3	8	N	N	53
84	Public administration and defence; Compulsory social security	3	9	O	O	54
85	Education	3	9	P	P	55
86	Human health activities	3	9	Q	QA	56
87	Residential care activities	3	9	Q	QB	57
88	Social work activities without accommodation	3	9	Q	QB	57
90	Creative, arts and entertainment activities	3	10	R	R	58
91	Libraries, archives, museums and other cultural activities	3	10	R	R	58
92	Gambling and betting activities	3	10	R	R	58
93	Sports activities and amusement and recreation activities	3	10	R	R	59
94	Activities of membership organisations	3	10	S	S	60
95	Repair of computers and personal and household goods	3	10	S	S	61
96	Other personal service activities	3	10	S	S	62
97	Activities of households as employers of domestic personnel	3	10	T	T	63
98*	Undifferentiated goods- and services-producing activities of private households for own use	3	10	T	T	63
99*	Activities of extra-territorial organisations and bodies	3	10	U	U	64

* These two groupings lie outside the UK production boundary and are not normally included in the presentation of the UK National Accounts.