

Consumer Price Indices

Technical Manual

2012 Edition

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Preface

This is the 2012 version of the Consumer Price Indices Technical Manual. The Technical Manual is a vital reference tool for anyone wanting to understand how the Consumer Prices Index (CPI), the Retail Prices Index (RPI), and associated indices, are compiled. It covers the concepts underpinning the indices, the statistical methodology used, collection and validation of prices, calculation of weights, and publication and usage of the different indices.

Consumer price indices are often used in contracts to index link or uprate payments to allow for inflation. The Technical Manual will help people drafting contracts to incorporate the major points that are necessary when using consumer price indices in this way. It will also help them to decide whether another measure of inflation might be more suited to their purposes. However, users of this Manual are advised to form their own independent assessment in relation to consumer price indices and their uses in specific cases and to seek such specific advice as they consider appropriate. Office for National Statistics accepts no liability whatsoever for losses of any kind arising as result of reliance on this Manual.

The CPI, RPI and associated indices are National Statistics. They are produced to high professional standards set out in the National Statistics Code of Practice, and associated protocols. The Technical Manual explains how these standards are met.

Office for National Statistics welcomes feedback and would be happy to receive comments on this Technical Manual. Contact details are given on the inside front cover of this publication.

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Chapter 1 Introduction

1.1 Overview

This manual describes the procedures used by Office for National Statistics (ONS) to produce the Consumer Prices Index (CPI), the Retail Prices Index (RPI) and associated price indices. CPI is the main domestic measure of inflation for macroeconomic purposes. Since December 2003 it has been used for the Government's inflation target that the Bank of England is required to achieve. Since November 2011 the CPI has been used for deflating consumer spending within the National Accounts. The CPI has also been used to index state benefits, tax credits and public service pensions since April 2011. The RPI is the most long-standing measure of inflation in the United Kingdom. RPI inflation is used to uprate indexed-linked gilts and for the revalorisation of excise duties. Historically, the RPI had been used as the basis for the Government's inflation target, deflation in the National Accounts and to index various prices and incomes including tax allowances, state benefits and pensions. The uses of the CPI and RPI by government, businesses and society in general are described more fully in section 1.4.

The manual is aimed at users who want to know the concepts and statistical methods underlying the different indices and how the data are collected. While it does not attempt to go into every detail, which would require a volume many times the size of this one, it will answer most of the questions that ONS is usually asked about consumer price indices' methodology and practice.

This manual is generally written in terms of the CPI. This reflects its use as the United Kingdom's primary macroeconomic indicator of domestic consumer price inflation. However, the methods and procedures described in Chapters 2 to 7 are also, in the main, applicable to the RPI; where this isn't the case, this is made clear. The two indices are also calculated from the same underlying price data, although their coverage and methodology differ in a number of important respects, which are described in Chapter 9.

1.2 A Brief Description of Consumer Price Indices

Everything that consumers buy has a price; the price may vary over time. Consumer price indices are designed to measure such changes. A convenient way to understand the nature of these indices is to envisage a very large shopping basket comprising all the different kinds of goods and services bought by a typical household. As the prices of individual items in this basket vary, the total cost of the basket will also vary - consumer price indices measure the change from month to month in this total cost.

No two households spend their money in exactly the same way. Each household's or person's experience of inflation will be different. The CPI and RPI are measures of average inflation, based on average household expenditure on the items in the shopping basket.

1.3 Historical Background

The CPI was launched in January 1996. Estimates, which are broadly consistent with the data from 1996, are also available back to 1988 along with indicative figures for the period 1975-1987, but these data should be treated with some caution. O Donoghue, J (2004) '*Harmonised index of consumer prices: historical estimates*' provides more details (see Bibliography for link to article). The CPI was published as the Harmonised Index of Consumer Prices (HICP) until December 2003 (further details on the background and purpose of 'HICP' can be found in section 2.1.1); its name was changed in December 2003 to reflect its new role as the basis for the Government's inflation target that the Bank of England's Monetary Policy Committee is required to achieve. Further details on the CPI are given in Chapter 2.

The RPI dates from 1947. The historical background to the development of the index can be found in Appendix 1.

1.4 Uses of the CPI and RPI

The CPI and RPI are used in many ways by Government, businesses, individuals and internationally. As explained later in this manual, the uses to which the different indices are put have historically helped shape their development. Their uses are summarised in the sections below. A more comprehensive description of the uses is provided in the article Davies, P (2011) '*How ONS consumer price statistics are used*' (see Bibliography for link to article).

1.4.1 Macroeconomic Indicator

A measure of inflation

There is no single definition of the word 'inflation'. However, most consumers might think of inflation as a fall in the value of money reflecting a more or less continuous increase in the price of the goods and services that they purchase. Simplistically therefore, inflation can be thought of as the amount of extra money needed in period *y* to purchase the same basket of goods and services purchased with a given sum of money in an earlier period *x*. Prices may also fall, of course, although a sustained fall in prices is unusual. Prices measured by the CPI have not, to date, shown a fall in value compared to 12 months earlier; however, the last time that overall prices, as measured by the RPI, were lower than their value 12 months earlier is relatively recent ie October 2009. Although a sustained fall in prices is unusual, due to seasonal effects and random fluctuations the CPI and RPI often fall between consecutive months.

The amount of money needed to purchase a fixed basket is also known as the **internal purchasing power of the currency**, which can be expressed in two ways. Firstly, it is the amount of money needed in period *y* to purchase the same basket of goods and services that one pound could purchase in an earlier period *x*. Conversely, it is the amount of money needed in an earlier period *x* which could buy the same basket of goods and services that one pound purchases in period *y*. See Section 9.7.4 for more details.

In recent years, UK governments have based their economic policies around targeting a specific rate of inflation, so that a comparison of the outcome for inflation against the target provides a means of measuring the success of the relevant economic policies. In May 1997, the Chancellor of the Exchequer announced that operational responsibility for setting interest rates would pass to the Bank of England. The Government retains, though, responsibility for setting the objectives of economic policy including the inflation target. The target was originally expressed in terms of the RPI excluding mortgage interest payments (RPIX). In December 2003, the target measure changed, with immediate effect, to one based on the CPI. The main characteristics of the current inflation target are:

- an inflation target for the CPI of 2 per cent
- if inflation is more than one percentage point higher or lower than the target, the Governor of the Bank of England is required to publish an open letter explaining why inflation has deviated from the target and what actions it intends to take to get it back to target
- provision for the target to be reviewed in each Budget

During the period up to December 2003, the inflation target for RPIX was 2.5 per cent.

Deflation of expenditure

For many purposes, comparisons over time are more useful when the effect of price changes is eliminated. For instance, estimates are made of gross domestic product (GDP) and its main components in each period, revalued at the average prices in a selected year. Current levels of household final consumption expenditure and other economic series in the national accounts are adjusted to produce constant price series. This is typically done by deflating (dividing) estimates of

expenditure at current prices by appropriate price indices. Until recently, the RPI and its components had been used for this purpose. In August 2011, ONS announced its intention to switch to the use of the CPI and its components for deflation purposes from October 2011, see Drew (2011) '*Deflation improvements in the UK National Accounts*' (see Bibliography for link to the article). This makes the UK more consistent with international best practice. For more information on the use of consumer prices for deflation purposes, and the rationale behind the switch from the RPI to CPI, please see the referenced article.

Both the CPI and RPI are used to remove the effect of price changes by a wide range of other Government departments, both to inform economic policies and to monitor the implementation of those policies. Other users, for example in business, academia and the general public are also interested in removing the effect of price change in economic time series.

1.4.2 Income Adjustment

Indexation of tax allowances: Some tax allowances and thresholds are revised annually in line with changes in the CPI, replacing the use of RPI prior to April 2011. For progressive taxes, inflation means that the Exchequer takes a growing share of a person's income. This is because wages tend to increase over time resulting in a greater proportion of income moving into a higher tax bracket. This tendency is known as *fiscal drag*; to offset this partly, the Chancellor frequently raises the tax threshold to take account of changes to the RPI. Unless the Chancellor decides otherwise, an amendment to the 1977 Finance Act, known as the Rooker-Wise amendment, has made this automatic for income tax allowances and thresholds and certain National Insurance contribution thresholds. The 2011 Budget announced that from April 2012, the default indexation assumption for direct taxes will switch from the RPI to the CPI.

Indexation of incomes: The change in the CPI and/or the RPI is an important factor in wage bargaining; some pay agreements explicitly link pay rises to these indices.

Index-linked gilts and national savings: The redemption values of certain gilt-edged securities and national savings certificates are automatically uprated by an amount dependent on the change in the RPI. A formal consultation on the issuance of CPI-linked gilts was completed in September 2011. A response to the consultation was published on 29 November 2011, concluding that CPI-linked gilts would not be issued in 2012/13, but the case for issuance would be reviewed in the future. The Government will also review the use of the CPI for indirect taxes, once its fiscal consolidation plans have been implemented and the duty increases it inherited from the previous Government have come to an end.

Indexation of pensions and benefits: Until recently, most state benefits were automatically revised every April in line with the change in the RPI over the 12 months to the previous September. Generally for non income-related state benefits, the all items RPI was used whereas income-related benefits were revised in line with the Rossi Index (which is the RPI all items index excluding mortgage interest payments, rent and council tax - further details are given in section 10.7). However, as of April 2011, the CPI is instead being used to index benefits and public service pensions.

1.4.3 Price Adjustment

Private contracts: Many contracts link payments due, such as rent, to the change in the CPI or RPI.

Regulation of utilities: Certain regulated privatised utilities have their prices constrained to rise by no more than a rate dependent on the CPI or RPI.

Other price regulation: Many pieces of legislation refer to the CPI or RPI as a way of adjusting prices, and there are a number of statutory instruments which refer to the CPI or RPI and their variants.

1.4.4 Price Monitoring

Many government departments use the CPI and/or RPI to understand price movements for specific goods or services, or to compare price changes for specific goods/services with general level of price change.

1.5 Overview of the CPI

1.5.1 Definition of the CPI

The CPI is a consumer inflation or pure price index defined as an *average measure of change* in the prices of *goods and services* bought for the purpose of *consumption by households* in the UK and *foreign visitors* to the UK.

There are several important points to note in this definition:

- *average measure*: a single figure which combines, or averages, all of the price changes covered
- *change*: its purpose is to measure how prices change over time, rather than the absolute level of prices at a point in time
- *goods and services*: it does not just measure price changes for necessities such as food, heating and clothing, but a wide variety of things purchased by most households, including leisure goods and services
- *consumption*: the CPI does not cover investment spending. Likewise, because they are not consumed, savings and direct taxes are also excluded
- *households*: it measures price changes affecting private households, but excludes price changes that affect business or Government.
- *foreign visitors*: the expenditure of foreign visitors to the UK is included in the reference population (section 1.5.4)
- *in the UK*: coverage extends to the whole of the United Kingdom (section 1.5.3)

1.5.2 Scope and Coverage of the CPI

The scope and coverage can be defined as follows:

Scope: All those transactions which one would ideally want to measure.

Coverage: Those transactions within the scope which it is possible to identify and measure in practice. This is determined by the expenditure categories for which weights are compiled.

The scope and coverage of the CPI are those goods and services which are included in the household final monetary consumption expenditure (HFMCE) component of the National Accounts. The coverage of goods and services is consistent with the HICP version of the international classification framework - Classification of Individual Consumption by Purpose (COICOP). The CPI coverage excludes housing costs such as council tax, mortgage interest payments, house depreciation, buildings insurance, ground rent and other house purchase costs such as estate agents' and conveyancing fees. All these costs are included in the RPI (see Section 1.6.2). Prior to 2012, trade unions' subscriptions, vehicle excise duty and television licence fees were also excluded from the CPI, since none of these categories were included in the HFMCE. However, in 2011 it was agreed that these items were within the scope of the CPI and should be included in the CPI from early 2012.

1.5.3 Geographical

The geographical coverage of the CPI is the economic territory of the UK (ie England, Wales, Scotland and Northern Ireland), but not the offshore islands, which strictly speaking are not in the UK (ie the Channel Islands and the Isle of Man).

1.5.4 Reference Population

This comprises all private households, foreign visitors to the UK and residents of communal establishments such as university halls of residence, retirement homes and nursing homes. Expenditure by UK households abroad is excluded.

1.5.5 Expenditure Items

Expenditure items are the goods and services bought by the reference population for the purposes of consumption. Thus expenditure for savings and investment purposes, direct taxes, national insurance contributions, cash gifts and gambling are excluded from the scope of the CPI. Expenditure on illegal transactions is included in the scope but excluded from the coverage. However, expenditure at legitimate outlets on goods, which may have been subject to illegal avoidance of tax or duty at some point in the supply chain, will generally be covered - for instance some smuggled alcohol and tobacco is thought to be sold through outlets such as bars, off-licences and similar outlets.

Expenditure relating to many owner-occupiers' housing (OOH) costs are currently excluded from the CPI, although work is underway to include some of these costs as soon as is practical, this is likely to mean from early 2013.

The CPI measures the price of goods and services paid for by consumers. No account is taken in the CPI of services free at the point of consumption, even if consumers have paid for them indirectly through taxes or national insurance contributions. For some goods and services provided or partly paid for by the Government, a charge is made at the point of consumption, such as the supply of prescription medicines and dental treatment under the NHS. These charges are included in the CPI but not the full economic cost of goods or services. When deriving the weights, only the costs paid by the consumer at point of delivery are included.

1.5.6 Transaction Prices

The prices used in the calculation of the CPI should reflect the cash prices typically paid by the reference population for the goods and services within the scope of the CPI. Consumption expenditure can be measured in three ways which it is important to distinguish. These ways are:

Acquisition means that the total value of all goods and services delivered during a given period is taken into account, whether or not they were wholly paid for during the period.

Use means that the total value of all goods and services consumed during a given period is taken into account.

Payment means that the total payments made for goods and services during a given period is taken into account, whether or not they were delivered.

For practical purposes, these three concepts cannot be distinguished in the case of non-durable items bought for cash, and they do not need to be distinguished for many durable items bought for cash. The distinction is, however, important for purchases financed by some form of credit, notably major durable goods, which are acquired at a certain point of time, used over a considerable number of years, and paid for, at least partly, some time after they were acquired, possibly in a series of instalments.

The difference between the three concepts of consumption is not just a matter of timing. If payment follows acquisition, interest may be charged on top of the equivalent of the cash price. When use extends over many years, the value of this use will reflect the price level of those years, not the price at the date of acquisition.

Which concept should we use?

Which concept is preferred depends on the uses of the CPI. If the main use is as a general indicator of inflation, an index is required that measures the change in price level of current output. Thus one would

not want a retrospective element relating to prices in previous months, meaning that the acquisition concept is probably preferred. However, for indexation of money incomes and benefits, it may be that the payment approach is the most suitable approach. Alternatively, some may argue that the use approach is better, as it is closer to the cost of living, which should take account of the flow of goods or services being consumed.

Since the CPI is used for all of these and other purposes, there is no simple answer as to which definition of consumption should be used. The CPI mostly measures the acquisition of goods and services, but there are exceptions where it has been decided that this is not the most appropriate approach.

1.5.7 Responsibility for the CPI

The rules underlying the construction of the HICP (known as the CPI in the UK) are specified in a series of European Regulations. These have been developed by Eurostat (the Statistical Office of the European Union) in conjunction with the National Statistical Institutes of Member States of the European Union. An initial Council Regulation, establishing the framework for the HICP, was passed in October 1995. Subsequent improvements have been enshrined in legislation, which have had to be approved by European Member States under qualified majority rules with around 70 per cent support needed.

Within this legislative framework, development of the CPI is guided by the Consumer Prices Advisory Committee (CPAC). Further information on the Consumer Prices Advisory Committee can be found in section 1.7 and in Annex 2.

1.6 Overview of the RPI

1.6.1 Definition of the RPI

Like the CPI, the RPI measures the average price change on the basis of the changed expenditure of maintaining the consumption pattern of households and the composition of the consumer population in the base or reference period.

1.6.2 Scope and Coverage of the RPI

The scope and coverage of the RPI are those goods and services which are based largely on the ONS's Living Costs and Food Survey (LCF). The coverage of goods and services is similar to the CPI, although the RPI includes council tax, mortgage interest payments, house depreciation, buildings insurance, ground rent and other house purchase costs such as estate agents' and conveyancing fees, whereas the CPI does not. The RPI excludes university accommodation fees, foreign students' university tuition fees and unit trust and stock broker charges.

1.6.3 Geographical

The geographical coverage of the RPI is the whole of the UK (ie England, Wales, Scotland and Northern Ireland), but not the offshore islands, which strictly speaking are not in the UK (ie the Channel Islands and the Isle of Man).

1.6.4 Reference Population

This comprises all private households (ie not those living in institutions such as prisons, retirement homes or student accommodation) excluding (a) pensioner households which derive at least three quarters of their total income from state pensions and benefits; (b) high-income households, defined as those households whose total household income lies within the top 4% of all households, as measured by the Living Costs and Food Survey (LCF). Unlike the CPI, the RPI also excludes foreign visitors to the UK, but it includes UK residents' spending abroad. Households not excluded are called Index Households.

1.6.5 Expenditure Items

Since expenditure items are the goods and services bought by the reference population for the purposes of consumption, expenditure for savings and investment purposes, direct taxes, national insurance contributions, cash gifts and gambling are excluded from the scope of the RPI.

Property taxes, currently council tax in Great Britain (rates in Northern Ireland), are included; while they are not connected with any given quality and quantity of goods or services provided by the local authority, they are considered an important part of the cost of using a dwelling.

House purchases could represent the acquisition of a major capital asset (investment) rather than consumption, so purchase without a mortgage and capital repayments of a mortgage are excluded. Mortgage interest payments are included, since for most home owners they are the best measure of the current shelter cost of utilising their dwelling. Major home improvements, such as building an extension, are capital investments and so are excluded, but re-decoration and maintenance are included.

Like the CPI, no account is taken in the RPI of services free at the point of consumption, even if consumers have paid for them indirectly through taxes or national insurance contributions. Charges made at the point of consumption, such as the supply of prescription medicines, are included, which is consistent with the CPI.

1.6.6 Transaction Prices

Prices used in the RPI should be purchaser prices actually paid by the reference population households to purchase individual goods and services via monetary transactions. These prices should include any taxes less subsidies on the products and exclude interest or services charges added under credit arrangements.

Section 1.5.6 described the three ways in which consumption expenditure can be measured. The distinction between the measures is important for purchases which are financed by some form of credit, notably major durable goods, which are acquired at a certain point of time, used over a considerable number of years, and paid for, at least partly, some time after they were acquired, possibly in a series of instalments. In the RPI, housing costs paid by owner-occupiers are an obvious example of this.

Whilst the RPI mostly measures the acquisition of goods and services, there are several exceptions where it has been decided that this is not the most appropriate approach. This particularly applies to owner-occupiers' housing costs, more detail of which is provided in section 9.5 (Chapter 9).

1.6.7 Responsibility for the RPI

The Statistical and Registration Service Act 2007 established new governance arrangements for the RPI and requires the UK Statistics Authority to compile and maintain the RPI and publish it every month. In terms of implementing any changes to the RPI, the Bank of England and the Chancellor of the Exchequer also have key roles in this aspect of RPI governance.

Before making any change to the coverage or the basic calculation of the RPI, the UK Statistics Authority must consult the Bank of England as to whether the change constitutes a fundamental change in the index which would be materially detrimental to the interest of the holders of relevant index-linked gilt-edged securities. If the Bank of England considers that the change does constitute a fundamental change in the index which would be materially detrimental, the change cannot be made without the consent of the Chancellor of the Exchequer.

1.7 Advisory Committees

Between 1946 and 1999, major changes in methodology and procedures for the RPI were referred to an RPI Advisory Committee (RPIAC), convened by the Chancellor of the Exchequer whenever there were

major issues on which advice was needed. The reports of successive RPIACs have been published, usually as Command Papers. (Appendix 2 provides details of the main recommendations of the RPIACs.).

From 2000 to the establishment of the Statistics and Registration Act 2007, the National Statistician, within the Framework for National Statistics, was responsible for the definitions and methodology of the RPI. The National Statistician also led on advising on methodological questions concerning the RPI. The scope and definition of the index was, though, the responsibility of the Chancellor of the Exchequer.

With the adoption of the Statistics and Registration Act 2007, any methodological changes to the RPI require the approval of the UK Statistics Authority before being referred to the Bank of England. To facilitate this, the Authority established a body in 2009 to advise it on proposals for changes to the RPI. This body is called the Consumer Prices Advisory Committee (CPAC). The Committee has three distinct roles:

1. To advise the UK Statistics Authority on the implication for the RPI of the improvements to this index recommended by the Office for National Statistics (ONS).
2. To provide the UK Statistics Authority with advice on RPI methodological issues.
3. To advise the UK Statistics Authority on improvements to the UK Consumer Prices Index recommended by the ONS.

In 2011, CPAC recommended that the inclusion of owner occupiers' housing costs in the CPI and the further improvement of the measurement of clothing inflation in both the CPI and RPI should remain the top priorities for the development of consumer price statistics. Furthermore the Committee recommended that ONS should complete the work necessary for the implementation of these two priorities as soon as it is possible.

The Committee also recommended the methods used to measure new car prices in the CPI and RPI be changed to collecting transaction prices from car dealer websites instead of the current approaches of using 'list' prices (CPI) and a proxy measure based on used car prices (RPI).

Finally, the Committee recommended that ONS extends the CPI item coverage from early 2012 to include TV licence fees, vehicle excise duty and trade union subscriptions. These items are already included in the RPI. Please refer to Appendix 2 for a full list of recommendations.

Chapter 2 CPI Construction

2.1 Overview

The Consumer Prices Index (CPI) is the main United Kingdom domestic measure of inflation for macro-economic purposes (section 1.4.1). Since December 2003 it has been used for the Government's inflation target that the Bank of England is required to achieve. Since November 2011, the CPI has been used as the principal deflator of consumer spending within the National Accounts. The CPI has also been used to index benefits, tax credits and public service pensions since April 2011. Until December 2003, it was published in the UK as the Harmonised Index of Consumer Prices (HICP); its name was changed at that time to reflect its new role as the basis for the Government's inflation target.

2.1.1 Development of the HICP

HICPs were developed in the European Union (EU) for the purpose of assessing whether prospective members of the European Monetary Union would pass the inflation convergence criterion, and has subsequently acted as the measure of inflation used by the European Central Bank to assess price stability in the euro area. One of the main requirements therefore was for a measure that could be used to make reliable 'like-for-like' comparisons of inflation rates across EU Member States. Such comparisons are not generally possible using national consumer price indices due to differences in index coverage and construction.

The rules underlying the construction of HICP indices for EU Member States are specified in a series of European Regulations (legal documents). These have been developed by Eurostat in conjunction with the National Statistical Institutes of Member States of the European Union. An initial Council Regulation, establishing the framework for the HICP, was passed in October 1995. This has been followed up with a series of detailed implementation measures.

2.1.2 Basic principles

Eurostat describe the HICP as a Laspeyres-type 'consumer inflation' or 'pure price' index "measuring average price change on the basis of the changed expenditure of maintaining consumption patterns of households and the composition of the consumer population in the base or reference period" (*Report from the Commission to the Council on Harmonisation of Consumer Price Indices in the European Union, COM(2000)742*). 'Pure' means that, strictly speaking, only changes to prices between the current and the base or reference period are reflected in the index. The CPI, like the RPI, therefore measures inflation with reference to the changing cost of a fixed basket of goods and services.

2.2 Structure of the CPI

The coverage and classification of the CPI item indices are based on the international classification system for household consumption expenditures known as COICOP (classification of individual consumption by purpose). Founded on National Accounts principles, the COICOP system, along with the conceptual coverage of Household Final Monetary Consumption Expenditure (HFMCE), is the starting point for defining which expenditures, in principle, should be included in the CPI. This is because 'COICOP' and HFMCE define which transactions constitute household final monetary consumption as opposed to other flows such as taxes, other transfers, or capital and financial transactions.

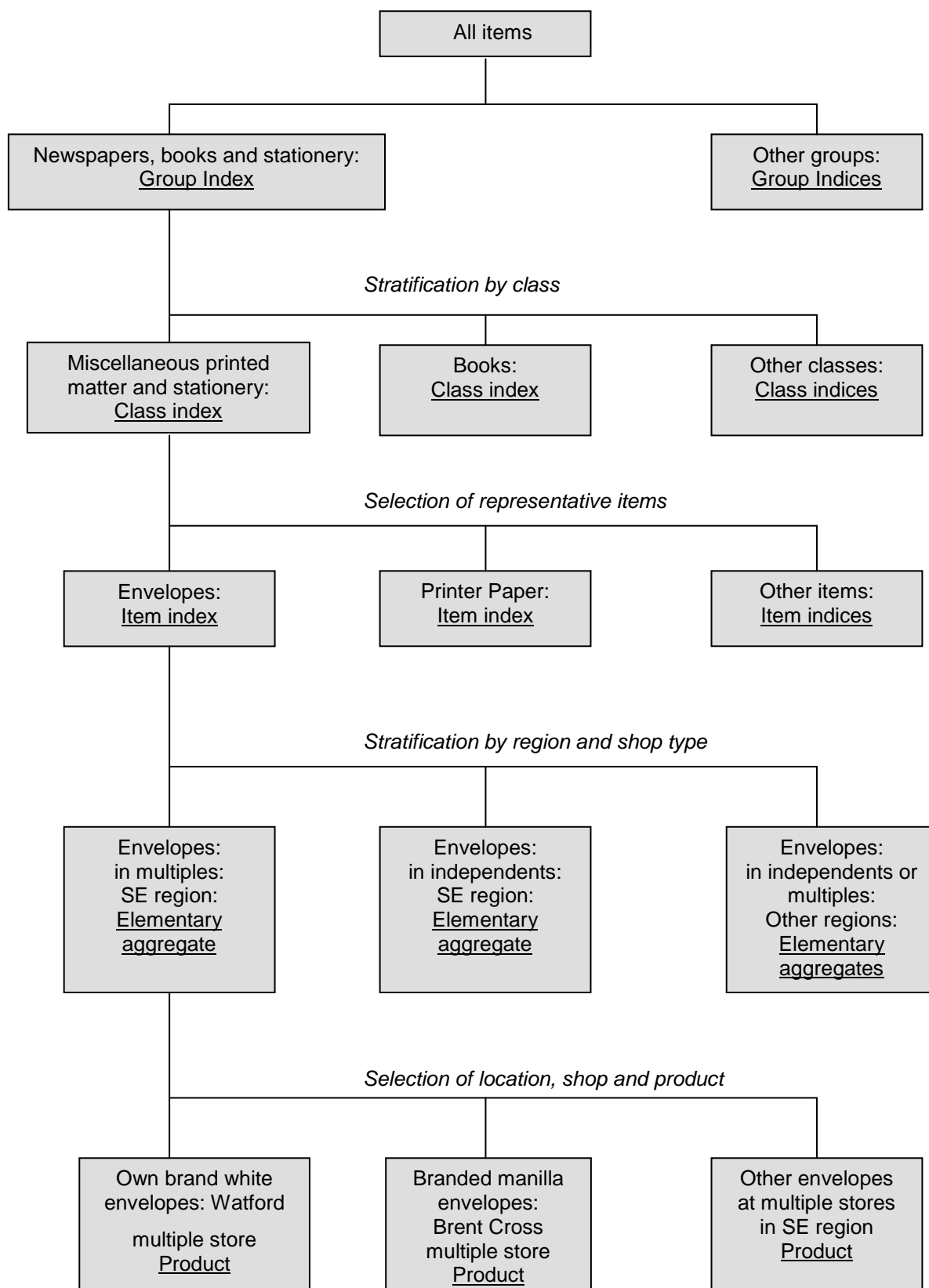
COICOP is a hierarchical classification system comprising: **Divisions** eg 01 Food & non-alcoholic beverages, **Groups** eg 01.1 Food, and **Classes** (the lowest published level) eg 01.1.1 Bread and cereals. A modified version of COICOP (known as COICOP/HICP) is used for the CPI with a few

categories of goods and services combined together. This classification system is detailed in Appendix 3.

The CPI is produced in stages, with indices derived at each stage weighted together to give higher level indices. Figure 2.1 shows how the data are combined together. A sample of prices are collected in line with the COICOP/HICP classification system, from a selection of items which are representative of UK consumer expenditure; prices are only collected for those items selected. For example, for the item home-killed lamb, prices are collected for 'loin chops with bone' and 'shoulder with bone'. Other joints, and loin chops and shoulders without bones, are not priced; it is assumed that their price movements are close to those of the joints of lamb that are priced. There are currently over 650 representative items in the CPI price basket of goods. The items usually have fairly broad specifications (such as a roll of wallpaper or women's jeans) and price collectors must choose a selection of products which conform to that item specification. If goods come in various pack sizes, usually a size or weight range is given in the item specification.

The lowest aggregate of prices, an **elementary aggregate**, covers all prices collected for one item in one stratum. For the local price collection, the UK is divided into regions and a number of locations selected in each region. Outlets are selected in each location, and are usually classified into two shop types: multiples and independents. Thus prices for an item may be stratified by region, shop type, both or neither (see Chapter 3 for more detail). Indices for the strata are combined together to produce an overall index for each item.

Indices for items are then combined into broader categories called classes which are themselves combined into broader categories called groups. Food, alcoholic beverages and clothing are groups; meat, spirits and garments are classes. Price indices are published every month for each group and class. A full list of the COICOP/HICP groups and classes are listed in Appendix 3.

FIGURE 2.1: THE STRUCTURE OF THE CPI

2.3 Index Calculation

Within each year, the CPI is a fixed quantity price index: it measures the change in the price of a basket of fixed composition, quantity and as far as is possible quality. This is often summarised by saying that the CPI uses a *fixed basket*. The index $I_{t,0}$ at time t based on time 0 is a Laspeyres-type or fixed base weight index, being the price of the basket at a given time as a percentage of its price on the base date:

$$I_{t,0} = 100 \times \frac{\sum_i P_{it} Q_{ib}}{\sum_i P_{i0} Q_{ib}}$$

where:

- P_{it} = price for i^{th} item at time t
- P_{i0} = price for i^{th} item at base date, time 0
- Q_{ib} = quantity of i^{th} item purchased in the base period

In principle, the sum should be taken over every possible good or service that is within the scope of the CPI (section 1.5.2), and the price measured in every outlet that supplies each good or service. In practice, only a sample of prices can be collected (see Chapter 3 for more information).

Another way to interpret the above equation is to re-write it as:

$$I_{t,0} = 100 \times \frac{\sum_i (P_{it} / P_{i0}) w_i}{\sum_i w_i}$$

where $w_i = P_{i0} Q_{ib}$. It is then a weighted average of *price relatives*, the weight being the expenditure on item i in the base period. A price relative is the ratio of a price at a given time to the price for the same commodity at another time.

Not a true Laspeyres index

For the CPI to be a true Laspeyres index, the base period would have to coincide with time 0. This cannot be done, for various reasons:

- time 0 can be defined in different ways and may refer to a month, a week, or even a particular day. However expenditure data for short periods of time are often too variable to be used in practice
- the production of comprehensive expenditure data is time consuming, hence reliable data are rarely available at time 0
- if expenditure is seasonal, the pattern at time 0 may be unrepresentative of the average over time

In practice, expenditure data for the most recently available 12 months are used (Chapter 6).

The value of the CPI also depends on the Q_{ib} and on what items are included. When the CPI or any index is said to cover or refer to a given population, it means that the Q_{ib} have been calculated to reflect the expenditure of that population. With regard to prices, the basket is not comprehensive, since it does not include every possible item. However, the weights reflect all expenditure by index households that is within scope (section 6.5 and 6.6).

2.4 Elementary Aggregates

The prices collected, a sample of all possible prices, are arranged into elementary aggregates. From these, elementary aggregate indices are computed for each month based on the previous January. An *elementary aggregate* may be all the prices for one item. However, for most items, outlets are stratified by region or shop type or both (section 6.4). For these items, an elementary aggregate consists of all the prices for one item from outlets in one stratum.

An elementary aggregate index can be constructed in different ways, primarily the **geometric mean (GM)**, the **ratio of average prices (RA)** and the **average of price relatives (AR)**. The method primarily used in the CPI is the GM. Algebraically, a GM index is calculated as follows: if prices $p_{1,0}$ to $p_{n,0}$ are obtained in the base period and matching prices $p_{1,t}$ to $p_{n,t}$ are obtained for the same commodities in month t , then we have:

$$\text{GM : } I_{t,0} = \sqrt[n]{\prod_{i=1}^n \frac{p_{i,t}}{p_{i,0}}}$$

This can be thought of as the geometric mean of the price relatives. An alternative, and algebraically equivalent, way of thinking about this calculation is to express it as the ratio of the geometric mean of the average prices:

$$\text{GM : } I_{t,0} = \frac{\sqrt[n]{\prod_{i=1}^n p_{i,t}}}{\sqrt[n]{\prod_{i=1}^n p_{i,0}}}$$

It is essential that matching prices are used. If, in any month, there is no price corresponding to one in the base month, that price must be excluded from the calculations.

In the CPI, HICP regulations permit the use of GM and the RA but do not endorse the use of the AR on the grounds that it does not produce indices that are comparable with other formulae, such as RA or GM. Note that in the RPI, both the AR and RA methods are used (see section 9.3 for more detail). The regulations therefore help to ensure that differences in inflation rates between EU countries reflect underlying differences in price changes, and not simply differences in the basic formulae used to aggregate the price data.

In the case of AR, it can be shown that in certain circumstances its use, when combined with chain-linking of the within-year indices, introduces a small upward bias in the overall price index. This phenomenon is known as ‘price bounce’ or ‘formula bias’. The GM formula is not susceptible to any bias due to price bounce (nor is RA) and, in the context of cross-country comparisons, is much less influenced by detailed differences in index and sample design in individual countries.

Among EU Member States, seventeen use the geometric mean in their HICP (Bulgaria, Croatia, Cyprus, Denmark, Finland, Greece, Ireland, Italy, Luxembourg, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden and Switzerland), eight use the Ratio of Averages (Belgium, Czech Republic, Estonia, Germany, Latvia, Lithuania, Malta and Slovakia) and six use a mixture of GM and RA (Austria, France, Hungary, Iceland, Netherlands, and United Kingdom). Beyond Europe, Canada, USA, Australia and New Zealand mainly use GM in the calculation of the national consumer price index, while Japan uses RA.

2.5 Aggregation

Indices for higher levels are weighted averages of the elementary aggregate indices. If the k^{th} representative item is stratified by region or shop type into strata in set K , the elementary aggregate indices for the strata in month t are $I_{i,t}$ and the stratum weights are w_i , the item index for item k for month t is:

$$I_t^k = \frac{\sum_{i \in K} w_i I_{i,t}}{\sum_{i \in K} w_i}$$

The CPI weights are updated in two stages every year: with the January index to take account of the new COICOP weights for CPI classes and above, and in the following month to take account of the changes to the basket of representative items, at which point weights for all of the individual items are updated.

In practice, the CPI item indices are computed with reference to prices for the previous January. For the period February to December therefore, compilation of CPI class indices proceeds straightforwardly, as a weighted arithmetic mean of the relevant item indices corresponding to the updated basket introduced in February:

$$I_t^C = \sum_j I_t^j \times w_t^j$$

where:

$$\begin{aligned} I_t^C &= \text{index for COICOP class } C, \text{ for month } t \text{ (February to December) based on previous January} = 100 \\ I_t^j &= \text{index for item } j \text{ in COICOP class } C \text{ for month } t \text{ based on previous January} = 100 \\ w_t^j &= \text{weight for item } j \text{ in COICOP class } C \text{ for month } t \end{aligned}$$

Calculation of class indices in January based on the previous December=100 is done as follows:

$$I_{Jan|Dec}^C = \frac{\sum_j I_{Jan}^j \times w_{Jan}^j}{\sum_j I_{Dec}^j \times w_{Dec}^j} \times 100$$

where:

$$\begin{aligned} I_{mmm}^j &= \text{Index for item } j \text{ in month } mmm, \text{ based on previous January} = 100 \\ w_{mmm}^j &= \text{weight for item } j \text{ in month } mmm \\ I_{Jan|Dec}^C &= \text{January index for COICOP class } c, \text{ based on previous December} = 100 \end{aligned}$$

For each class, the set of item indices used in this calculation will in most circumstances match those used in the compilation of the previous December's CPI. However, for any classes subject to extensions in coverage in January, it is of course important that the calculation is based on an extended set of item indices consistent with the change in coverage.

In both cases, that is indices for January, and indices for February through to December, higher level aggregates (ie group, division or the all items CPI index) are calculated as weighted arithmetic means of the relevant class indices, using COICOP weights for the current year.

2.6 Chaining

Since the CPI weights are updated in two stages every year: with the January index to take account of the new COICOP weights for CPI classes and above, and in the following month to take account of the changes to the basket of representative items, the CPI must be chain-linked twice every year. This involves calculating an index for January based on the previous December = 100 and, for February to December, a further index based on January of the current year = 100. In contrast, the RPI is chain-linked just once a year as the weights are updated at the same time as new items are introduced each February.

The CPI is published with a reference date of 2005=100. The chain-linked index is calculated as follows:

$$I_{t,y|2005}^C = I_{Dec,y-1|2005}^C \times I_{Jan,y|Dec,y-1}^C \times I_{t,y|Jan,y}^C$$

Item and elementary aggregate indices are not chained, because many items in the CPI basket change each year.

Unlike a within-year index, a chain-linked index spanning more than one year cannot be represented either as the ratio of the price of a basket in the current month to that in the base month or as the weighted average of price relatives, as the weights are not constant and even the list of items in the basket is not fixed.

It is necessary to chain the CPI every year because the weights change. It is possible to chain an index every month rather than just every January.

2.7 Re-basing the CPI

When the HICP was launched it was referenced on 1996=100. Starting with the publication of the January 2006 index, it has been referenced on 2005=100. The change of reference period was accompanied by a full re-referencing of all HICP indices back to 1996. This resulted in widespread revisions to 1-month and 12-month rates of change. This is because the 1996 based rates of change are calculated from indices rounded to one decimal place and are therefore subject to rounding errors. This is not the case for the 2005 based rates of change which are calculated from indices rounded to six decimal places and therefore there will be no widespread revisions in future re-referencing exercises.

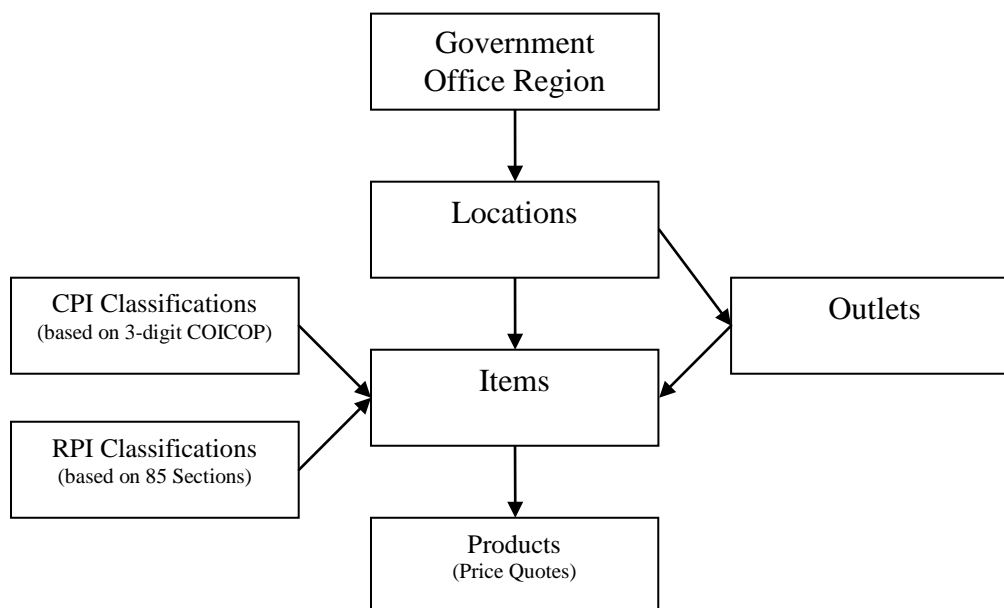
Estimates, which are broadly consistent with the data from 1996, are also available back to 1988 along with indicative figures for the period 1975-1987 but these data should be treated with some caution. O Donoghue, J (2004) '*Harmonised index of consumer prices: historical estimates*' provides more details (see Bibliography for link to article).

Chapter 3 Sampling Procedures

3.1 Introduction

Ideally, to construct a perfectly accurate CPI and RPI we would need to know and record the price of every variety of every good or service available in every outlet in the UK. This is not feasible in practice, so it is necessary to sample prices. There are four levels of sampling for local price collection: locations, outlets within location, items within section and product varieties. As only a sample of prices is recorded, there is inevitably some sampling error in measuring the CPI and RPI.

Figure 3.1. CPI and RPI Local Prices Sampling Scheme



3.2 Sampling of Locations

3.2.1 Producing a Location Boundary

Prior to 1995, the choice of locations had not changed for many years, and largely reflected the location and availability of civil servants in Unemployment Benefit Offices around the country who were then carrying out the price collection on behalf of the Office. In 1995 this process was changed. To ensure the country was fully represented, Great Britain was divided into its standard regions (eg London, Wales, East Midlands etc) and a number of locations for price collection selected in each region proportional to the total consumer expenditure for the region. Locations within each region were placed in size categories based on factors such as size of shopping population, the number of shops and drive time to the shopping centre. Locations were then randomly selected from each of the size categories. These locations were gradually included in the sample; around one-quarter were brought in each year from 1995 to 1998, with a few being introduced in 1999. This meant that a complete random sample of locations was used from January 1999. Sufficient information was not available to extend the model to Northern Ireland, so five locations were chosen judgementslly. Further details are given in the 1998 edition of the Technical Manual.

In 2000, previous methodology used to define the location boundaries was further refined. Locations are intended to be broadly representative of a central shopping area and the areas where the local shopping population tend to live. The boundaries of the locations used since 2000 have been produced

by defining a central point for a shopping centre, and growing the boundary outwards at a rate depending on retail activity in the area, stopping when another area is encountered.

In order to do this, the first stage was to purchase a commercial database giving a list of 1,200 shopping centres in the UK ranked by the size of the population they serve. A starting shopping area was defined around this, based on its size ranking. This was used to give each location a minimum size. These starting areas were then used as the basis for growing the full location.

The growth of locations was achieved by expanding out from the centre at a rate defined by the retail activity in the area using Geographic Information System (GIS) software; the more activity, the faster the growth. Retail activity was measured by a combination of the number of retail outlets and the number of employees in the retail sector, obtained from the ONS's Inter Departmental Business Register (IDBR). Locations were grown until they reached the boundary of the neighbouring location.

This meant that all locations had to be grown at the same time. Two further factors influenced the boundaries of locations. Firstly, locations cannot cross bodies of water without a bridge. Thus, if an estuary or river was reached without a crossing within the location boundary, then the location boundary became the edge of the water course. Secondly, in remote locations, these boundaries could be very large. Therefore travel time restrictions were applied, limiting travel to 30 minutes. This produced locations with a largest diameter of around seven miles.

These locations were then compared to census enumeration districts, and boundaries adjusted to be common with these. This was to ensure that the locations produced are useful in the field, by ensuring that location boundaries follow roads.

From 2004-2008, a new way was examined to define locations using a similar approach carried out by the Office of the Deputy Prime Minister (ODPM) in 2004, which defined the 'centre of retail activity in UK'. This approach has not been implemented, but the boundaries for some locations were subsequently modified in order to take into account these retail activity centres.

3.2.2 Location Selection

Location selection takes place separately within each region, using PPS (probability proportional to size, explained below) systematic sampling with a size measure of the number of employees in the retail sector. The number of locations in each region is determined as the proportion of national expenditure taking place in that region, multiplied by the total number of locations to be visited nationally.

Sampling takes place by first listing shopping locations within each region. This forms the basic sampling frame which is then modified in three ways in order to ensure that a full shopping basket (all the items in the CPI and RPI sample) can be collected in each location.

- firstly, locations with fewer than 250 outlets are excluded, as experience suggests that it is not possible to obtain a complete basket from these areas
- secondly, out-of-town shopping areas are paired with a small location in the region to form a new location. This is done because, despite out-of-town shopping areas attracting significant expenditure, they rarely contain food outlets. Therefore, in order to obtain a full basket, it is necessary to pair them with locations in which food is available
- thirdly, locations that are judged not to be large enough to support the collection of a full basket based on the field auditor experiences are merged with the nearby location to form a single collection area from which it is possible to collect prices for a complete basket of goods

Before 2009, PPS systematic sampling within a region was computed as follows: the first stage was to order the sample base locations randomly and calculate the cumulative total of employees, producing a range of the number of employees associated with each location. Selection took place using interval sampling, with the interval value calculated by dividing the cumulative total of employees by the number

of locations to be sampled. Checks were made to ensure the properties of a PPS sample held and in the cases where a location had a number of employees larger than the interval value, it was selected with certainty.

Interval sampling is performed by generating a random starting point between zero and the interval value. The location within whose range of employee numbers the starting value lies is selected as the first location. The second random number is generated by adding the interval value to the starting point. This is then used to select the second location by choosing the location whose range of employee numbers contains the new random number. The process of adding the interval value to the previous random number, and selecting the corresponding location, is repeated until the requisite number of locations have been sampled. This is illustrated in Figure 3.2 on the following page.

From 2010, PPS systematic sampling for location selection is performed through the SURVEYSELECT procedure in Statistical Analysis Software (SAS), using retail employment to proxy retail activity.

Figure 3.2 Illustration of Interval Sampling

Location Name	No. Outlets	No. Employees	Cumulative Total	Range
Location A	607	5377	5377	$0 < x \leq 5377$
Location B	306	2486	7863	$5377 < x \leq 7863$
Location C	264	2265	10128	$7863 < x \leq 10128$ Selection 1
Location D	449	4006	14134	$10128 < x \leq 14134$
Location E	322	2589	16723	$14134 < x \leq 16723$
Location F	319	2097	18820	$16723 < x \leq 18820$
Location G	283	2127	20947	$18820 < x \leq 20947$
Location H	457	5252	26199	$20947 < x \leq 26199$
Location I	539	4945	31144	$26199 < x \leq 31144$ Selection 2
Location J	371	4102	35246	$31144 < x \leq 35246$
Location K	518	4875	40121	$35246 < x \leq 40121$
Location L	928	10923	51044	$40121 < x \leq 51044$
Location M	407	3366	54410	$51044 < x \leq 54410$ Selection 3
Location N	374	2449	56859	$54410 < x \leq 56859$
Location O	539	3625	60484	$56859 < x \leq 60484$
Location P	326	3357	63841	$60484 < x \leq 63841$
Location Q	291	2473	66314	$63841 < x \leq 66314$
Location R	277	2052	68366	$66314 < x \leq 68366$
Location S	1815	16499	84865	$68366 < x \leq 84865$ Selection 4
Location T	443	3930	88795	$84865 < x \leq 88795$
Location U	329	2387	91182	$88795 < x \leq 91182$
Location V	258	2122	93304	$91182 < x \leq 93304$
Location W	420	3513	96817	$93304 < x \leq 96817$ Selection 5
Location X	1714	20335	117152	$96817 < x \leq 117152$
Location Y	305	2819	119971	$117152 < x \leq 119971$ Selection 6
Location Z	458	3429	123400	$119971 < x \leq 123400$
Location AA	380	3777	127177	$123400 < x \leq 127177$
Location BB	264	2375	129552	$127177 < x \leq 129552$
Location CC	452	6218	135770	$129552 < x \leq 135770$
Location DD	271	1839	137609	$135770 < x \leq 137609$
Location EE	250	1792	139401	$137609 < x \leq 139401$ Selection 7
Location FF	870	8100	147501	$139401 < x \leq 147501$
Location GG	1315	16303	163804	$147501 < x \leq 163804$ Selection 8
Location HH	321	2139	165943	$163804 < x \leq 165943$
Location II	283	2227	168170	$165943 < x \leq 168170$
Location JJ	2365	21887	190057	$168170 < x \leq 190057$ Selection 9
Location KK	312	3097	193154	$190057 < x \leq 193154$
Location LL	314	2724	195878	$193154 < x \leq 195878$
Location MM	332	2649	198527	$195878 < x \leq 198527$
Location NN	309	1723	200250	$198527 < x \leq 200250$
Location OO	892	7864	208114	$200250 < x \leq 208114$ Selection 10
Location PP	499	5921	214035	$208114 < x \leq 214035$
Location QQ	408	3299	217334	$214035 < x \leq 217334$

No. of baskets 10
 Employment total 217334
 Interval value $21733.4 = \text{Employment total} / \text{No. of baskets}$
 Random number 0.39904
 Random starting point $8672.5 = \text{Interval value} \times \text{Random Number}$

Random numbers (x) for selection

$8672.5 = \text{Random Starting Point}$
 $30405.9 = \text{Random Starting Point} + \text{Interval Value}$
 $52139.3 = \text{Random Starting Point} + 2 \times \text{Interval Value}$
 $73872.7 = \text{Random Starting Point} + 3 \times \text{Interval Value}$
 $95606.1 = \text{Random Starting Point} + 4 \times \text{Interval Value}$
 $117339.5 = \text{Random Starting Point} + 5 \times \text{Interval Value}$
 $139072.9 = \text{Random Starting Point} + 6 \times \text{Interval Value}$
 $160806.3 = \text{Random Starting Point} + 7 \times \text{Interval Value}$
 $182539.7 = \text{Random Starting Point} + 8 \times \text{Interval Value}$
 $204273.1 = \text{Random Starting Point} + 9 \times \text{Interval Value}$

Select Location in whose employee range random numbers fall.

3.2.3 Location Rotation and Re-enumeration

It is not feasible to select and enumerate all the outlets for a fresh set of locations every year (see section 3.3 for a description of enumeration). However, maintaining a fixed sample of locations and enumerating only once would reduce the total number of locations ever used for price measurement and, more importantly, create enumeration lists that contained many outlets that were no longer operating but omitted many outlets that had opened since enumeration. The compromise used is to try to update a sample of around 30 locations each year, either by excluding a location and replacing it with a new one (rotation), or refresh the list of outlets in the existing location (re-enumeration). Locations are enumerated in the year they are sampled and then introduced into the collection the following year at the same time as the basket is updated. They should remain in the sample for four years so that each location is refreshed either through rotation or re-enumeration once in a 5-year period cycle.

3.3 Sampling of Outlets

Until 1994, the sample of outlets chosen within a location was purely judgmental. Collectors chose outlets 'which typical people would visit in your area' or which were 'reasonably popular and which will represent the typical shopping pattern in your area'. Since 1995, the following method has been employed: each selected location is first defined as a cluster of enumeration districts. Within a location, outlets are selected by PPS sampling or, if this is not necessary, simple random sampling (SRS). To do this, the outlets in a location are enumerated to produce a sampling frame. This enumeration is carried out by price collectors visiting the postcodes in each location and noting details of all retail outlets found, up to a limit of 1,500 outlets per location. The details noted include, for each outlet: the outlet address, postcode, the range of items sold and (if a shop) its size and whether it is independent (I) or multiple (M). Shops of centrally collected chains (section 4.4) are excluded from the enumeration. In order to use PPS sampling the ideal size measure of an outlet would be turnover, but as this is not readily available, the net retail floor space (estimated by the outlet enumerators) is used as a proxy. For department stores and other shops selling a wide variety of goods, the floor space devoted to each commodity group is measured. The appropriate code indicating what each shop sells is assigned to each outlet based on the CPI and RPI classifications.

Use of the Coding List

CPI classification is based on COICOP (Classification of Individual Consumption by Purpose) at a three digit level (see Chapter 2), whereas RPI is based on a classification of 85 item sections (see Chapter 9). This classification drives the link between outlets and items. The link is handled via a master list of shop types, taken from the full coding list, which shows those which are in scope for a given group of items, in that they sell all or most of the group. Using this, outlets are classified by commodity group and, where appropriate, by shop type (multiple or independent). This is not a true stratification: an outlet may be in more than one stratum if it sells items from more than one commodity group.

For each commodity group, the required number of outlets, plus some reserves (used if an outlet closes down) are drawn from the sampling frame by either SRS or PPS sampling. The latter is used where there is known to be a wide range of store sizes and therefore a wide range of turnover, such as for Do It Yourself (DIY) stores which may be superstores or local shops.

The table below shows how this works for meat. Items are grouped into commodity groups, so fresh beef and lamb are grouped together, as are all cooked meats. The second column lists the shops where meat is sold. These meat items are sold in butchers, supermarkets, and some department stores. The third column shows whether a multiple or independent shop should be selected; for meat, either may be selected. The fourth column shows how many prices should be collected in each location for that commodity group. For meat, there should be one price from a butcher and one from either a supermarket or a department store that sells food. The fifth column shows what type of sampling is used to select the sampled outlets from all those of that type in that location. The butcher is selected by a

simple random sample of all butchers in that location; the supermarket or department store is sampled with probability proportional to size, since store size in this outlet group is likely to vary widely.

COMMODITY GROUP	SHOPS TO SELECT	TYPE	NO	SAMPLE
Meat	Butcher	M or I	1	SRS
1 Fresh beef & lamb	Supermarket	M or I	1	PPS
2 Cooked meats	Supermarket (licensed)			
3 Fresh bacon, pork, chicken	Department store type 1			
	Department store type 3			
	Department store type 5			

A shop holding a closing down sale is treated as already closed, and hence excluded from the sampling frame. This is because its prices will not be comparable with previous ones, and will not be available in the future. Shops selling only second-hand goods are also excluded.

3.4 Sampling of Representative Items

It would be both impractical and unnecessary to measure price changes of every item bought by every household in compiling the CPI and RPI. There are some individual goods and services where expenditure is sufficiently large that they merit inclusion in the CPI and RPI in their own right; these include the television licence fee, car insurance and electricity supply. However more commonly, it is necessary to select a sample of specific goods and services that give a reliable measure of price movements for a broad range of similar items. For example, price changes for garden spades might be considered representative of price changes for other garden tools. The selection of these representative items in the CPI and RPI is purposive or judgmental; the significant difficulties involved in defining an adequate sampling frame (that is, a list of all the individual goods and services bought by households) precludes the use of traditional random sampling methods.

A number of factors are taken into account when choosing representative items. Specific brands or varieties conforming to the item description must be easy to find by the price collectors, ensuring that estimates of price changes are based on an adequate number of price quotations throughout the United Kingdom. Since the CPI and RPI is based on the cost of a fixed in-year basket of goods and services, they should also be available for purchase throughout the year (except for certain food and clothing products which are seasonal, and so require a slightly different treatment).

The number of items chosen to represent price changes within each of the CPI and RPI sections depends both on the weight of the section and the variability of price changes between the various items that could be chosen to represent the section (reflecting, for example, the diversity of products available). Intuitively, it makes sense to select more items in areas where spending is high; this helps to minimise volatility in estimates of price changes for high-weighted sections and therefore in the CPI and RPI overall. However, if price movements for all possible items in a given section are very similar, it is sufficient to collect prices for only a few. By contrast, if price movements within a section are very different, a much larger selection of representative items will be needed to obtain a reliable estimate of price change for the section as a whole. This helps to explain why a relatively large number of items are selected in areas such as food and clothing, whereas price changes for more homogenous product groupings such as petrol, alcohol and tobacco are based on fewer items.

In practice, relative expenditures on the different types of goods and services play the most important role in determining the selection of representative items used to compile the CPI and RPI. This mainly reflects the wealth of data available describing household spending patterns. Two major sources of information come from the Household Final Monetary Consumption Expenditure (HFMCE) and ONS Living Cost and Food Survey (LCF), which also underpin the calculation of the CPI and RPI weights

(Chapter 6). This is supplemented by detailed analyses of trends provided by market research companies, trade journals and press reports. The price collectors and auditors also report developments in the retail environment to ONS.

Representative items are chosen centrally for the whole of the United Kingdom and, in order that the CPI and RPI remains representative of consumer spending patterns over time, the selection of items is reviewed each year. Consistent with the principle of a fixed basket, the sample of items is held fixed within each year, with annual changes effective from the February index. At this point, revised item weights and chain-linking of indices (section 2.6) are applied.

New items may be introduced for a variety of reasons. These include the development of new products, particularly in high technology sectors such as audio-visual equipment; increasing household expenditure in specific spending areas such as leisure or personal services; the need to improve coverage in areas where consumers already spend a significant proportion of their income; or the replacement of existing items for very similar products that have become more popular. Within the context of ongoing development of Harmonised Index of Consumer Prices (HICPs) within the European Union, member states are obliged to inform one another of market developments leading to the introduction of new items into their consumer price samples.

Additions to the basket of representative items each year are broadly matched by the number of items removed so that production costs and lags can be contained. There are currently over 650 items in the basket. In many cases, the decision to remove items from the basket reflects low or declining levels of household spending. However, where price changes for goods and services are very similar to other items within the same product grouping, items may be removed in that they do not provide sufficient extra information to justify their continuing inclusion; this does not necessarily imply that the consumer market for such items is small or declining.

The detailed contents of the CPI and RPI basket, and changes to the sample from year to year, should not be afforded significance beyond their purpose as representative items. Indeed, within each product grouping there is usually a point at which the number, choice of items and the precise weights attached to them become a matter of judgement. At this detailed level, it is unlikely that such choices have any significant impact on the CPI and RPI overall. For example, a selection of specific household appliances has been chosen to represent spending on small electrical goods, including irons, kettles and food processors. However, other representations would clearly be possible and equally valid.

In selecting the sample of items to represent distinct categories of household spending, those items must be well defined so that the products and varieties prices and reasonably homogenous. However, sometimes a relatively wide definition is used to accommodate rapidly changing consumer tastes, for instance clothing where fashions can change very rapidly. If the definitions were too specific in these cases, it would be very difficult for the price collectors to find the examples of the items in the shops. The diversity of products and therefore the range of possible price quotations that conform to a particular item description have implications for the choice of elementary aggregation method (section 2.4).

Examples of typical item descriptions are given below:

- large loaf, white, unsliced (800g)
- home killed beef, braising steak (per kg)
- butter, home produced (250g)
- fresh vegetables: onions (per kg)
- fish & chips, take-away, state size/type
- Bitter, 4 cans (440-500ml)

- plumber (daytime hourly rate including call out)
- single bed (width approx. 3ft/90cm)
- electric cooker, 4 rings, grill and oven
- dog kennel fees, boarding, daily charges
- child minder (hourly rate)
- men's suit (ready made)
- ultra low sulphur petrol
- swimming pool admission, standard, adult, off peak

3.5 Selection of Products and Varieties (price quotes)

For most goods, the selection of products and varieties within outlets is purposive. In each outlet, collectors choose one variety 'representative of what people buy in your area' from all products matching the specification of each item to be priced in that outlet. To facilitate this, they ask the retailer what are the most popular brands and those stocked regularly. As it is vital that the same product is priced each month, collectors must record enough detail of the product, such as make and model, to ensure that it is uniquely identifiable.

The chosen products are reviewed each January to ensure that what is being priced still reflects the above criteria. If the product being priced is not available for January, one that is available must be chosen so that there is a valid base price for the forthcoming year. In January, prices are collected for both the old (if possible) and new products (and for old and new items where these change) to permit chain-linking.

Local Probability Sampling

In January 2004, a new procedure, local probability sampling, was introduced at the lowest level of the sample, individual models within outlets, for a number of goods. This procedure is currently applied to washing machines, fridge freezers, audio-systems and digital camcorders. The aim was to improve the representativeness of the sample collected for each of the goods by controlling the items selected by the price collectors, rather than asking them to select the best sold in the outlet instruction. Other items are reviewed on a regular basis to assess whether it is appropriate to apply this method to them.

The principle behind this methodology is to define individual models in terms of their main price determining attributes (eg for televisions these include screen size, sound quality, picture frequency etc) and to use the selling patterns of different combinations of these attributes to create a representative sample. The appropriate attributes are identified by hedonic regression techniques (see section 7.2 for a fuller description of this technique). Scanner data¹ are then stratified by these attributes to give a matrix of the proportion of total sales represented by each combination of attributes.

This matrix is used as the reference for a PPS scheme to select the combinations of attributes for which each collector will search. PPS gives each combination of attributes a chance of being included proportional to its total expenditure. Application of the procedure produces a list of six prioritised attribute groupings for each price collector. Each collector is asked to find an item matching the first attribute group on the list in their outlet; if this is not possible they move on to the second etc. They have six choices and if the sixth is not found they revert to the current method of looking for the best sold product in the outlet.

3.6 Review of Sampling Arrangements

¹ Product and price information electronically captured at the point of sale in retail outlets

In 1996, as part of a programme of quality improvements to consumer price indices, the ONS carried out a re-balancing of the sample design for local price collection. The result of the re-balancing was a 20 per cent reduction in the number of locations offset by collecting more price quotations for commodities with high variability of price changes and fewer price quotations for commodities with low variability.

This reflected ONS analyses which suggested that the commodity dimension is a more important determinant of price changes than geographical location. The re-balancing was done by Neyman allocation and investigated how best to distribute the locally collected price quotations among the items so as to minimise the variance. It was not considered desirable to make wholesale changes to the existing structure of the index because of the importance of maintaining continuity for the users.

The practical implementation of the optimal allocation centred on how best to re-balance the sample without increasing the number of outlets visited, without greatly increasing the number of items collected and within the existing structure. As a result of the re-balancing, the number of locations selected was reduced from 180 to 146 with effect from August 1996, without decreasing the accuracy of the indices. Collection was increased for items which showed high variability in their prices and reduced for items which showed very low variability.

The re-balancing of the sample in 1996 was part of an ongoing process to review the sampling arrangements, which also resulted in the introduction of the new location sampling methodology in 2000. As part of development work on CPI and RPI, ONS is currently undertaking research reviewing boundaries of the CPI and RPI locations and the optimal location sampling process.

Chapter 4 Collection of Prices

4.1 Methods of Price Collection

There are two basic price collection methods: local and central.

Local collection is used for most items; prices are obtained from outlets in about 150 locations around the country. Around 110,000 quotations are obtained by this method. Normally, collectors must visit the outlet, but prices for some items may be collected by telephone (section 4.2.2).

Central collection is used for items where all the prices can be collected centrally by the ONS with no field work. These prices can be further sub-divided into two categories, depending on their subsequent use:

- a. *central shops*, where the prices are combined with prices obtained locally
- b. *central items*, where the prices are used on their own to construct centrally calculated indices

4.2 Local Price Collection: General Procedure

Until 1994, collection was carried out by civil servants, latterly from the Employment Service, with prices collected on batches of paper forms.

Since 1995, price collection has mostly been done by a market research firm on a contract basis, operated to European Community open competition tendering procedures. Prices are recorded on hand-held computers. This speeds up data processing and transfer, and means that prices are validated interactively as they are entered, reducing the number of queries that need to be dealt with when the data are processed (section 5.2).

4.2.1 Choice of Index Day

The CPI is intended to reflect prices over at least one working week at or near the middle of the calendar month of the reference month, whilst the RPI is intended to reflect prices on a particular Tuesday of each month (Index Day). In practice, local collection for both CPI and RPI is carried out on the day before and day after Index Day as well as Index Day, as it is not practically possible to collect every price in one day. However, for fresh fruit and vegetables (including potatoes), the prices are always obtained on Index Day itself. Even for prices that do not need to be collected on Index Day itself, collectors aim to provide month to month consistency by collecting them on the same day of the week each month.

In the CPI, the prices for petrol and oil, which exhibit particularly volatile price movements, are averaged over the month, based on the prices prevailing on each Monday during the month. This is in order to comply with an EU Regulation. However in the RPI, petrol and oil prices are collected on Index Day.

Index day is always the second or third Tuesday of the month. The choice of week depends on operational considerations, and particularly the timing of bank holidays. Index day is never chosen to fall in a week which includes a bank holiday Monday, because some prices are collected on the Monday, and outlets may be closed or charge abnormal prices on bank holidays. There are five weeks between the Index Days for December and January, and on four other occasions during the year. Otherwise, there are normally four weeks between Index Days. The dates of Index Days are not published in advance because of the hypothetical risk that service providers or retailers may change their prices in order to influence the CPI or RPI.

4.2.2 Telephone Enquiries

The prices for certain items, such as electricians' charges, childminder fees and driving lesson fees, are obtained by the ONS telephoning the businesses or organisations concerned. Most items for which prices are obtained by telephone are periodic (section 4.3.1). Monthly telephone enquiries include oil central heating and theatre admission. In the Local Collection certain outlets can be telephoned because it is relatively easy to avoid ambiguities in price where the outlet provides standard items or services. However, even if prices are obtained by telephone, the retailer must be visited occasionally. This helps to maintain personal contact and to ensure that there are no misunderstandings over the prices. This will be more important for some retailers than others. For example, due to the specialist nature of the service provided by Opticians, this clarification will be more important than, say, the price of a take-away meal.

4.3 Particular Rules of Local Price Collection

4.3.1 Frequency of Collection

Local collectors should try to collect all prices every month, except for seasonal items when they are not in season and periodic prices which are only collected in three or four months in each location.

For periodical items, each location is allocated a periodic (quarterly) code, A, B, C, D at random. Prices are then collected according to the following timetable:

- A January, May and September
- B January, February, June and October
- C January, March, July and November
- D January, April, August and December

In the months when periodic items are not collected in a location, the previous month's prices are carried forward. Items collected periodically are mainly services in the household and leisure groups.

4.3.2 Methods of Payment

The price usually used is that for a cash transaction. This means that charges for paying by instalments or for use of credit cards, and discounts for paying by direct debit, are usually ignored (though not always: some centrally calculated indices such as electricity charges measure the price of several different forms of payment) but discounts for paying by cash should be allowed for. Value Added Tax (VAT) and compulsory service charges are included.

4.3.3 Indicator Codes

Collectors are required to note if there are any special features in the prices recorded. Certain codes are used:

- S sale or special offer (explains a reduction in price)
- R recovery from S (explains a price jump); is not necessarily the same price as before the sale
- N non-comparable product or variety to represent an item (implying that the original product's or variety's base price is not suitable for comparison)
- C changed product or variety but not significantly different from old one (C for comparable, implying that the original base price is suitable for comparison)
- T temporarily out of stock

- M item missing from outlet and not likely to be stocked again in the near future
- Q a special note has been made (Q for query) by the collector for ONS staff to examine and respond as required
- W weight/size change, eg manufacturer has made a permanent change to the weight of a product; used only as and when instructed by ONS
- X comparable item introduced which is on sale
- Z non-comparable item introduced which is on sale

Also, if the price entered fails a validation check carried out by the hand-held computer (section 5.2), collectors must enter a message explaining why. These messages and indicator codes are used by ONS staff at a later stage of the validation process.

A price should only be recorded if the exact product being priced is on display or in stock at the outlet. For some large items, such as furniture, which must normally be ordered, it is acceptable to record the price if the item is available to order.

4.3.4 Unavailable Items

If a chosen product is temporarily out of stock, no price is recorded and a T code is used. If it is out of stock for three consecutive months, the collector should choose a replacement product which matches the item description, using an N, C, X or Z code as appropriate to inform ONS staff carrying out subsequent validation on the replacement. If a replacement product cannot be found, the collector should use an M code.

4.3.5 Obtaining a Price per Unit

Some food items, such as cheese, are sold in packs of variable weight, so it may not be possible to find the identical weight each time. In this case, a price per unit weight is collected. If it is not marked, it is found from the displayed price and weight. Each month, a pack of roughly the same weight is used, as a lower price per unit weight may be charged for larger packs.

If a single good such as one bar of chocolate is specified, and it is only available as a multi-pack in January, the price of one bar is computed from that of the multi-pack. The same multi-pack is used in subsequent months. If price collectors are forced to calculate a single good price from a multi-pack price, they are instructed to use the smallest multi-pack (eg using a 2-pack rather than a 3-pack).

4.3.6 Special Rules for Individual Items

Book prices are collected locally; the collection is carried out in a mixture of specialised book shops, stationers and major retail chains. The collectors are required to price both fiction and non-fiction books, in both hardback and paperback (three price quotes in total), from the top ten best seller list from the *Sunday Times*. The selected title is then priced until it falls out of the list from which it was selected. In all cases, the author's name, the number of pages, position and details of the best seller list used must be provided, to enable the collector to make a decision on comparability when a new title has to be chosen. Collectors are also asked to price a reference book of their own choice, a teenage fiction book and a children's book for under-5s.

Locally collected *CD albums and singles, pre-recorded DVDs, Blu-ray discs and computer games* are priced in a similar way to locally collected books. For CDs, Blu-ray discs and computer games, the selection is made from the top 40 best sellers' list in the shop in which price collection takes place. The item is then priced until it falls out of the list when a replacement is chosen. A similar approach is used for DVDs, except the selection is made from the top 20 best seller list from www.theofficialcharts.com/dvd-chart.

For *DVDs collected centrally over the internet*, prices are collected from major retail outlets for the top 10 best seller list using the same chart as the local collection. CDs are collected based on the BBC top 20 chart list.

A similar approach is used for *computer games*. Prices of the top few games (between three and ten, depending on the retail outlet and type of platform) on the GFK Chart-Track top ten list are collected centrally from a number of major retailers.

For *music downloads* a slightly different approach is used. Prices are also collected for albums chosen from the official UK best sellers' list. However, the positions to be priced are selected randomly at the start of each year, with probability inversely proportional to position, and held constant throughout the year. This means, for instance, that number two has twice the chance of being selected as number four, and five times the chance of being selected as number ten.

For the RPI, *Private rents* are taken net of any inclusive water, sewerage or council charges, as these are accounted for by separate centrally collected items.

4.4 Central Shop Price Collection

Central shop prices are obtained from major chains of shops with national pricing policies. Branches of these chains are excluded from the local collection. Some chains enter price data on spreadsheets via emails; more frequently, the data is obtained from the company's internet website. Mail order catalogues are also treated as central shops: prices are collected via the internet twice a year. These prices are combined with those for the same items from the local collection.

4.5 Regional Central Shop Price Collection

Chains with no national pricing policy cannot be treated as central shops. However, it may be reasonably accurate to visit only a few of their outlets and assume that each outlet reflects their pricing policy within a given region. Chains treated like this are called regional central shops. For these chains, one collection is carried out in each of the eleven Government Office Regions in England, and Wales, Scotland and Northern Ireland, where the retailer operates. The prices collected in these stores are given extra weight to reflect their market share, in the same fashion as the weights applied to central shop collected prices (section 6.3).

4.6 Centrally Calculated Indices

There are about 140 items for which the prices are collected centrally and the index calculation is carried out separately from the main method of index production. Selecting this type of collection and calculation is usually dependent on one or more of the following considerations: sources of data, data presentation, frequency of price changes, national pricing policies and the possibility of future fundamental changes to pricing methods.

For most of these items, the method of collection and calculation is based on the generic model, the exceptions being those referred to in Chapter 7. Indices are aggregated from the lowest level up, with weights often available at the level of individual price quotes. Where weights are not available, the CPI item index is calculated using the geometric mean (section 2.4), while the RPI index is calculated as a ratio of average prices or an average of relatives (section 9.3). The weights data used in the centrally calculated indices come from a variety of sources, which are usually specific to a particular index.

Collection

Where feasible, price data is collected over the internet. If this is not possible, price data is collected from one central source (trade associations, Government departments etc) whenever possible although market forces do require contact with regional or competing companies in many cases. Data may be requested in writing, by telephone or by e-mail, or may come automatically because the ONS is on a provider's mailing list. Providers may send either a full price list or tariff sheet from which the relevant prices will be extracted. Some travel fares data are provided in the form of price indices. Frequency of

enquiry varies across the range of items and depends on when prices are known or expected to change. The most common frequencies are monthly or quarterly but thrice (eg some travel fares), twice (eg local authority rents) and once a year (eg football admissions) as well as 'when necessary' (eg when changes to national rail fares are announced) are also included in the timetable.

Chapter 5 Validation Procedures

5.1 Summary

The validation checks described in this chapter are applied to all prices collected locally, regionally and from central shops. One exception to this is that the checks using hand-held computers mentioned in section 5.2 are not applied to prices collected from central shops.

5.2 Field Checks Using Hand-held Computers

Several checks are carried out on data entered into the hand-held computers by collectors, for instance to ensure that indicator codes (section 4.3.3) have been used sensibly and correctly. The most important tests are the price change check and the min-max check.

5.2.1 Price change check

The price entered is compared with the price for the same product, in the same shop, in the previous month. A warning is given if the change exceeds plus or minus 50% for home killed lamb; 40% for clothing, personal goods, toiletries, electrical goods, books and services; and 33% for other food and non food items except estate agents' fees, where a warning message is generated if the entry is outside the range of 0.75% - 3.50%, and conveyancing fees, where a fee range is set and reviewed annually. Potatoes, other fresh vegetables and fresh fruit (which have the largest month to month variation) do not go through this test at all. If there is no valid price for the previous month, for example because the item was out of stock, the check is made against the price two months ago or, failing that, three months ago. If there is no valid price for the last three months, the test is not carried out.

5.2.2 Min-max check

The min/max range used by the collection programme is derived from the latest non zero price for the specific item in the respective shop. The range will be a higher/lower percentage of the price depending on the type of item, for example the min/max range for clothing will be larger in comparison to the price than the respective range for a dairy product. The validation in the collection programme compares the price entered by a collector against this min/max price range.

Whenever the collected price is outside of the min/max price range, a warning message on the IPAQ will prompt out with previous month price and min/max information. The collector is asked to confirm the price they've entered is correct; if they say no they have they are taken back to the item screen to amend the price they've entered. If the collector confirms the price outside of range is correct they will be prompted to enter a comment. It is important to note that the min max range used by the IPAQ collection programme differs from that used in the office based data validation, which is derived from the price entered for that item across all regions and shop types.

As a further check, the data are put through checks by the collecting agency on their central computer system after all local data have been submitted to ensure that all prices which have these unusual price changes/levels have appropriate messages for use by ONS staff later on in the processing cycle. For example, a check to determine whether the price entered exceeds a maximum or is below a minimum price for the item of which the particular product is representative. The range is derived from the validated maximum and minimum values observed for that item in the previous month (across all regions and shop types), expanded by a standard scaling factor. This factor varies between items.

5.3 ONS Data Consistency Checks

After the locally collected data are transmitted to ONS, initial checks are carried out to ensure that data are complete and correct. For instance, checks are run to ensure that unexpected duplicate prices (ie for the same item, in the same shop, in the same location) are removed and that the location, outlet and item identifier codes which accompany each price exist and are valid. If any prices fail these checks, they are returned to the contractor for clarification. Once the price data are correct and complete, validation tests are run in three phases.

5.3.1 Phase 1

The checks described in section 5.2 are applied again. Prices failing either test are excluded from the CPI compilation unless manually accepted during subsequent analysis by ONS staff. Failures of the max/min test are rare (about 30 per month from over 110,000 locally collected prices). There are between 1% and 2% failures of the price change test; the number of failures is seasonal, being higher in months when there are sales and also in the following months when the prices return to normal. In these circumstances, it is likely that many of the prices failing these tests are valid. A programme is run to accept prices automatically in the following circumstances:

- the indicator code (section 4.3.3) shows the item is on sale in the current month but was neither on sale nor recovering from a sale in the previous month; and the price has fallen by less than 55 per cent
- the item has been on sale in both the current and previous month, and the price is unchanged
- the item has recovered from a sale in the previous month, and there has been a price increase of less than 110 per cent

ONS staff then look at all remaining prices failing these tests, along with any indicator codes and messages provided by the collectors. In the light of the information available for each failed price, ONS staff make one of the following decisions:

- accept the price
- accept the price but as a new product and thus calculate a new base price (section 7.2c)
- return the price to the contractor, requesting more information on which to base a decision
- confirm rejection of the price

5.3.2 Phase 2

Taking just the prices originally set as valid for the current month (ie not those manually or automatically accepted) from Phase 1, an outlier detection process known as the Tukey algorithm (section 5.3.4) is used to remove outliers. Preliminary item indices are then calculated using the prices which passed the Tukey algorithm plus those which have been manually or automatically accepted; all prices failing the Tukey algorithm but with price relatives within 10 index points of the item index are then marked as valid for use in calculating the CPI. Thus, if the preliminary item index is 107.2, all prices with price relatives in the range 97.2 to 117.2 are marked as valid.

Item indices for all items are then recalculated using all prices now accepted as valid. Some items are selected by ONS staff for further analysis, during which both failing and some non-failing prices are examined. Items for examination are selected on the basis of a combination of factors, such as the movement of the item index compared with the previous month, or the same month in the previous year, and market information on particular factors affecting prices that month. When examining prices within a particular item, operators can take any of the actions detailed in phase 1, although due to time pressures reference back to the contractor is less likely.

5.3.3 Phase 3

5.3.3.1 Q code examination

Code Q is used by collectors to alert ONS staff that they have provided extra information that cannot be easily categorised by using an alternative code (section 4.3.3). All 'Q' labelled price quotations and their relevant messages are extracted electronically for scrutiny and action by ONS staff. The validity of an individual quote may be changed as a result of the information provided, but in most cases the message is of a more general nature and is used as a source of market information on the product in question. Feedback is given to price collectors when appropriate.

5.3.3.2 3 month check

To ensure that individual prices are not omitted from the index calculation indefinitely, the computer system automatically implements base price imputation procedures (section 7.2c) when a price quotation has been missing or invalid for three consecutive months. Every month, a report of all quotes that have an invalid price quotation in the current month is issued to ONS staff. ONS staff then consider the validity of the current quotation with a view to reducing the necessity to impute prices, and thus retaining true price chains where possible.

5.3.3.3 Final check

As a final check of the acceptance of high and low level indices in the final index calculation, all individual price quote indices above 180 or below 60 are identified. For each, a report of all locally collected quotes, treated as valid, is issued to senior price analysts for final approval. At this stage, the scrutineer will seek confirmation that particularly high or low outliers have been checked and may withdraw them from the final calculation if not satisfied.

Prices failing any of the ONS checks and not subsequently revalidated automatically, or by ONS staff action, remain invalid and are therefore excluded from the final index calculation.

5.3.4 The Tukey Algorithm

This algorithm is used in Phase 2 of the ONS checks (section 5.3.2). It identifies and invalidates price movements which differ significantly from the norm for a particular item. For some seasonal items for which price movements are erratic, the algorithm looks at price level rather than price change. It has three parameters which govern its operation. At present these are set uniformly over all items, though this is not essential.

The algorithm operates as follows:

- the ratio of current price to previous valid price (the price relative) is calculated for each price. (In the case of items tested by price level rather than price change, this stage is omitted)
- for each item, the set of all such ratios is sorted into ascending order and ratios of 1 (unchanged prices) are excluded. (In the case of items tested by price level rather than price change, the prices themselves are sorted)
- the top and bottom 5% of the list are removed (this 5% is parameter 1)
- the 'midmean' is the mean of the residual observations
- the upper and lower 'semi-midmeans' are the midmeans of all observations above or below the *median*
- the upper (or lower) Tukey limit is the midmean plus (or minus) 2.5 times the difference between the midmean and the upper (or lower) semi-midmean. This figure of 2.5 represents parameters 2 and 3. These parameters can be set independently if desired but are currently set to be equal

- the upper (or lower) limit is increased (or decreased), as necessary, to ensure that all unchanged prices fall within the Tukey limits
- price relatives, or price levels, outside the Tukey limits are flagged as unacceptable

The Tukey algorithm has been used since 1987. It produces limits that are; intuitively reasonable, consistent from month to month, robust in the presence of outliers (in other words, adding in one or two rogue observations does not affect the limits set by the algorithm very much) and robust as data volume changes (ie limits calculated from a subset of the data do not vary much from those calculated on the full data set).

5.4 Auditing

To check that price collections are carried out correctly, auditors employed by ONS carry out monthly quality audits of individual local price collections selected by ONS. There are two types of quality audits. The first involves auditors accompanying collectors on price collections. The second consists of audits which take place no later than three days after the collection (back checks). Normally, eleven locations are inspected each month for each of the two types of audit. The locations visited change each month and collectors do not know which locations will be chosen for the back check when they carry out the collection.

5.4.1 Accompaniment of Collectors

A quality auditor who accompanies a collector on a collection examines the collection to ensure that:

- suitable products are chosen
- the correct indicator codes are used
- the correct prices are recorded
- the prices are collected in the correct outlet type
- the prices for fresh fruit, vegetables, petrol and oil items are collected on Index Day
- the price is only recorded if the item is available to take home the day it is collected
- any need for training of a collector is identified, to help improve the quality of the collection

5.4.2 Back Check of Price Collection

The back checking quality audits involve auditors visiting the outlet where the price was recorded by the collector, and checking to see whether the price was correctly recorded. The ONS auditors are accompanied by a member of staff from the contractor.

Locations in which to conduct back checks are selected at random. Locations are stratified into areas and a fixed number of strata are selected at random, without replacement, with probability of selection proportional to the number of locations within each stratum. A single location is then selected from each chosen stratum by simple random sampling.

For a given month, the same list of items is audited in each location selected. The list comprises 70 uniquely defined and randomly selected price quotes, drawn from the complete set of quotes to be collected that month. For those items where more than one price quote should be collected, individual quotes are identified by outlet type.

The back check covers accuracy of price collection and other aspects which are important to sustain the comparability of price collection across months and to better inform the validation process, for example, the quality of item descriptions and the use of indicator codes. For accuracy, a formal test has been devised, the principal aim of which is to see if the rate of error is acceptable; an acceptable error probability is defined as three per cent or less. Items which were out of stock at the time of the price

collection are ignored and not replaced. Therefore, the total number of price quotes audited in each location will be less than or equal to 70. Associated with each possible total is a threshold (derived from the binomial distribution and designed to give a significance level less than or equal to 5%) that defines the number of price errors required for the location to fail the test and for the inference to be made that the underlying error rate is not acceptable.

If a collector fails a back check, this is reported to the contractor and the collector is checked again after a three month period to ensure that standards have improved.

Chapter 6 Weights

6.1 Introduction

The CPI and RPI measure changes in the cost of a representative basket of goods and services. This involves weighting together aggregated prices for different categories of goods and services so that each takes its appropriate share within household budgets. For instance, as most people spend far more on electricity than on dry cleaning, a price rise for electricity must have more effect on overall price rises than a similar-sized increase for processed fruit. At the lowest level therefore, each elementary aggregate (section 2.4) should receive a weight equal to the ratio of expenditure by index households on goods and services represented by that aggregate to all expenditure in the UK by index households on items within the scope of the index.

The CPI weights cover monetary expenditure within the UK on goods and services that are part of Household Final Monetary Consumption Expenditure (HFMCE). The weights are based on expenditure within the domestic territory by all private households, foreign visitors to the UK and residents of institutions (such as nursing homes, retirement homes and university halls of residence). Given the focus on 'monetary' expenditures, imputed expenditures, such as imputed rents and company cars in kind, are excluded.

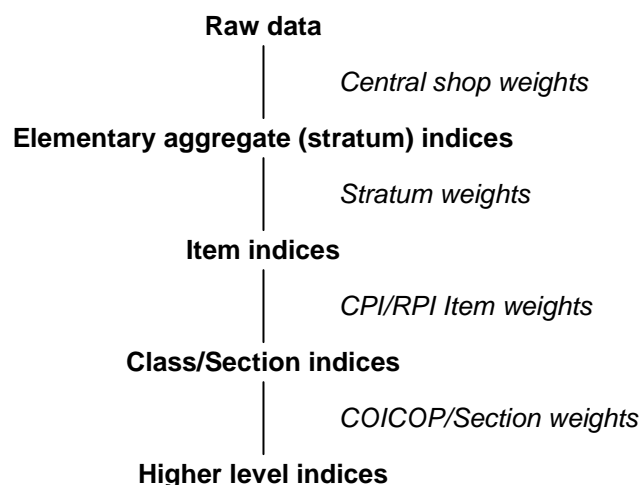
Within the CPI, there are four different types of weight (compare Figures 2.1 and 6.1):

- central/regional shop weights (section 6.3; sections 4.4 and 4.5 discuss central and regional central shop collection)
- stratum weights (ie region and shop type; section 6.4)
- CPI item weights (section 6.5.1)
- COICOP weights (for CPI class level indices and above) (section 6.6.1)

The above is the order in which the weights are used. The first two types of weight are used to produce the item indices, the next is used for the class level indices and the last is used for the group level, the division level and the all items indices. Only the COICOP weights are published.

Within the RPI, the same central/regional shop weights and stratum weights are used as in the CPI. RPI item weights (section 6.5.2) are used for the section indices and section weights (section 6.6.2) are used for the all items index. Only the section weights are published.

FIGURE 6.1: AGGREGATION PROCEDURE



The COICOP weights are largely calculated from HFMCE data, since they cover the relevant population and range of goods and services and, in addition, are classified by COICOP. This is supplemented for certain classes by Living Costs and Food Survey (LCF) data, International Passenger Survey data (IPS) and data from Public Sector Branch.

In contrast, the RPI weights are mainly based on data from the LCF and relate to expenditure by private households only, excluding the highest income households and pensioner households mainly dependent on state benefits.

All of the weights used in compiling the CPI and RPI are updated annually to coincide with general review of the representative items in the basket (section 3.4). Firstly, this is necessary so that the weights reflect the introduction of new items and the deletion of those no longer needed. Secondly, using up to date expenditure data ensures that the indices remain representative of current expenditure patterns over time.

6.2 Plutocratic and Democratic Weights

The use of aggregate expenditure to calculate weights, as the CPI does, means that each index household contributes to the weights an amount proportional to its expenditure. This means that the expenditure patterns of high-spending households (which of course tend to be those with higher income) have more influence. Such weights are sometimes called *plutocratic*. In principle, it is possible to derive *democratic* weights from the LCF (but not from other data sources), where each household is assigned an equal weight.

The ONS does not calculate democratic weights. They would be higher for goods and services that are relatively more important to lower income households, such as food, fuel and light, and lower for sections such as mortgage interest payments and motoring. The effect on the CPI and RPI of using such weights depends on relative movements in different section indices as well as the differences between the weights. However, in the case of the RPI, the exclusion of high income non-index households should reduce the difference between the two sets of weights.

Plutocratic weights are more appropriate for an index used as a general measure of inflation, for current cost accounting and for deflating expenditure estimates. Democratic weights might be more appropriate for an index used for indexation purposes, eg for pensions or social security benefits.

There have been a number academic studies of democratic weights, including one by the Institute of Fiscal Studies (IFS) (2002) who calculated democratic and plutocratic indices based on RPI price components and weights derived from the EFS. They showed that though there were differences between the two indices, they were relatively minor (Crawford, I. & Smith, Z. (2002) *Distributional Aspects of Inflation*, IFS Commentary 90).

6.3 Central Shop Weights

These weights reflect the market share of chain shops and are used to weight the centrally collected shop prices. They are not strictly weights; they are replication factors which give the number of times that each central shop price should appear in each stratum. The centrally collected shops are of two types, Supermarkets and Non-Supermarkets.

6.3.1 Supermarkets

The five biggest supermarkets account for about 70% of the food market. The method of price collection depends on the pricing policy of the company. If prices are reasonably uniform throughout the country, it makes sense to collect the prices centrally; if there are likely to be substantial regional variations, prices must be collected separately in each region. The five biggest supermarkets are all treated as Regional Centrals and priced regionally (section 4.5).

The same central shop weights are used in both the CPI and RPI. The market shares of the companies are calculated mainly from LCF survey data, along with a variety of sources such as market research reports. These are then broken down into individual shop weights for each item priced at that shop. Before the shop weights are estimated, the stratum weights, the number of prices expected to be collected in each stratum cell and the weights given to other supermarket chains are considered. The weights for each company are broken down to regions, based upon the distribution of the company's shops.

Suppose that for item "widget", which is stratified by shop type but not region, there is just one centrally collected supermarket "Shopco", while all the other price data for this item are collected locally. Also, assume that the following statistics relate to the collection of data for this item:

- item "widget" is stratified by shop-type (multiple versus independent) only
- "Shopco" has 20% overall market share for item "widget"
- on average, around 160 price observations are taken locally each month, of which 110 come from multiples and 50 from independent shops

The single price observation from "Shopco" will be replicated 40 times in the multiples stratum cell. This means that of the 200 total price observations, 40 will be from "Shopco", thus giving it 20% of the market share. Overall, there will be 150 price observations in the multiple-shop stratum cell (110 locally plus 40 from "Shopco") and 50 price observations in the independent-shop stratum cell (all collected locally). The two stratum indices can then be combined using stratum weights to produce an item index for widgets.

The formulae used to calculate the replication factors are:

$$R_t = \frac{\frac{M_t}{W} \times 100}{\left(100 - \left(\frac{M_t}{W} \times 100\right)\right)} \times L$$

$$R_s = R_t \times \frac{M_s}{M_t}$$

where:

- R_t = total of all replication factors for that item
- R_s = replication factor for central shop s
- L = expected prices to be locally collected for multiple shops for that item
- M_t = market share for all central shops for that item (as percentage)
- M_s = market share for central shop s for that item (as percentage)
- W = shop-type stratum weight for multiple shops for that item (as percentage)

For example, suppose for central shop s, the following values apply:

$$L = 60; M_t = 61; M_s = 11; W = 68$$

Inserting these values into the formula, the total of all replication factors for that item, R_t , is 522.86, which rounds to 523, and the replication factor for central shop, R_s , is 94. So 94 copies of the price collected from that central shop for that item will be included in the database when calculating the item index. If the item is also stratified by region, then the replication will be split up so that the price is replicated within each region as well. The proportion of the replication factor put into each region depends on market information on total revenue by region for that shop. If this information is not available, the proportions are estimated by examining the total number of outlets for that shop in each region.

6.3.2 Non-Supermarkets

Central shop weights for non-food retailers are calculated in the same way as for supermarkets. For prices collected centrally from mail-order catalogues (principally for clothing and minor household goods), two prices are collected for each item (in other words, two brands or varieties are priced).

6.4 Stratum Weights

For some types of expenditure, purchasing patterns may differ markedly by region or type of outlet and in these cases stratification will improve estimates of item indices. Each locally collected item in the index is allocated to one of four different stratum types. This allows the best available information about purchasing patterns to be incorporated in the index calculation. The stratum types are:

- region and shop type
- region only
- shop type only
- no stratification

The assignment of stratum type depends on the information available for constructing the weights for each item and the number of prices collected per item. In principle, all locally collected items should be stratified by both region and shop type, but if the weights data are inconclusive or there is no information available, then the item is allocated to another stratum type. Allocation also partly depends on which shop types were specified for the collection of prices and the number of prices collected. If the rules for the choice of outlets (section 3.3) did not specify that both a multiple and an independent should be chosen for an item, there may be too few prices collected in one of these shop types to make stratification by shop type meaningful. In some instances, there is no stratification because research has shown that stratification has little effect.

Once calculated, the same stratum weights are used in both the CPI and RPI.

6.4.1 Shop Type

In the CPI and RPI, two types of shop are identified for the stratum weights: multiples and independents. Retailers with fewer than 10 outlets are classified as independents, while retailers with 10 or more outlets are classified as multiples. Shop type weights were updated annually until 1999 using data collected in the Annual Retailing Inquiry. Following the termination of this Inquiry, shop type stratum weights have been updated where possible using data from various sources, including the LCF. The same shop type stratum weights are used in both the CPI and RPI.

6.4.2 Region

Regional stratum weights are used in the construction of many item indices, and the same weights are used in both the CPI and RPI. They represent the proportion of national average household expenditure by category of product (based on RPI sections) in each region of the UK. The LCF provides average household expenditure by RPI section and Government Office Region (GOR). From this, the percentage of expenditure in each region is calculated for each RPI section. The regional weight for an item is the percentage for its section. Thus, if 12% of expenditure on fresh fruit occurs in Scotland, the regional weights for apples, oranges, etc for Scotland are all 12%.

For example, suppose that for item x, the proportion of expenditure is 60% in multiples and 40% in independent shops, and that the regional breakdown of expenditure by index households (expressed as percentages) for item x is as follows:

London	15	Yorkshire and the Humber	10
South East	15	North West	10
South West	10	North East	5
Eastern	5	Scotland	5
East Midlands	5	Wales	5
West Midlands	10	Northern Ireland	5

Then the stratum weights for item X will be as follows:

Multiples

London	0.09	Yorkshire and the Humber	0.06
South East	0.09	North West	0.06
South West	0.06	North East	0.03
Eastern	0.03	Scotland	0.03
East Midlands	0.03	Wales	0.03
West Midlands	0.06	Northern Ireland	0.03

Independents

London	0.06	Yorkshire and the Humber	0.04
South East	0.06	North West	0.04
South West	0.04	North East	0.02
Eastern	0.02	Scotland	0.02
East Midlands	0.02	Wales	0.02
West Midlands	0.04	Northern Ireland	0.02

Sum of stratum weights = 1.00

6.5 Item Weights

Some items are intended only to represent themselves; others represent a subclass of expenditure within a section. For instance, within electrical appliances, the electric cooker item represents only itself and not any other kinds of electrical appliances. However, other items represent price changes for a set of items, which are not priced, so for these the weight reflects total expenditure on all items in the set. For example, a screwdriver is one of several items representing all spending on small tools within DIY materials, and there are other items within the section representing all spending on paint, timber, fittings and so on. It would be difficult to get expenditure data for each possible DIY item and inordinately time-consuming to collect and process these every month.

The expenditure figures for all items in a section are expressed as a percentage of the section weight. Each percentage is rounded to the nearest unit, except where percentages are less than 0.5 which are rounded up to 1. Manual adjustments are then made to constrain the sum of each section's item weights to 100.

6.5.1 CPI Item Weights

The CPI item weights are updated twice each year – with the January index when the new COICOP weights are introduced, and in February when the representative items that make up the basket of goods and services are updated.

The CPI item weights for January are generally calculated by scaling the previous year's item weights to the new COICOP weights introduced that month, as follows:

$$W_{Jan}^i = W_{y-1}^i \times \left(\frac{W_y^C}{W_{y-1}^C} \right)$$

where:

i = item i in COICOP class C in the basket in year $y-1$

w_y^C = weight of COICOP class C in year y

w_{Jan}^i = weight of item i in January of year y

This formula assumes that the goods and services covered by a COICOP class, and the items used to represent them, are unchanged between December and January. However, this is not the case when coverage of a COICOP class is extended, as in each of the Januarys from 2000 to 2002 (section 2.4). In these circumstances, new items will be introduced in January consistent with extensions in coverage and given appropriate weights. Weights for existing items are then scaled so that the sums of weights for all items (new and old) are consistent with the new class totals.

When the basket of goods and services is updated in February, item weights are updated by drawing on data from a variety of sources. These include detailed National Accounts expenditure data, LCF data, market research data and other sources including administrative data. For each COICOP class, the sum of the new item weights introduced in February is constrained to be equal to the updated class weight introduced in the previous month.

6.5.2 RPI Item Weights

Wherever possible, RPI item weights are calculated using data from the LCF, based on data for the latest available four quarters. The 2012 item weights were based on LCF expenditure data relating to the period July 2010 to June 2011. Each LCF expenditure category (eg spending on furniture) is mapped onto one or more RPI items (bed, sofa, bookcase and so on). Where an expenditure code is mapped to more than one item, and there is no further information with which to refine the weights, the expenditure is split evenly between the RPI items in calculating the weights. In many cases, the LCF information is supplemented by data from a variety of sources including other Government data, market research and other data. For example, a range of market research data is used to derive item weights for various RPI sections including alcohol, clothing and footwear, and a range of household and leisure goods.

6.5.3 Pensioner Indices Item Weights

Item weights for the pensioner indices (section 10.8) are based on the RPI item weights, adjusted to reflect the differences between spending patterns for this group and the RPI population.

6.5.4 Seasonal Item Weights

Prior to February 2008, fruit and vegetables (including potatoes) in the CPI and RPI had associated seasonal item weights, ie the item weights varied from month to month, depending on typical expenditure on that item for each month. However, the higher level section weights were fixed so that the principle of the fixed basket of goods is maintained.

However, from the February 2008 index, the seasonal weights were replaced by annual weights. The change reflects the fact that most types of fruit and vegetables are available in shops all year round.

6.6 Higher Level Weights

6.6.1 CPI COICOP Weights

Each class is given an integer weight in parts per thousand so that the sum of the class weights equals 1000. The COICOP weights are calculated from HFMCE data, with the following exceptions:

- the Living Costs and Food Survey (LCF) which is used in the calculation of weights for Air Travel, Package Holidays and Actual Rentals

- the International Passenger Survey which is used in the calculation of the weight for Air Travel
- the public sector component of the National Accounts which is used in the calculation of the weight for Passport Fees

The CPI COICOP class level weights are updated annually with a reference period of December of each year. They are based on the previous calendar year's HFMCE data. For instance, for 2012, the weights reference period is December 2011, with the underlying expenditure data referring to the 2010 calendar year. The expenditure data are price updated at the level of COICOP class to the reference period using movements in the relevant class price index. New CPI COICOP class level weights enter into the CPI with the January index published in February each year.

6.6.2 RPI Section Weights

Each section is given an integer weight in parts per thousand so that the sum of the section weights equals 1000. Most of these weights are based on the LCF. The main exceptions are for some housing sections including mortgage interest payments and depreciation, where weights are estimated from other sources, and for certain other sections (tobacco, confectionery, soft drinks and alcoholic drinks) where the LCF is thought to under-record expenditure and better data are available elsewhere.

The four most recent available quarters of LCF data are used, and are supplied in the form of annual average household expenditure per week. For 2012 the data covered the periods July 2010 to June 2011. The data are classified according to COICOP (the internationally agreed classification of individual consumption by purpose) and are mapped to RPI sections, aggregating or disaggregating the COICOP headings as appropriate. The expenditure values are then revalued to base month prices (ie current January) using the change in the appropriate RPI indices.

For example, for calculating the section weights for 2012, LCF annual average data for the period July 2010 to June 2011, which are centred around January 2011, were adjusted for the increase between the RPI in January 2011 and the RPI for January 2012. In the following example, the data are hypothetical.

Average expenditure on goods in section *y* per week, July 2010-June 2011 = £2.47

Price indices for section *y* at January 2012 = 101.8 (January 2011 = 100)

Then average expenditure on goods in section *y* per week after revaluation is:

$$£2.47 \times \frac{101.8}{100.0} = £2.51$$

The total expenditure for each section (expressed as a proportion of the total expenditure over all sections within RPI coverage) is then converted into a rounded 'parts per 1000' weight. Manual adjustment may be needed to make the rounded section weights sum exactly to 1000. Usually, those sections needing the smallest percentage change in expenditure to round a weight up or down to an integer are adjusted.

For some sections, an average of three years' LCF data is used rather than one. This is because the items within these sections are purchased infrequently, meaning that reported expenditure can fluctuate significantly from year to year, and sampling errors can be very large. By using LCF data from a longer time period, these large fluctuations are reduced.

The section weights for the pensioner indices (section 10.8) are also calculated using three years' data so as to reduce the sampling error. This is necessary because the number of relevant pensioner households included in the sample in a single year is relatively small.

6.6.3 Special Cases

Insurance

When calculating the weights in the CPI, the difference between expenditure on insurance premiums and the amount paid out in claims (ie the service charge) is allocated to the relevant insurance heading; the amount paid out in claims is allocated to other relevant headings according to the nature of the claims (for instance, expenditure on repairing a car is attributed to the heading for maintenance and repair of vehicles). This calculation is based on the average of the most recent three years data. Conversely in the RPI, the gross expenditure on insurance premiums is assigned to the relevant insurance heading.

This difference in approach means that the weight of insurance in the CPI is significantly lower than in the RPI, and so the impact of changes in the cost of insurance at the all-items index level is correspondingly smaller. Overall, the combined weight for car, health, house contents and foreign holiday insurance in the CPI is around one-quarter of that in the RPI. However, note that the insurance indices themselves are constructed with reference to gross premiums paid both in the CPI and RPI.

RPI Section Weights Special Cases

For some sections (tobacco, confectionery, soft drinks and alcoholic drinks), the LCF is known to under-record expenditure. For these sections, data from the Household Final Consumption Expenditure (HHFCE) are used to adjust LCF data. In common with UK National Accounts, the weights used for alcohol and tobacco products include estimates of household expenditure on smuggled alcohol and tobacco.

The section expenditure values for index households are obtained from the LCF, multiplied by an adjustment factor equal to the HHFCE data divided by the "all household expenditure" data from LCF, then revalued using RPI indices as before. This procedure is necessary because HHFCE reflects all persons, not just those in index households.

Example: Cigarettes

To produce the adjustment factor for the cigarette section for 2012 weights the following calculations were made.

First, the annual total of expenditure on cigarettes is calculated by summing four quarters of HHFCE data. For the calculation of 2012 weights, the data from the last two quarters of 2010 and the first two quarters of 2011 are summed (see below). This is so that the data relates to the same period as the LCF data used to calculate the weights for the 2012 RPI.

HHFCE expenditure data (£ million, current prices)

2010 Q3	2010 Q4	2011 Q1	2011 Q2	Annual total
3804	3919	3972	4203	15898

Then from the LCF "all household expenditure" data, the figure for the average weekly expenditure on cigarettes for the year to June 2011 is taken. This is then multiplied by the number of households and the number of weeks in a year to obtain the implied LCF all household total annual expenditure on cigarettes.

LCF all household (weekly average, £) Year to June 2011	Number of households (million) 2011	Implied LCF all household total annual expenditure (£ million)
3.996	26.258	5472

To obtain the correction coefficient used to calculate the section weight the ratio of HHFCE to LCF all household data is calculated.

HHFCE expenditure (£ million, current prices) Annual total	Implied LCF all household total annual expenditure (£ million)	HHFCE expenditure/ LCF all household data = Correction Coefficient
15898	5472	2.9

The LCF average weekly expenditure on cigarettes index households is therefore multiplied by 2.9.

6.7 Weights Calculation for Centrally Calculated Indices

For indices which are calculated centrally, weights are used to aggregate the strata (eg varieties, suppliers) used in the item index calculation wherever this information is known. Wherever possible, weights used are calculated in expenditure terms, but where this information is not available, weights based solely on market shares are used as the closest available proxy. For some centrally calculated indices (or for some strata within a central index), no weights information is available and the item index (or stratum index) is calculated using arithmetic or geometric means (section 2.4).

Chapter 7 Special Issues, Principles & Procedures

7.1 Subsidies and Discounts

There is a long-standing principle that the prices used in calculating the consumer price indices are those actually paid by households. This may appear simple, but in practice it is difficult to implement in a completely consistent way, and there are several special treatments. The 1986 RPI Advisory Committee laid down the guidelines, which departed slightly from previous practice. They recommended the following rules:

- the guiding principle is that the RPI reflects the cash prices commonly charged for goods and services
- where subsidies or discounts are available to *all* potential consumers (non-discriminatory) the price taken into the RPI should reflect these
- where subsidies or discounts are available only to a restricted group of households (discriminatory), the price should be measured 'gross'. An exception is made when the concession is financed by the supplier (ie not funded by a third party such as the Government) as a form of multiple pricing, typically for commercial reasons: eg discounts available for paying electricity and gas bills by direct debit (section 4.3.2)

A European Commission Regulation (no 2602/2000) on the treatment of price reductions in the Harmonised Index of Consumer Prices (now known as the CPI) complements the earlier Advisory Committee guidelines.

The guidelines are implemented in the following ways in the production of the consumer price indices.

Discounted and subsidised prices are only recorded if available to anyone with no conditions, otherwise the non-discounted or unsubsidised price is recorded. In particular, money off coupons and loyalty cards are ignored. Reduced prices for payment by direct debit are taken into account in the calculation of some centrally calculated indices such as electricity charges, in accordance with the third rule above. If there is a discount for multiple purchases, only the price of a single purchase is recorded. Where a price reduction on one product is associated with the purchase of another product, this reduction is ignored. However, a reduction associated with a particular level of total spending on purchases is included where cost of the single item being priced lies above that level (eg the discount "10% off for purchases over £500" would be deducted for a bed priced at more than £500).

Sale prices are recorded if they are temporary reductions on goods likely to be available again at normal prices or end of season reductions. Prices for special purchases of end of range, damaged, shop soiled or defective goods are not recorded as they are deemed not to be of the same quality as, or comparable with, goods previously priced or those likely to be available in future.

Free gifts/extras such as plastic toys in cereal boxes, "send in 20 tokens for a free pen" and trading stamps are ignored; they are regarded as extras which may not be wanted by consumers. Prices for items *temporarily* bearing extra quantities (eg 20% extra free) are not adjusted to account for the increased quantity.

Rebates: The treatment of these is not clear-cut. It is made on a case by case basis, with references to the above guiding principles and to historical precedents. For instance, they are sometimes treated as

subventions to income and hence not allowed as a price change, as in the case of rent rebates; in other cases, they are treated as price changes.

Two examples come from electricity charges. Regional electricity companies made a one-off reduction of about £50 on their charges on the first bill of 1996 to all domestic customers in England and Wales, as a result of the flotation of the National Grid in December 1995. Its main economic impact was considered to be to raise household incomes (ie electricity consumption was not expected to increase markedly) and so it was not treated as a price reduction. This was consistent with the UK National Accounts treatment of the rebate according to international guidelines of National Accounts compilation (the European System of Accounts), where a price change is expected to “have a significant influence on the amounts producers are willing to supply and on the amounts purchasers wish to buy”. However, more recently, there was a further reduction on electricity bills as a result of the abolition of the fossil fuel levy. In this case, it was decided, because of the payment method of the rebate (reducing bills rather than sent as a separate cheque) and in accordance with historical precedents, that this would be treated as a price change.

7.2 Product Substitution, Quality Adjustments and Imputation

One of the more difficult issues in producing the consumer price indices is the accurate measurement and treatment of quality change due to changing product specifications. As a measure of price change alone, the CPI and RPI should reflect the cost of buying a fixed basket of goods and services of constant quality. However, products often disappear or are replaced with new versions of a different quality or specification, and brand new products also become available. When such a situation arises, one of the following methods is adopted:

- a. direct comparison
- b. direct quality adjustment
- c. imputation

In all cases, a nominal price in the base month is needed for the new or replacement product; this nominal base price is used until the following January. If the retailer can supply the previous January price of the new product, this can be used as the new base price with no further adjustment.

a. Direct comparison

If there is another product which is directly comparable (that is, it is so similar to the old one that it can be assumed to have the same base price), for example a garment identical except that it is a different colour, then the new one directly replaces the old one and its base price remains the same. This is described as “obtaining a replacement which may be treated as essentially identical”, and is equivalent to saying that any difference in price level between the new and the old product is entirely due to price change and not quality differences.

b. Direct quality adjustment

This is the preferred method of dealing with the situation where a replacement product is of a different quality or specification. An attempt is made to place a value on the quality, or specification, difference and the base price is adjusted accordingly. This section discusses quantity adjustment and hedonic regression. Another method of direct quality adjustment, option costing, can be used when a product changes in specification and it is possible to value separately the components that have changed.

Quantity adjustment

The simplest form of direct adjustment is quantity adjustment, which is used when there is a permanent size change in an item. This occurs most frequently with homogenous goods such as food and drink, and has been used recently when the size of some confectionery bars was changed. In this case, in each outlet the nearest equivalent new size of the product priced in that outlet was

found, and an adjustment made to the base price pro rata for the change in weight. Similar adjustments were made in the RPI in October 1995 when many items were changed from imperial to metric quantities. In this case, in each outlet the nearest equivalent new size of the product priced in that outlet was found, and an adjustment was made for the change in weight.

More complex calculations are required when a component part of a more complex product changes in specification. In practice adjustments of this sort can only be made where it is possible to value the change separately. The following section describes how this is done using the hedonic regression technique.

Hedonic regression

Hedonic regression is a technique that uses a set of ordinary least squares regressions to relate the price of an item to its measurable characteristics. It is used for quality adjustment of personal computers (PCs), laptop computers, digital cameras, pre-pay mobile phone handsets and pre-pay smartphone handsets. For computers, the measurable characteristics may include the speed of the processor, the size of the hard disk drive and the amount of memory. For digital cameras, the characteristics may include the resolution. The results of the regressions are used to value changes in quality when a product that is part of the sample is no longer available and is replaced by another product. An example of how this is done for PCs is given below. A similar approach is used for the other items.

For PCs, hedonic regressions are calculated on the basis of a single month's data, using unweighted regressions based on price data collected from retailers' web sites. The log of price is chosen as the dependent variable in the regression for two reasons. Firstly, a log-linear model produces a multiplicative relationship between price of a PC and its attributes, which is a better reflection of pricing in the retail market. This is because the cost of adding a new feature tends to be related to the underlying quality and price of a machine. For example, the addition of a DVDRW drive to an expensive PC typically costs more than for a cheaper PC, because a higher quality drive will be included in the more expensive PC. Secondly, multiplicative relationships are more robust to general changes in price, and so have a longer life span.

An iterative approach is used to derive the hedonic regressions. This procedure includes an element of statistical judgement and product/market knowledge, and is preferred over the more traditional automatic stepwise regression technique because it is better able to cope with the potential relationships between independent variables in the regressions. For instance, the attributes 'TV tuner' and 'remote control' are often inter-correlated because PCs that have a TV tuner often include a remote control as well. These relationships can cause the automatic methods of regression estimation to produce either sub-optimal regressions, or in some circumstances ones in which the relationships revealed are counter-intuitive.

The regressions are then used to predict prices when an existing PC in the sample is no longer available and has had to be replaced by a PC with a different level of quality. Price adjustments are made based on these predicted prices.

The following is an illustrative example of how hedonic based quality adjustment can be applied in a situation where an individual PC was priced in January, but could not be found in February. The replacement is close in quality, but has a single change in specification – an increase in processor speed.

Step 1: Produce regression function**Step 2: Predict old and new price**

Attribute	Coefficient	January PC		February PC	
		Level	Effect On Price	Level	Effect On Price
Brand		PC Company		PC Company	
Intercept	5.02277	1	£151.83	1	£151.83
Monitor	0.03886	19	× 2.09	19	× 2.09
Processor Speed	0.00014	1600	× 1.25	2800	× 1.48
Hard Drive	0.00004	640	× 1.03	640	× 1.03
Memory (MB)	0.00003	3072	× 1.10	3072	× 1.10
Video Card	0.06673	1	× 1.07	1	× 1.07
Predicted Price			£480.87		£569.35
Actual Price			£475.00		£550.00
(only change is processor speed)					

The effect on price for each individual attribute is calculated by multiplying the level of the attribute by its coefficient, and then taking the exponential of the resulting value. For instance:

$$\begin{aligned}
 \text{the effect on price for monitor} &= \text{exponential}(19 \times 0.03886) \\
 &= \text{exponential}(0.73834) \\
 &= 2.09
 \end{aligned}$$

These effects on price are then multiplied together to give the overall predicted price:

$$\text{Predicted price} = \text{Intercept} \times \text{effect of monitor} \times \text{effect of processor speed} \times \text{effect of hard drive} \times \text{effect of memory} \times \text{effect of video card}$$

For instance:

$$\text{Predicted price for January PC} = 151.83 \times 2.09 \times 1.25 \times 1.03 \times 1.10 \times 1.07 = £480.87$$

Step 3: Adjust base price to reflect new attributes

$$\begin{aligned}
 \text{Change in January due to changes in quality} &= \frac{\text{Predicted price new PC}}{\text{Predicted price old PC}} \\
 &= £569.35 / £480.87 \\
 &= 1.184
 \end{aligned}$$

$$\begin{aligned}
 \text{New base price} &= \text{Base price old PC} \times \text{quality change} \\
 &= £475 \times 1.184 \\
 &= £562.40
 \end{aligned}$$

Step 4: Compare current price with new base price

$$\begin{aligned}
 \text{PC Index} &= (£550 / £562.40) \times 100 \\
 &= 97.8 \\
 \text{Unadjusted index} &= (£550 / £475) \times 100 \\
 &= 115.8
 \end{aligned}$$

The calculation shows that, once the difference in quality between the original PC and its replacement has been taken into account, the price has effectively fallen by 2.2 per cent. This compares with an increase of 15.8 per cent in the unadjusted price.

MoT Tests

A Government regulation introduced in the early 1990s extended the range of tests carried out on motor vehicles as part of the MoT test, which was a representative item in the RPI basket and is now in both CPI and RPI. There was a debate as to whether or not this constituted a quality change (an improvement) on the grounds that the customer was in effect getting more for the same cash amount. It was decided to make no adjustment, on the basis that the increase in tests carried out was not requested by the customer, who has to have the MoT test to comply with UK law. In other words, customers were not expected to alter their economic behaviour due to the change in the quantity or quality of tests being carried out on their vehicles.

c. Imputation

If the replacement product is of a different quality or specification, and no information is available to quantify the difference, assumptions must be made. A base price is calculated for the new product by assuming that its price change from the base month up until that month equals the average change in the elementary aggregate for that item. Thus if the price is £14.99 and the elementary aggregate index for that item (calculated excluding the product in question) in that stratum is 108.34, the new base price is:

$$£14.99 / 108.34 \times 100 = £13.836$$

This procedure ensures that bringing in the new product has no effect on the elementary aggregate for that item in the month that it is introduced.

If an outlet closes, or refuses to allow further price collection, all items priced there are dropped. In that case, a new outlet is selected in the same location and new base prices are imputed for items priced in the outlet as shown above.

7.3 Services Previously Provided Free

From time to time, services which have hitherto been provided free at the point of provision have become chargeable. Examples are the introduction of university fees in 1998, and the London congestion charge in 2003. The problem for the consumer price indices in these cases is twofold:

- there is no weight in the base period (expenditure is zero)
- there is no base period price with which to compare the new price to create a price relative

The solution is to go back to the standard formulation of the Laspeyres index in terms of quantities and price levels, rather than expenditure weights and price relatives. We treat the new product as if it were already included in an existing section (or item) index with zero price but with non-zero quantity equal to its consumption in the base period. The index is then adjusted from the point of introduction of the new price to take on the new expenditure. The adjustment is as follows:

$$I_a = \frac{I_u \times EXP_u + 100 \times Q_o \times P_t}{EXP_u}$$

where:

- I_a = adjusted index
- I_u = unadjusted index
- EXP_u = average weekly household expenditure in the base period for the index
- Q_o = quantity of the newly-priced service used in the base period
- P_t = price of the newly priced service

In practice, it is not necessary to know Q_o and P_t explicitly if their product, the expenditure on base year quantity at period t , is known or can be estimated.

After the year of introduction, the product may merit a separate index.

7.3.1 University Fees

From 1998/9, new students on full-time higher education courses contributed up to £1,000 a year towards the cost of their tuition, the actual amount depending on their own and, if appropriate, their parents' or spouse's income. The introduction of student fees raised a number of conceptual issues relating to the coverage of the indices and the service paid for.

Index coverage

At the time, the CPI was intended to reflect the average spending pattern of private households. (In 2000 this was extended to include spending by residents of institutional households.) RPI coverage was (and is) a subset of this since it excluded the top 4 per cent of households by income. The definition of household in the case of students might be considered to vary according to whether they are:

- dependent or independent (depending on age and whether married)
- living at home or away from home
- if away from home, living in communal or independent accommodation

However, in practice, most households would regard dependent students as part of their household even if attending an institution away from home. It was therefore decided to treat all students in higher education as within scope except, in the case of the RPI, for those who were dependent on parents who fell within the top 4% of households by income.

Scale of fees

In the case of goods or services provided or partly paid for by the government, it is clear that the amount paid is the charge made at the point of consumption not the full economic cost of the service. (A similar approach is used for medicines bought on prescription, where the fixed charge is taken rather than the cost of the medicine itself.) In this situation, students are liable for an amount between zero and a maximum set by the government depending on their own or family income. This implies therefore that the price recorded, and the index weight, should be that actually paid by the consumers, for which average estimates are made by the Department for Business, Innovation and Skills.

Timing

The assumption is made that all fees are billed at the beginning of the academic year, before the October index day.

Method of incorporation

Initially, the index was combined with private education fees, in order to compute an adjusted index as described in section 7.3.

The price of student fees was zero in the base period (January 1998) and an average of £550 in October 1998. This figure was combined with the estimated average payment of school fees, using the formula at section 7.3. From 2000, higher education fees and private education fees were represented by separate item indices.

7.3.2 Congestion Charging in London

Congestion charging in London was introduced in February 2003, and first included in the March index. Transport for London (TfL) estimated that £110m would be generated over a year from the standard charge of £5 levied on cars while the annual revenues generated from the residents' 90% discount were estimated at £6m. TfL based these estimates on a 10-15% estimated reduction in traffic. As the CPI and RPI is a base-weighted, fixed basket index that does not take into account substitution away from a service as a result of a price increase, the estimated £110m from the standard charge was increased by the estimated reduction in traffic of 12.5% to £123.75m.

This figure was then reduced by 38% to remove revenue from both non-index households and from index households paid for by their employers, giving an annual expenditure of approximately £79.95m or 7p per index household per week. Base period expenditure on road tolls (the existing RPI item with which London congestion charging was combined) was estimated, using information from the LCF, to be 28.7p per household per week.

Thus, using the formula given in section 7.3 the adjusted index is calculated as:

$$I_a = \frac{I_u \times 28.7 + 100 \times 7}{28.7}$$

giving an increase in the sub-index for road tolls due to congestion charging of about 24%.

7.4 Exceptions to Generic Methods

Most components of the consumer price indices are collected locally or centrally in the manner described in Chapter 4, constructed as shown in Chapter 2 and combined together using weights data as described in Chapter 6. However, there are some component indices which are not covered by these generic descriptions for one reason or another, and these are described below.

7.4.1 Treatment of Seasonal Items

A small number of areas covered by the consumer price indices have marked seasonal purchasing/consumption patterns: some items of clothing, gardening products, holidays and air fares. Historically some fresh fruit and vegetables have also been seasonal though this has become less evident with products being imported from around the world into supermarkets. The treatment of seasonal clothing, gardening and food is described below. Air fares and holidays are described in sections 7.4.4 and 7.4.7.

Clothing and gardening: For seasonal clothing and gardening products, some items are unavailable for part of the year and there is seasonal variation in the supplies of other items. Examples of these include swimwear and raincoats, barbecues and seeds, all of which are largely available only in certain months of the year. Since January 2011, prices are imputed for those products which are 'out of season'. If a product is 'out of season':

- a. the price is imputed forward each month using the average price movement of the 'in-season' products

- b. the 'in-season' products used to inform the imputation are in the same classification group as the 'out of season' product
- c. 'in-season' in this context refers to products that are available to price when the 'out of season' product is unavailable

Before 2011, the last collected price was carried forward for months when a seasonal item was not available. The new method is internationally recognised as an improvement with the main drawbacks of the old approach being:

- a. in a fast moving inflationary environment the index was subject to sudden shocks as the previously unavailable products became available again
- b. as the 'carry forward' method meant 'no change', this approach could underestimate inflation when inflation was increasing and could overestimate inflation when there was negative inflation

As well as implementing a statistically superior approach, the UK also remained compliant with European legislation for the CPI.

Food: Before 2008, the item weights for fresh fruit and vegetables including potatoes varied throughout the year in line with differing spending patterns. This reflected the retail availability of certain fresh food items limited by seasonal factors. For example, it was not generally possible for the UK consumer to buy strawberries in winter. In recent years, however, the variation in the seasonal availability of fresh fruit and vegetables has become negligible. From the publication of the February 2008 CPI and RPI, seasonal weights were replaced with annual weights to reflect the change in availability and associated spending patterns on fresh fruit and vegetables. The change brought the approach for fresh fruit and vegetables into line with the approach used for other food products. In 2011 there is, however, one seasonal food series, peaches and nectarines, which is treated in the same way as seasonal clothing. Details of the earlier seasonal weights approach are given in the 2007 edition of the Consumer Price Indices Technical Manual.

7.4.2 Electricity and Gas Tariffs

For each of the major electricity and gas suppliers, ONS collects fixed costs (standing charges) and prices per unit of the most popular domestic tariff bands at both day and night rates. Average bills are calculated for each tariff using average consumption figures and the tariffs for each supplier are weighted together using expenditure figures derived from average bills and customer numbers. The individual suppliers are then weighted together, again using expenditure figures derived from average bills and customer numbers, to give a final index.

Before 2008, gas and electricity price changes were phased in over a four month period to reflect the fact that the tariff rate did not change for a customer until the day the meter was read (or the bill was estimated). It was clear that by 2008, tariff increases were implemented at the time the change was made, regardless of when the meter was read. As a result, the phasing in of price changes ceased from the February 2008 index. Any residual phasing effects from tariff changes which had not fed through completely were introduced in full in the February index. Details of the phasing methodology are given in the 2007 edition of the Consumer Price Indices Technical Manual.

7.4.3 Purchase of Motor Vehicles

Used cars

ONS produces two price indicators for used cars: one for two-year old and one for three-year old cars. The two indicators are combined (giving equal weight to each) to give a single price index for used cars.

The two component sub-indices are constructed identically, using the same sample of cars within any given year. A sample of 35 models of two-year and three-year old cars is priced using retail prices information from a monthly trade guide. These prices are weighted together according to the

corresponding manufacturers' approximate market shares of new car sales two and three years before the current year, using data provided by the Driving and Vehicle Licensing Agency (DVLA).

To compile the index for two-year old cars, the base price for each model in the current year's sample is taken as the price recorded in the January edition of the trade guide for a car registered two years earlier. For example, the cars adopted for pricing in January 2003 had 2001 'X' registrations. Prices of the same models were then tracked through the year using successive monthly issues of the guide.

Quality adjustment

An adjustment is made to the guide prices for February and later months so that the resulting index prices a 'constant quality' sample of models throughout the year. The guide specifies cars which have been notionally registered in the March and September of each year. The average car of three years old or less is assumed to have covered 1,000 miles a month since its first registration. The January price is taken straight from the guide, but all subsequent months' prices are interpolated in order to ensure that a car with the same age and mileage is priced each month.

The base (January) price for each model in the sample of notional two-year old cars is taken directly from the January issue of the guide based on the registration plate first issued two years earlier. Using the 2003 example, in January a 2001 X plate was adopted. The required month's price after January for a two-year old car was interpolated between those quoted for a 2001 'X' and 2002 '51' of the same model. In February, the price was 11/12 of the 2001 'X' plus 1/12 of the 2002 '51'. In March, the respective weights were 10/12 and 2/12 and so on (see table below). By January 2004 the 'two-year old' car which was first priced with a 2001 'X' registration plate will have turned into a 'two-year old' car with a 2002 '51' plate. Similarly, a 'three-year old' had changed from a 2000 'W' to a 2001 'X' registration. The 2001 'X' car which entered the sample of two-year old cars in January 2003 transferred to the 'three-year old' sample for pricing during 2004.

The following example shows how the interpolation for a two-year old car was carried out in 2003. The standard mileages assumed by the trade guide (in thousands) are indicated by the suffixes.

January 2003		2001 X ₂₂			
February	11/12	2001 X ₂₃	+	1/12	2002 51 ₁₁
March	10/12	2001 X ₂₄	+	2/12	2002 51 ₁₂
April	9/12	2001 X ₂₅	+	3/12	2002 51 ₁₃
May	8/12	2001 X ₂₆	+	4/12	2002 51 ₁₄
June	7/12	2001 X ₂₇	+	5/12	2002 51 ₁₅
July	6/12	2001 X ₂₈	+	6/12	2002 51 ₁₆
August	5/12	2001 X ₂₉	+	7/12	2002 51 ₁₇
September	4/12	2001 X ₃₀	+	8/12	2002 51 ₁₈
October	3/12	2001 X ₃₁	+	9/12	2002 51 ₁₉
November	2/12	2001 X ₃₂	+	10/12	2002 51 ₂₀
December	1/12	2001 X ₃₃	+	11/12	2002 51 ₂₁
January 2004					2002 51 ₂₂

A similar methodology is used to calculate prices for other motor vehicles such as mopeds and motorcycles.

New car prices

The CPI also includes an index representing new car prices. The index is based on collecting new car prices, net of discounts, from dealer websites for a sample of around 35 cars covering a range of manufacturers. The use of dealer websites to collect new car prices has been effective from early 2012 and was implemented to provide a more realistic measure of true transactional prices. The revised treatment of new car prices also means that the new car prices are treated equally in both the CPI and RPI.

Prior to 2012, the new car price index in the CPI was based on the 'list' prices of new cars. A trade guide was used to obtain the list price and the specification of the model. In the RPI, the price index for new cars was based entirely on the prices for used cars. There were three main reasons why new car prices were not used historically as a price indicator in the RPI prior to 2012. Firstly, there was the difficulty in constructing a satisfactory indicator that monitored vehicles of a constant quality over time. Secondly, it was difficult to ascertain what prices were actually paid as many new car purchasers obtained discounts from the list price. Thirdly, new car purchases were historically much less important to households (especially index households) than purchases of used cars.

Up until 2008, quality adjustment of new cars was done using an option costing technique whereby the additional characteristics of the new car, such as air conditioning, were priced separately as optional extras and then a percentage of this value (usually 50 per cent) was used to value the changes in specification of the car. The base price was then adjusted accordingly to reflect the estimated quality change. This technique was also used for quality adjusting the CPI personal computers index until it was replaced by hedonic regression methods in January 2003. Details of how option costing was applied in practice are given in the previous edition of the CPI Technical Manual (2010 edition).

7.4.4 Air Fares

Air fares have been included in the Consumer Prices Index since 1996, although the methodology described below was not introduced until 2001. In the RPI, air fares are part of the *Other Travel* section. Originally, their price movements were implicitly represented by movements in the overall index for *Other Travel* but since 2003, an explicit index has been included in the section to represent them.

The key features of the air fares index are as follows:

- a. changes in the price of air fares are recorded in the index in the month in which the flight departs, not when the ticket is bought
- b. prices are compared against January base prices, like most other RPI and CPI indices
- c. separate sub-indices are compiled for domestic, short haul (European) and long-haul flights
- d. prices are collected for return flights at various periodicities in advance of departure, reflecting usual consumer behaviour

The sample of destinations is selected in line with their relative importance based on expenditure data derived from the International Passenger Survey (IPS) and the Civil Aviation Authority (CAA).

Prices are collected over the internet from web pages of airlines and the prices recorded are the on-line prices for travelling with one item of checked in baggage. The airlines chosen are those with a departure flight closest to a pre-specified time on a particular day on randomly selected routes. The return flight is a pre-specified number of days later. Some flexibility is allowed to vary these details, if the prices collected are unreasonably high (eg because the flight is booked out), by choosing an alternative flight, operated by a carrier of similar quality, or departing at a slightly different time of day, or on the day preceding or following. Only scheduled flights are priced, because they account for by far the greater proportion of independent travel. The majority of travel on chartered flights is undertaken as part of a package holiday, which is included in the foreign holidays index.

Prices for long haul flights are collected 6 months, 3 months and 1 month in advance of departure dates; short haul prices are collected 3 months and 1 month in advance; and domestic prices are collected 1 month in advance. Separate indices are calculated for each advance booking period for each of the three sub-indices, with individual routes weighted according to expenditure share. The short haul 3 and 1 month indices are given equal weights in deriving the overall short haul index while the 6, 3 and 1 month long haul indices are weighted together in the proportions 45: 45: 10. The overall index is obtained by weighting the domestic, short haul and long haul indices in line with IPS expenditure and CAA Passenger Traffic data.

7.4.5 Telephone Charges

BT

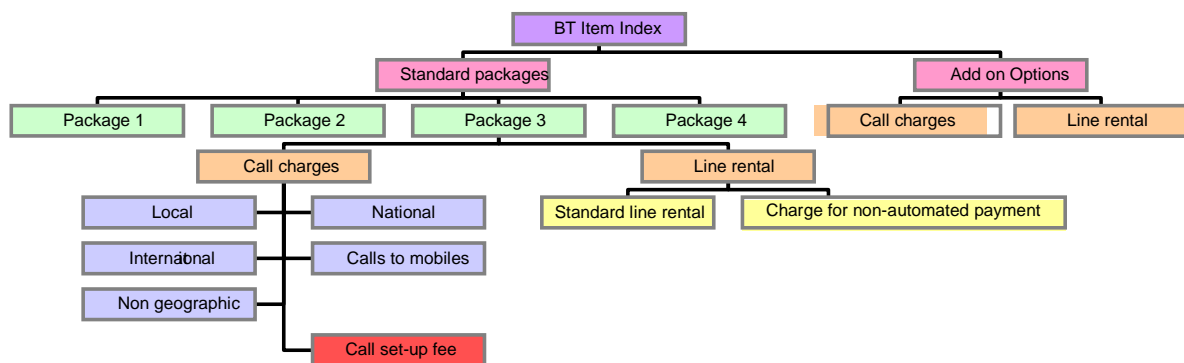
BT telephone charges represent the majority of the fixed line telephony market by expenditure and remain a significant component of the CPI and RPI.

Prior to 2006, the index was constructed as the ratio of annual revenue (projected from a given month's charges) to the revenue calculated using base month (January) charges. The annual revenue figure in subsequent months was based on the pattern of consumption used for the January revenue figure, adjusted for any expected changes to revenue resulting from price changes in the intervening months using projections supplied by BT. These revenue projections took account of users switching between various discount packages offered by BT, but not of any overall changes in the volume of services consumed. Information was provided for each of the following services: line rentals; low user registration; specific services such as Friends and Family; instrument rental charges; calls; charge cards; connection and takeover charges; calls from public call phones; and operator calls.

To bring the methodology into line with the other components of the index, whereby actual price changes are used rather than projected price changes, a new approach was adopted from 2006. Figure 7.4.2 below illustrates the detailed pricing information including VAT which is collected for both call charges and line rental for each of the main packages offered by BT.

Within each of these packages, headline pence per minute call charges are collected according to destination (ie local, national, international, calls to mobiles and non-geographical calls), and within each destination, time of day (ie daytime, evening and weekend). Call charges to 0870 and 0845 are used to represent call charges to all non-geographic numbers. Line rental is collected for all packages and takes into account the method of payment ie automated (such as direct debit) or not.

Figure 7.1 Stratification of the BT index



Detailed annual consumption information is provided directly from BT each year in order to weight together the individual components mentioned above.

In the majority of cases, customers pay for BT calls on a basis of a headline pence per minute charge, although calls are actually charged by the second. However, each call is subject to a call set-up fee of a defined number of pence.

In order to capture this aspect of the pricing structure and give it an appropriate weighting, BT provide ONS with the total annual number of minutes charged to customers and the average cost per minute which represents an effective charge. The total number of minutes multiplied by the effective charge gives the total actual revenue, which provides the individual weightings for each of the stratified components mentioned above. The revenue generated from the call set-up fee is calculated by multiplying the number of calls by the set-up fee.

Cable Telephones

Prices are obtained from major suppliers by type of call (local, national, international or to a mobile telephone), by time of day, and for connection fees and line rental. For each type of call, prices are weighted together by supplier and by destination (for international calls) or time of day (for other call types) to give indices for each call type. These are then weighted together to give an overall index for cable telephony. The weights are derived from information obtained from the Office of Communications (OFCOM).

Mobile phone charges

Mobile phone charges were introduced into the Consumer Price Indices in 1998 and now account for a significant proportion of household spending on telephone services. However, the large number of service providers, complex pricing structures and substantial variation in customer usage pose significant difficulties in accurately measuring the average change in prices actually paid by customers.

Prior to 2004, a sample of packages for each of the main service providers and each mode of provision - pay-as-you-go (PAYG) and monthly contract - was selected randomly. Monthly bills for each package in the base and subsequent months were then estimated with reference to a fixed usage pattern, determined by an appropriate customer profile chosen from a set supplied by OFCOM. Customer profiles were categorised according to overall use ("low", "medium" and "high"), time of call (peak, off peak and weekend) and destination of calls (local, national, own or other network). Line rentals (for contract customers) and text messages were also priced in calculating monthly bills.

The basket of representative packages was held fixed throughout the year in compiling the overall item index. In effect, the product being priced was the individual packages available and in this sense mobile phone call charges were treated in much the same way as locally priced goods, with specific product varieties selected in each outlet. However, experience in compiling the index suggested that sampling of specific packages may not always have provided the best guide to the average change in call charges actually paid by consumers, in part reflecting the rapid in-year turnover of packages provided by the major suppliers.

From 2004 an improved methodology has been introduced whereby the cheapest package available for all of the detailed customer profiles supplied by OFCOM is priced for each of the main service providers in compiling the index. This methodology embodies the principle therefore of a fixed basket of mobile phone usage, as opposed to a fixed basket of representative packages. Profiles are categorised according to voice and text usage and, from 2011, data and smartphone/non-smartphone usage. Company indices are further subdivided between PAYG and contract customers, with some variation in specific methodology employed in each case as described below. The final index is a weighted average of the company indices, with weights based on expenditure shares supplied by OFCOM.

Pay-as-you-go (PAYG)

PAYG users have no formal contract with a particular service provider and so are free to switch between the various packages available following price changes. Each month, the cheapest package available from each of the main service providers is selected for each customer profile and weighted over the profiles to produce a PAYG index for each supplier. The methodology only allows for in-year migration between packages *within* service providers. Substitution *across* providers typically involves the additional cost of replacement handsets and price changes in this case could also partly reflect changes in the quality of the service provided (eg due to differences in network coverage).

Monthly Contract

Monthly contract customers by contrast are usually "locked" into a package for 12 months or more, with an average of 21 months. For profiles in this group, the cheapest package available is selected in January and tracked in subsequent months in compiling indices for each of the main providers. However, in each subsequent month it is assumed that every twenty-first customer will switch to a

cheaper alternative contract package (if one exists) from the same service provider, reflecting the ongoing turnover in existing contracts.

Directory Enquiries

Prior to 2003, directory enquiries were included with other telephone charges. With the deregulation of the market a separate item was created for directory enquiries which covers the main providers. Weights are provided by OFCOM.

7.4.6 Internet Subscriptions

The only price indicators used are the ongoing monthly charges. Any initial joining fees to register with Internet Service Providers (ISPs), and any free introductory offers (eg first month free), are ignored. From 2003 the sample included then standard dial-up tariffs and a selection of broadband tariffs, but from 2011 dial-up tariffs were removed due to reduced spending in comparison to the spend on broadband connections. The tariffs are weighted together using market share information to calculate the item index.

7.4.7 Measurement of Holiday Prices

7.4.7.1 Foreign Holidays

These are included in both the CPI and RPI. They were introduced into the RPI in January 1993, based on recommendations from the RPI Advisory Committee. The basic principles in the construction of this index are as follows:

- a. **Holidays taken in different months are fundamentally different items**, each with its own weight and price indicator: ie a January holiday is a different item from an August holiday.
- b. **Each month's index covers holidays for all 12 months of the year** - the weight for holidays, like all RPI weights, covers expenditure over a 12-month period. This procedure means that price levels in any month are compared with those in the preceding January for the same holidays. The weight for an individual month's holidays (eg August holidays) in the overall index reflects the relative expenditure for that month in a 12-month base period.
- c. **The price for a particular month's holiday changes only in the month in which the holiday is taken.** The index changes as and when people take holidays and to the extent that prices of holidays bought this year have changed from comparable holidays bought a year ago. In months when many people experience a price change, the index shows a larger overall change than in those months when few are affected. For example, the change in the index between July and August depends upon the extent to which August prices this year are higher or lower than the comparable prices last August, and also reflects August being a peak holiday month. In the 11 months when the holiday is not taken, the price used in the calculation of the index is the last one to have been observed.
- d. **The price of a holiday is used when the holiday is actually taken**, not when it is booked or when the final balance is paid. For example, the price for a holiday to be taken in August 2011 first enters the index in August 2011 rather than in some earlier month when it was booked and any deposit was paid or when the final balance was paid.
- e. **The price used is that paid by the customer**, including any discounts.

Price collection

Prices are mostly taken from tour operators' brochures for a sample of package holidays, both winter and summer, though operators' websites are used to supplement the sample of city breaks. As tour operators usually issue revised brochures during the course of the booking season to incorporate any modifications to prices, the latest brochures are used to measure holiday prices for the index. The prices used are the cost of a one or two week holiday for an adult sharing a double room and a

child sharing a room with adults. These are compared against comparable holidays taken 12 months previously, and a price relative calculated for each one. These are then combined, using information from the International Passenger Survey (IPS) on the composition of groups taking holidays, to give indices by country and month for each tour operator. The resulting indices are weighted together, using information on market shares of the tour operators involved, to give an index for each country in each month. These, in turn, are weighted together using data from the IPS on inclusive tours to individual countries abroad, to give the final index for the month in question.

Three day City Breaks, Cruise and Coach Holiday prices were included for the first time in 2001. From 2004, three separate indices have been calculated for apartments and villas, hotels, and cruises where previously a single combined index was produced for brochure prices. Similarly, from 2005, separate indices have been calculated for city breaks and coach holidays. Holidays are priced for departure on the 1st of every month. If the brochure does not have this option, then the 31st (or earlier) of the previous month is taken as long as the holiday will run over to the 1st.

Travel insurance

Travel insurance is an integral part of foreign holidays. A separate index has been calculated to cover price changes in travel insurance since 2000; previously it was included within the foreign holiday index, with the premiums in the brochures included as part of the cost of the overall holiday. The premiums in the travel insurance index from 2000 include those offered by travel companies, banks, insurance companies and supermarkets. Premiums are collected for a range of holiday destinations, durations and types.

Late availability holidays

Price changes for foreign holidays booked close to their dates of departure have been calculated as a separate index since 2001; previously they were included within the foreign holiday index. The prices for late-booked holidays are obtained directly from tour operators, as they are not shown in the brochures. Principles **a.** to **e.** described above for foreign holidays also apply to late-booked holidays. Prices used are the cost of a one week holiday for an adult sharing a double room. Prices for children are not collected. The prices are then weighted together using information on the market shares of the tour operators and data from the IPS on holiday destinations, to give the final index. In successive years, holidays are matched as closely as possible for destination, standard of accommodation and dates of departure within the month.

7.4.7.2 UK Holidays

Principles **a.** to **e.** for foreign holidays also apply to UK holidays. To avoid double counting costs already covered in the 'Motoring', 'Fares and Other Travel' and 'Catering' sections, the index covers only independently booked accommodation and packages. Expenditure on packages may, however, include meals and leisure services to the extent that these components are included in the package. Five relatively homogenous types of holiday are sampled:

- a. weekend and short breaks (up to three nights)
- b. hotel and bed and breakfast accommodation
- c. package holidays such as holiday camps and centres
- d. coach holidays
- e. self-catering holidays and accommodation

A sample of holidays is distributed between these holiday types and between the regions of the United Kingdom in line with their relative importance, as measured by the expenditure in each region or group. Two separate indices have been calculated for UK holidays since 2000, one of which covers categories a to d and one which covers category e. Previously a combined index was produced, with the holiday types weighted together by their relative importance.

Prices come from operators' brochures, websites or from enquiries to hotels, guesthouses, caravan and camping grounds. They are generally taken for seven night stays for sharing a double or family room but there are exceptions: short break holidays, where the length of visit is shorter; some types of self-catered accommodation, such as holiday cottages or camping sites, where there is a flat rate irrespective of the number of guests; and coach holidays, where a range of tour types is priced. These prices are weighted together, using data from the United Kingdom Tourism Survey on holiday types, location and by the month in which they are taken, to provide a final index.

7.4.8 Horse Racing Admission

From 2003, the cost of admission to a selection of race-courses and special events, eg Royal Ascot, has been included in both the CPI and RPI. Like holidays, different month's race meetings are seen as different items, with the programme of events changing from month to month, and attendance patterns varying markedly over the year. The basic principles outlined in section 7.4.7 for constructing an index for holidays therefore apply in a similar way to horse racing admissions.

Information on admission prices is collected for regular meetings at main racecourses as well as for special events (Royal Ascot, the Grand National etc). An average price for entry to the courses in the sample is calculated for each month, and compared to the average price for the corresponding month in the previous year, eg August 2011 against August 2010. Each month's index covers admission for all 12 months of the year as the weight for each item covers expenditure over a 12-month period. The weight for admission in a particular month in the overall index reflects the relative expenditure for that month in a 12-month base period.

7.4.9 Treatment of Housing Costs

The treatment of owner-occupied housing is one of the most difficult issues faced by compilers of consumer price indices. A number of alternative conceptual treatments exists, and the choice between them can have a significant impact on the overall index, affecting both weights and, at least, short-term measures of price change. The absence of any firm consensus concerning the appropriate treatment of such costs, both in the UK and international contexts, partly reflects the fact that national consumer price indices like the CPI are often constructed to serve several distinct purposes, from monitoring the economy to adjustment of incomes or state benefits. National housing market structures and of course practical measurement issues are likewise important considerations.

A RPI Advisory Committee considered the various options for the treatment of owner-occupier costs in the RPI in 1992-94 (Cmd 2717). The Committee concluded that mortgage interest payments, first introduced into the RPI in 1975 replacing an equivalent rents approach, should continue to represent the current cost to home-owning index households of occupying the dwelling and so acquiring housing shelter services (alongside a rents component for tenants). Repayments of mortgage capital are excluded so as to preserve the distinction between consumption and investment expenditure. The Committee also recommended that a new 'depreciation' component for shelter costs should be introduced to represent the ongoing costs homeowners face in maintaining the standard of their properties. Section 9.5 describes the current treatment of the various components of owner-occupied housing costs in the RPI.

Currently, owner occupiers' housing costs are not included in the CPI. This is one of the most challenging areas in the construction of harmonised consumer price indices. The main reasons for this include:

- housing markets can differ significantly across Europe
- various methods are used by countries to measure housing in their respective national CPIs
- there are significant measurement challenges to overcome and methodological issues to resolve

However, the development of a harmonised approach to owner occupiers' housing remains the highest development priority for Eurostat who are working hard with Member States to reach a solution.

The development of a measure of owner-occupiers' housing costs is also a top priority for Prices division within the Office for National Statistics (ONS). As well as working closely with Eurostat to reach a European wide solution, ONS is considering how best to measure these costs from a UK perspective. Development work is underway under the guidance of the Consumer Prices Advisory Committee to enable the publication of a UK inflation measure that includes owner-occupiers' housing costs. More information on this is included on the Consumer Prices Advisory Committee page of the National Statistics website –

<http://www.ons.gov.uk/ons/guide-method/development-programmes/other-development-work/prices-development-plan/consumer-prices-development-work.html>

Chapter 8 Publication and Usage

8.1 Availability

The CPI, RPI and associated data are first issued in a publication called the '*Consumer Price Indices Statistical Bulletin*' at 9.30am, usually on the second or third Tuesday in the month immediately following the month to which the data refer. At the same time, accompanying '*Briefing Notes*' are published giving more detail about the factors contributing to changes in the percentage change over 12 months for the headline indices. The data are published simultaneously in electronic format on the ONS website. More detailed data can also be found on the ONS website by downloading the data associated to the current CPI Release as an Excel file or via the Time Series Data function. The latest data can be downloaded at the same time as the Statistical Bulletin. The CPI and RPI also appear in other ONS publications (see Appendix 5).

Revisions

The CPI is a revisable index although revisions due to errors have been minimal. A comprehensive revision of the CPI took place with the publication of the January 2006 index, when the whole of the CPI, including back data, was re-referenced to 2005=100 (see sections 8.5 and 2.6). Around one-third of the monthly and annual rates of change were revised as a consequence. Once the RPI indices are published, they are **never** revised.

Pre-release arrangements

Details of the policy governing the release of new data are available from the ONS press office. Also available on the ONS website is a list of the roles and departments of those who are given pre-publication access to the contents of the Statistical Bulletin. The following pre-release arrangements apply to the consumer price indices:

- the advance copy of the Statistical Bulletin is circulated, on a need to know basis, 24 hours before release in line with other sensitive economic data (ie at 9:30am on the Monday preceding publication)
- special arrangements apply in the case of the Governor of the Bank of England:
 - a. if the Bank of England's Monetary Policy Committee (MPC) meets in the week immediately preceding publication, then an advance estimate of the CPI is provided to the Governor 3½ working days ahead of publication (ie on the Wednesday evening). The Governor shares this information with the MPC and officials present at the MPC meeting. In the months when this happens, a footnote is included in the Statistical Bulletin
 - b. otherwise, the Governor of the Bank of England receives an advance copy of the Statistical Bulletin 24 hours before publication, in line with other pre-release recipients. However, if he observes that the percentage change over 12 months in the CPI moves away from the target by more than one percentage point in either direction (ie it is 3.1% or higher, or 0.9% or lower) he may share this information with MPC members. In the event of this arrangement being triggered, a footnote would be included in the Statistical Bulletin noting that MPC members had been given advance access to figures
- in cases where the CPI is more than 1% away from the 2% inflation target, and for every three months after (while the CPI remains above or below target), ONS send notification to the Governor of the Bank of England who writes an Open Letter to The Chancellor of the Exchequer, on behalf of

the MPC. The Open Letter explains why inflation is moving away from the target, the period in which it is expected to move back on target and the policy action that the committee is taking

Choice of publication date

The CPI and RPI are published as early as practicable, four or five weeks after Index Day, usually on the second or third Tuesday of the month. In practice, this means publication generally falls between the 12th and 20th of the month. The date of publication is announced six months in advance in the Background Notes to the Statistical Bulletin, and up to twelve months in advance on the ONS website.

8.2 Percentage Change Between any Two Months

Once a chain-linked index is produced, it can be used to calculate changes between any two months after the base period. For example, the all items CPI for April 2005 is 99.7 and that for August 2009 is 111.4 so the change between these months is:

$$(111.4/99.7-1) \times 100\% = 11.7\%$$

Note that the base period in the CPI is 2005=100. This base period applies to the full series from 1988 (note that the figures pre-1997 are estimates). The definitive CPI is quoted as a level relative to the base period; for instance, the CPI for January 2012 is 121.1. However, for users' convenience the result is also expressed as the percentage change on the figure 12 months earlier, which is commonly known as the annual inflation rate. The CPI level for January 2011 is 116.9, so the annual inflation rate at January 2012 is 3.6%.

In the RPI, the base period (month) is January 1987. The computation of the changes between any two months after the base period (ie after January 1987) is applied in the same way as is applied to the all items CPI in the example above. However, for months before January 1987, the time period is split at January 1987. The series based on January 1974 is used up to January 1987, then the series based on January 1987 for the remainder of the period. For example, the indices for July 1986 and January 1987 based on January 1974 are 384.7 and 394.5 respectively; the index for July 1987 based on January 1987 is 101.8. Thus the change from July 1986 to July 1987 is:

$$(101.8/100 \times 394.5/384.7 - 1) \times 100\% = 4.4\%$$

For months before January 1974, the series based on January 1962 is also needed. For example, the indices for July 1968 and January 1974 based on January 1962 are 125.5 and 191.8 respectively; that for January 1987 based on January 1974 is 394.5; the index for July 1987 based on January 1987 is 101.8. Thus the change from July 1968 to July 1987 is:

$$(101.8/100 \times 394.5/100 \times 191.8/125.5 - 1) \times 100\% = 513.8\%$$

In the CPI, percentage changes are calculated from the published unrounded indices, and are then rounded to 1 decimal place. However, the RPI is calculated from rounded indices (see section 8.4 for more detail).

Although indices are produced monthly, they are sometimes quoted as annual or quarterly averages. Indeed, the pensioner indices for the RPI are only published as quarterly and annual averages.

$$I_{12av} = \frac{1}{12} \sum_{t=1}^{12} I_t$$

8.3 Annual and Quarterly Averages

The annual average is defined as the arithmetic mean of the twelve monthly values for the year in question. Quarterly indices for Q1 (January to March), etc are defined similarly. Since the indices are

always calculated so that a particular period (currently the year 2005 in the CPI) equals 100, there will not usually be any year or quarter with an average index of exactly 100.

The CPI calculations are performed at maximum precision throughout, therefore the quarterly and annual average indices are calculated from unrounded monthly indices with changes over 12 months in the quarterly and annual average indices being calculated from the corresponding unrounded quarterly and annual average indices. The approach adopted in the UK differs from that used in other European countries for their HICPs where:

- annual and quarterly average indices are calculated from the published rounded indices
- the 12-month rates for the annual and quarterly indices are calculated from the unrounded averages of the rounded monthly indices

For both CPI and RPI, the annual average inflation rate is the change in the annual average index from the year before. For example, for the all items CPI for 2011 we have annual average = 119.6, the annual average for 2010 = 114.5 so the percentage change is $(119.6 - 114.5) / 114.5 \times 100 = 4.5\%$. This will not in general exactly equal the average of the percentage changes for January, February, ..., December but in practice the difference will be small. Either average figure will usually be closer to the change between the middle of the year before and the middle of that year than to the change between the start and end of that year. Note that the RPI uses a slightly different approach for calculating quarterly and annual average inflation rates (section 9.6).

To calculate an annual average inflation rate over any period other than a year, the following equation should be used:

$$\text{Annual average inflation rate} = \left(\left(\frac{I_2}{I_1} \right)^{\frac{12}{n}} - 1 \right)$$

where:

I_2 = CPI or other index in later month/year

I_1 = CPI or other index in earlier month/year

n = number of months in the period in question

It should be noted that this may produce misleading results for just one or two months' change in the index. One reason is that the month-to-month change includes a seasonal component. Another is that some prices change only infrequently, perhaps only once a year. Hence a comparison between different years' annual average indices, or at least between the same month in different years, is to be preferred.

8.4 Rounding Policy and the Effects of Rounding

All derived statistics – ie annual and quarterly average indices, one-month and 12-month percentage changes - are published rounded to one decimal place. Very occasionally, because of the degree of precision to which decimal fractions are stored electronically, a derived statistic ending with the digit 5 may be rounded downwards. For the main CPI and RPI monthly indices, the percentage changes are manually checked and, where necessary, rounded up if the calculated figure is exactly at the rounding point. Because of practical constraints, other derived statistics are not manually overridden in the same way.

The CPI and RPI differ in the way in which the derived statistics are calculated. The CPI follows the standard ONS approach which is to calculate derived statistics from unrounded monthly indices while the RPI calculations are based on the published rounded indices. The CPI approach limits the impact of rounding effects (see below) and ensures that re-referencing will not in future lead to revisions to one-month and 12-month percentage changes. However, it means that the derived statistics cannot always be calculated from the published headline indices. In order to address this, the unrounded CPI indices

are available on request (the re-referencing from 1996=100 to 2005=100 led to revisions in the rates of change because of rounding errors arising from the previous practice of calculating rates of change from the published indices rounded to one decimal place).

The RPI approach is transparent in that all derived statistics can be traced back to the published monthly index levels. This is particularly important given that the RPI is used for the indexation of index linked gilts. However, when publishing rounded indices to 1 decimal place, and then calculating percentage changes from these rounded indices which are then themselves rounded to 1 decimal place, some extreme rounding effects can occur. See section 9.7 for an example illustrating rounding effects in the RPI.

8.5 How to use the CPI and RPI

The ONS neither encourages nor discourages the use of price adjustment measures in contractual agreements. The decision to employ an indexation mechanism, as well as the choice of the most suitable index, is up to the individual or party. When drafting the terms of an indexation provision for use in a contract to adjust future payments, both legal and statistical questions can arise. ONS cannot help in relation to legal questions; in particular, it cannot draft specific wording for contracts nor mediate interpretative or other legal disputes which may arise between the parties to an agreement. On statistical questions, ONS can provide basic assistance, and certain general guidance is set out in the following paragraphs. However, this assistance and guidance is provided without acceptance of any responsibility by ONS. As stated at the start of this manual, users should form their own independent assessment in relation to the CPI or RPI and its use in specific cases, and should seek such professional advice as they consider appropriate. Users are advised to take account of the relative levels of accuracy of the relevant indices.

General guidance

The following are general guidelines to consider when drafting a clause using the CPI or RPI:

- define clearly the payment (rent; wage rate; maintenance; child support or other value) that is subject to review in line with prices
- identify the precise index (CPI or RPI) or component that will be used to adjust the base payment. This should include the full series title (eg All-items Consumer Price Index (CPI) as published by the Office for National Statistics) and index base period (eg 2005 = 100)
- specify clearly a reference period from which changes in the CPI or RPI will be measured. This is usually a single month or an annual average. There is a lag of about two weeks from the end of the reference month to the date when data for that reference month are published
- if you decide to use the CPI then note that, unlike the RPI, it is a revisable index and that CPI rates of change are calculated from unrounded indices, which are available from ONS on request. Hence, in specifying the CPI rate of change you must specify, not only the reference period over which the change is measured, but also the date on which that CPI was published. You must also specify whether the index to be used is the published index rounded to one decimal place or the unrounded index
- state the frequency of adjustment. Adjustments are usually made at fixed time intervals such as monthly; quarterly; or, most often annually
- determine the formula for the adjustment calculation. Usually, the change in payments is directly proportional to the percentage change in the CPI or RPI between the two specified periods. Consider whether to have a 'cap' which places an upper limit to the increase in wages, rents, etc, or a 'floor' which promises a minimum increase regardless of the percentage change (up or down) in the CPI or RPI

- provide a built-in method for handling situations that may arise because of major revisions to the structure of the CPI or RPI or changes in the index base

Adjustment clauses using the CPI or RPI usually involve changing the base period payment by the percentage change in the level of the CPI or RPI between the base period and a subsequent time period. This is calculated by determining first the change between the two periods and then the percentage change. The example below illustrates the computation of the percentage change:

CPI for current period	136.0
CPI for previous period	129.9
First figure less second figure equals change	6.1
Divided by previous period CPI	129.9
Equals	0.047
Result multiplied by 100	0.047×100
Equals percentage change	4.7

- it is acceptable to refer to the 'Consumer Prices Index' or 'CPI', but users may consider it better to clarify it by referring to the 'all items CPI' and perhaps stating '... or any future Government index which shall replace that index and shall provide a measure of the general increase in consumer prices'
- referring to a component of the CPI or RPI is more risky as the sub-division components varies over time. Perhaps reference should be made to a suitable alternative if the definition changes (eg refer to the all items CPI or all items RPI if the component is no longer published)
- refer to the fact that the all items CPI or all items RPI will still be used even if calculated differently, on a different basis, or using different components
- if reference is made to the annual percentage change in an index, ensure that the number of decimal places to be used in the calculation is mentioned (preferably one decimal place). It is better to refer to the annual percentage change in the CPI or RPI as published by the ONS (or its successor) rather than attempt a calculation oneself, as for the RPI, ONS calculates percentage changes from rounded indices, and then round these percentage changes as well
- refer to which months or years values of the index will be used, if possible. Referring simply to the latest available index may cause problems. For instance, if the uprating is due on 15 January, the latest available CPI may in some years be the December CPI but in other years it may be the November CPI. This is due to the publication schedule, see 8.1 for further information. This could affect the number of months to be used in the uprating calculation
- reference should be made to the possibility that ONS may change its name at some point in the future, or the CPI and or RPI may even be published by another Government department. The words "ONS or any successor Government department" may be used
- reference should be made to cover the event of re-basing of the CPI or RPI. The following form of words may be useful as a starting point:

'The all items Consumer Prices Index (CPI) is expressed in terms of a comparison of prices relative to a reference date, currently the year 2005. To uprate an amount of money in line with the movement in the CPI, multiply it by the published index at the later date in question, and then divide it by the index at the earlier date in question.'

8.6 How to Construct Aggregates

The indices for CPI groups and classes can be combined to suit users' particular requirements where the standard aggregates are not appropriate. Note that the weights are revised annually, so relate only

to the applicable year, not to the whole period since the 'reference date' (ie 2005=100). The aggregate indices must therefore be calculated one year at a time, as follows:

- a. for each component, calculate an index for the current month based on the previous January. This is done by dividing the current month's index by the January index and multiplying by 100; since the CPI is chain-linked twice each year, the January index must be divided by the previous year's December index
- b. calculate a weighted average of these January-based indices, using the weights relating to the current year. (Each years weights come into use in February and remain current up to and including the following January)
- c. convert this January-based aggregate index back to the standard reference base. This is done by multiplying it by the aggregate index for the January in question and dividing by 100

If a January index for the aggregate (on the standard reference base) is not available for the current year (say year T) then it can be calculated sequentially from the component indices, as follows:

- a. use the above method with January of year T as the 'current' month, to calculate the aggregate index for January of year T with January of year T-1 as 100
- b. then calculate an index for January of year T-1 with January of year T-2 as 100
- c. similarly for as many years (say N) as are necessary to get back to the reference base (January 1987 at present)
- d. multiply the N January-on-January indices together and divide by 100 to the power N-1

8.7 Contributions to Changes in All Items CPI

It is often of interest to estimate the effect of the component COICOP categories on the change in the all items CPI. The contribution of a component to a change in the all items CPI over a given period of time is defined as the change that would have occurred in the all items index if that component had undergone its observed change but all other component indices had remained frozen at their values at the start of the period (and all weights are kept the same). The effect of each component depends on both the size of its change and its weight.

The formula for calculating the contribution of a component to the monthly change in the CPI is given below:

Contribution of component i to monthly change in all items CPI =

$$\left(\frac{I_t^i}{I_{t-1}^i} - 1 \right) \times 100 \times \frac{I_{t-1}^i}{I_{t-1}^a} \times \frac{w_t^i}{1000}$$

where:

I_t^i = index for component i (base previous January = 100) in month t

I_{t-1}^i = index for component i (base previous January = 100) in month $t-1$

a = all items CPI

w_t^i = weight (parts per 1000) of component i in all items CPI in month t

As the definition of the variables above makes clear, it is important that these calculations are performed using unchained (ie base period January =100) indices. The formula for the contribution of components to the monthly change in the CPI is the same as for RPI (section 8.9). However, the formula for the contribution to the change in the annual rate is different, reflecting the fact that the CPI is chain-linked twice every year (section 2.5). The formula is as follows:

Contribution of component i to annual change in all items CPI =

$$\left(\frac{w_y^c}{1000} \right) \times \frac{(I_{Dec}^c - I_{t-12}^c)}{I_{t-12}^A} \times 100 + \left(\frac{w_y^c}{1000} \right) \times \frac{(I_{Jan}^c - 100)}{I_{t-12}^A} \times I_{Dec}^A + \left(\frac{w_y^c}{1000} \right) \times \frac{(I_t^c - 100)}{I_{t-12}^A} \times \frac{I_{Jan}^A}{100} \times I_{Dec}^A$$

where:

c = component c

A = all items CPI

w_y^c = weight (parts per thousand) of component c in CPI in year y

I_t^c = index for component c in month t based on January of current year = 100

I_{Jan}^A = all items index for January based on previous month (December) = 100

I_{Dec}^A = all items index for December based on previous January = 100

As with the corresponding formula for contributions to the monthly change in the all items CPI, it is important that the calculations are performed using unchained indices (ie based on previous January = 100, or for the January index, based on previous December = 100). For the month of interest, the contribution of each component of the CPI to the 12-month rate is calculated. The same is done for the preceding month. The differences between the two are the contributions to the *change* in the CPI 12-month rate, which are published in the *CPI Statistical Bulletin* and the accompanying *Briefing Notes*.

8.7.1 Example calculation

Using the formula above, the contribution of food and non-alcoholic beverages to the CPI all items annual rate for September 2006 can be calculated based on this example. The published (chained) index values, based on 2005=100, for food and non-alcoholic beverages and the all items CPI are as follows:

Published (chained) index (2005=100)					
	Jan 2005	Sep 2005	Dec 2005	Jan 2006	Sep 2006
Food and non-alcoholic beverages	99.2	99.7	100.7	100.4	103.6
All items	98.6	100.6	101.0	100.5	103.0

In order to work out the contribution of food and non-alcoholic beverages to the all items CPI 12-month rate for September 2006, it is necessary to unchain the indices so that they are based on the most recent January or, in the case of the January indices, on the previous December. This is done by dividing the current month's index by the previous January's (or December's) figure. For instance, the food and non-alcoholic beverages index for Dec 2005 (the first link month) is calculated as:

$$I_{Dec}^i = \frac{100.7}{99.2} \times 100 = 101.51$$

Performing this calculation for each of the dates gives the following set of unchained index values:

Unchained indices					
	Based on Jan 2005=100			Based on Dec 2005=100	Based on Jan 2006=100
	Jan 2005	Sep 2005	Dec 2005	Jan 2006	Sep 2006
Food and non-alcoholic beverages	100.00	100.50	101.51	99.70	103.19
All items	100.00	102.03	102.43	99.50	102.49

The contribution of food and non-alcoholic beverages to the 12-month rate for September 2006 can then be calculated as follows, given that the weights for food and non-alcoholic beverages in 2005 and 2006 are 106 and 102 parts per thousand respectively:

$$\begin{aligned} \text{contribution} = & \frac{106}{1000} \times \frac{(101.51 - 100.5)}{102.03} \times 100 + \frac{102}{1000} \times \frac{(99.7 - 100)}{102.03} \times 102.43 + \\ & \frac{102}{1000} \times \frac{(103.19 - 100)}{102.03} \times \frac{99.5}{100} \times 102.43 = 0.40\% \end{aligned}$$

Thus food and non-alcoholic beverages contributed 0.40 percentage points to the all items CPI 12-month rate in September 2006.

Chapter 9 Retail Prices Index

9.1 Overview

The RPI is the most long-standing measure of inflation in the United Kingdom. It is currently used for the revalorisation of excise duties and for index-linked gilts. In the past, it has been used for a variety of other purposes. These included the Government's inflation target, uprating tax allowances, state benefits, and pensions, as well as deflating consumer expenditure in the National Accounts.

9.1.1 History of the RPI

Although there were occasional official comparisons of prices for food in the late 19th century and early 20th century, the Government first began a systematic, continuous check on the increase in the cost of living in 1914. This 'cost of living index' was produced throughout the 1920s and 1930s. In 1946, a Cost of Living Advisory Committee was set up. This Committee recommended fundamental changes in the selection and number of representative items for which prices should be collected, as well as the removal of the name 'cost of living index' and the associations it implied. The resulting index, the Interim Index of Retail Prices, began in June 1947 and continued with some minor modifications to 1956. By 1955, sufficient information became available to underpin a new index and this became the first official Retail Prices Index beginning in January 1956. The historical background to the development of the index can be found in Appendix 1.

9.1.2 Basic principles

The RPI, like the CPI, measures inflation with reference to the changing cost of a fixed basket of goods and services. In most areas, the RPI is calculated from the same basic price data as the CPI, and uses similar methodology both in compiling and aggregating the component price indices. However it does differ from the CPI in some specific respects and, in some cases, these differences can have an important influence on the measured rate of inflation. The differences, including the coverage and classification of goods and services, the population basis for the weights, and the mathematical formula used to aggregate the prices at the most basic level, are considered in the sections that follow. Roe and Fenwick (2004), '*The new inflation target: the statistical perspective*', Economic Trends No 602, January 2004, discusses these issues in greater detail as does the article by Green, T (2011) '*Implications of the differences between the Consumer Prices Index and Retail Prices Index*'.

9.1.3 Reference period

The published RPI, and its components, express price levels at a given point in time as a percentage of the level at some previous date, known as the reference date. The level at the reference date is 100 by definition. A change in reference date has no effect, other than due to rounding, on the percentage movement between any pair of months but is merely a re-scaling of the whole series up or down by a constant factor. For the RPI, unlike many other statistical series, the reference date has no connection with the 'weighting base date'.

The RPI uses a single collection point in time, a January, for the reference date. It is of course possible to use, say, an annual average as a reference date. The 1986 report of the RPI Advisory Committee reviewed this issue and decided to keep the reference date as a single month, partly because it makes the chain-linking calculation far more straightforward for the RPI compilers.

Since 1947, the reference date for the RPI has changed five times (in January 1952, January 1956, January 1962, January 1974 and January 1987), on each occasion following the recommendations of

the RPI Advisory Committee (see Appendix 2 for more information on the Committee). The main argument against changing the reference date is that users prefer to have a continuous series for as long as possible; re-referencing causes them inconvenience. The main argument for re-referencing is that some users find that index numbers much in excess of 100 are more difficult to use, particularly if they are not accustomed to concentrating on changes in percentage terms rather than in index points. Further, very high index levels can lead to misleading impressions among users of the precision of the RPI. The RPI can only be regarded as accurate to about one-tenth of one per cent. The difference between 400.0 and 400.1 is only a quarter of this, so would not be meaningful.

9.2 Index Coverage and Classification

The RPI index scope, and its associated classification system comprising groups and sections, was specified and developed by earlier RPI Advisory Committees, whilst the coverage and classification of the CPI indices are based on the international classification system for household consumption expenditures known as COICOP (classification of individual consumption by purpose). The RPI classification system comprises: Broad Groups eg Food and catering, Groups eg Food, and **Sections** (the lowest published level) eg Bread. The two classification systems are listed in Appendices 3 and 4. The broad relationship between the RPI Groups and COICOP Divisions is summarised in the following table:

COICOP Divisions	RPI Groups
01 Food & non-alcoholic beverages	Food
02 Alcohol & tobacco	Alcoholic drink (off sales) Tobacco
03 Clothing & footwear	Clothing & footwear
04 Housing & household services	Housing (exc mortgage interest payments, depreciation, council tax, ground rent & building insurance) Fuel & light
05 Furniture & household goods	Household goods Domestic services
06 Health	Personal goods & services (health-related items)
07 Transport	Motoring expenditure Fares & other travel costs
08 Communication	Household services (exc. domestic services & fees and subscriptions)
09 Recreation & culture	Leisure goods Leisure services
10 Education	Fees & subscriptions (education-related items)
11 Restaurants & hotels	Catering Alcoholic drink (on sales)
12 Miscellaneous goods & services	Personal goods & services (non health-related items) Fees & subscriptions (non education-related items)

While the vast majority of goods and services that are priced are included in both the RPI and CPI, there are a small number of important differences. The main differences are in the area of housing costs. In particular, unlike the CPI, the RPI includes council tax, as well as the categories relating to

owner-occupiers' housing costs: mortgage interest payments, house depreciation, buildings insurance, ground rent, and other house purchase costs (such as estate agents' fees and conveyancing fees).

Conversely, there is a small number of representative items which are excluded from the RPI but included in the CPI because they represent expenditure by people who are not covered by the RPI weights, including high income private households, residents of institutional households and foreign visitors. In practice, the number of these items is small, currently: university accommodation fees, foreign students' university tuition fees, unit trust and stockbrokers charges and foreign exchange commission on the purchase of sterling by overseas visitors. As described in section 9.3, differences in the population coverage between the RPI and CPI have a greater significance in terms of their impact on the calculation of weights for all of those items common to both the RPI and CPI baskets.

9.3 Elementary Aggregation Formula

One of the key differences between the RPI and the CPI is the formula used for the calculation of elementary aggregate indices (section 2.3). The RPI uses arithmetic means - the average of relatives (AR) and ratio of averages (RA), whereas the CPI generally uses the geometric mean (GM). If prices $p_{i,0}$ to $p_{n,0}$ are obtained in the base period and matching prices $p_{i,t}$ to $p_{n,t}$ are obtained for the same commodities in month t , then we have:

$$\text{AR: } I_{t,0} = \frac{1}{n} \sum_{i=1}^n \frac{p_{i,t}}{p_{i,0}} \quad (\text{average of price relatives})$$

$$\text{RA: } I_{t,0} = \frac{\sum_{i=1}^n \frac{p_{i,t}}{n}}{\sum_{i=1}^n \frac{p_{i,0}}{n}} \quad (\text{ratio of average prices})$$

Strictly, the above indices require a third suffix because they are just components of the overall index.

With either definition, it is essential that matching prices are used. If, in any month, there is no price corresponding to one in the base month, that base month price must be excluded from the calculations.

RA is less distorted than AR if one of the $p_{i,0}$ is abnormally low, for example due to January sales, while the corresponding $p_{i,t}$ is not low. However, it has the disadvantage that if one pair of prices relates to an object of much higher price than the others, this pair dominates the calculation. AR is thus used when the objects within an aggregate are likely to vary a lot in price, such as for items of furniture.

AR shows a greater price rise than RA if the price relatives $p_{i,t} / p_{i,0}$ are negatively correlated with the base prices, which is often the case in practice. However, if the price relatives are positively correlated with the base prices, AR shows a smaller price rise than RA.

Another way to describe the difference between AR and RA is to consider the expression:

$$I_t = \sum_{i=1}^n u_i \frac{p_{i,t}}{p_{i,0}}$$

where the u_i are the weights to be given to each price relative. Ideally, the u_i should reflect actual expenditure, but there are no data currently available to estimate the weights at this very low level of aggregation, so some assumptions must be made. If it is assumed that all the u_i are equal, this is AR. This is appropriate if each price quote within the aggregate is considered to be as important as any other. However, if the weights are assumed to be proportional to the base price $p_{i,0}$ this is RA. This is appropriate if expenditure is proportional to price.

9.3.1 Arithmetic means compared with Geometric mean

The GM formula is used predominantly in the CPI at the first stage of aggregation, which in practice always shows a lower price rise than AR for given price data. However, it can be higher or lower than RA. Like AR, GM shows a greater price rise than RA if the price relatives $p_{i,t}/p_{i,0}$ are negatively correlated with the base prices, but a lower price rise if the reverse is true. (As noted in section 9.4, RA can be thought of as a weighted average of price relatives, with weights proportional to base prices).

Since 1997, when the official series for the 12-month rate of change for the CPI begins, the formula effect (that is, the effect of using GM for elementary aggregation in the CPI, rather than arithmetic means) has contributed at least 0.4 percentage points, and on average about 0.6 percentage points, to the difference between the CPI and RPI 12-month rates of change. In other words, the CPI annual rate would typically have been about 0.6 percentage points higher if the elementary aggregates had been calculated using arithmetic means as in the RPI.

9.4 Aggregation and Chain Linking

The RPI is an annually chain-linked index: each year a separate index based on the most recent January = 100 is produced, and each year's indices are then chained together once a year as the weights are updated at the same time as new items are introduced each February, to produce an index covering several years. This is in contrast to the CPI, which must be chain-linked twice every year (see Section 2.6).

9.4.1 Aggregation

Indices for higher levels (based on the previous January) are weighted averages of the elementary aggregate indices. If the k^{th} representative item is stratified by region or shop type into strata in set K , the elementary aggregate indices for the strata in month t are $I_{i,t}$ and the stratum weights are w_i , the item index for item k for month t is:

$$I_t^k = \frac{\sum_{i \in K} w_i I_{i,t}}{\sum_{i \in K} w_i}$$

The same formula is used with item weights to generate section indices from item indices, and with section weights to generate the all items index from section indices. This aggregation is done with indices based on previous January = 100, before they are chained as described below. (In practice, sections are aggregated into groups, groups into the broad groups listed in Appendix 4, and then these into the all items index.)

9.4.2 Chain-linking

Monthly indices are calculated on the above basis until the January of the following year. To produce the 1987-based indices, the indices are chained together each January starting from 1987. Thus for May 1988 we have

$$I_{\text{May88/Jan87}} = \frac{I_{\text{Jan88/Jan87}}}{100} \times I_{\text{May88/Jan88}}$$

For May 1989 we have

$$I_{\text{May89/Jan87}} = \frac{I_{\text{Jan88/Jan87}}}{100} \times \frac{I_{\text{Jan89/Jan88}}}{100} \times I_{\text{May89/Jan89}}$$

and so on. Item and elementary aggregate indices are not chained, because many items in the RPI basket change each year.

Unlike a within-year index, a chain-linked index spanning more than one year cannot be represented either as the ratio of the price of a basket in the current month to that in the base month or as the weighted average of price relatives, as the weights are not constant and even the list of items in the basket is not fixed.

It is necessary to chain the RPI every year because the weights change. It is possible to chain an index every month rather than just every January. For RA, provided that the weights and item list remained fixed this would yield the same results. However, for AR the result would usually be that the index would grow more rapidly than it should, a phenomenon known as 'price bounce'.

9.5 Treatment of Housing Costs

Section 7.4.9 described how unlike the CPI, the RPI includes owner-occupied housing costs. The sections below describe the approach currently adopted for Mortgage Interest Payments, Owner-Occupiers' Housing Depreciation, Council Tax and Estate Agents' Fees.

9.5.1 Mortgage Interest Payments (MIPs)

Both the weight and price changes for Mortgage Interest Payments (MIPs) are modelled in the RPI. This model is designed to estimate the interest payment due on a standard dwelling for an average index household over time. A range of assumptions and parameters are employed meaning that the calculation can appear complex in practice. However, the underlying approach may be summarised as follows.

Consistent with the fixed basket approach adopted throughout the RPI, average payments are calculated each month with respect to a fixed stock of new and existing mortgages (of various ages) equivalent to those existing in the January base period. In calculating the index in subsequent periods it is important that the base period stock of mortgages of various vintages is uprated according to changes in house prices. For example, a new mortgage taken in February will in most years be higher than the equivalent new mortgage taken in the January base period reflecting the monthly increase in house prices. Similarly, in February the value of a mortgage taken say 24 months earlier will on average be higher than the equivalent 2-year old mortgage in January to the extent that house prices rose between the two months 2 years ago.

Interest payments on this basket of revalued base mortgages may then be calculated with reference to current period mortgage interest rates. It follows that current mortgage rates and movements in house prices over time are the main determinants of the MIPs component of the RPI.

The MIPs calculation

Table 9.1 below provides a stylised example of the monthly calculation underpinning the MIPs index.

Table 9.1: Example of monthly calculation of Mortgage Interest Payments in the RPI

	Average House Price (£) (a)	Prop. of price advanced (b)	Prop. of Repayment mortgages (c)	Prop. of Endowment mortgages (d)	Prop. of debt outstanding for repayment mortgages (e)	Prop. of mortgagor households (f)	Current debt for repayment mortgages (£) (g)	Current debt for endowment mortgages (£) (h)	Current total debt (£) (i)	Debt Per household (£) (j)
This mth	141,553	0.55	0.75	0.25	1.0000	0.0074	58,391	19,464	77,854	576.12
1 mth ago	143,357	0.55	0.75	0.25	0.9981	0.0074	59,022	19,712	78,734	582.63
2 mths ago	141,766	0.55	0.75	0.25	0.9962	0.0073	58,256	19,493	77,749	567.57
3 mths ago	142,886	0.55	0.75	0.25	0.9943	0.0073	58,605	19,647	78,251	571.23
4 mths ago	140,322	0.55	0.75	0.25	0.9924	0.0072	57,443	19,294	76,737	552.51
5 mths ago	142,267	0.55	0.75	0.25	0.9904	0.0072	58,122	19,562	77,683	559.32
6 mths ago	138,554	0.55	0.75	0.25	0.9885	0.0071	56,496	19,051	75,547	536.39
7 mths ago	135,756	0.55	0.75	0.25	0.9866	0.0071	55,249	18,666	73,915	524.80
8 mths ago	132,692	0.55	0.75	0.25	0.9847	0.0070	53,898	18,245	72,143	505.00
9 mths ago	131,101	0.55	0.75	0.25	0.9828	0.0070	53,149	18,026	71,175	498.23
10 mths ago	130,152	0.55	0.75	0.25	0.9809	0.0070	52,662	17,896	70,558	493.91
11 mths ago	127,913	0.55	0.75	0.25	0.9790	0.0069	51,656	17,588	69,244	477.78
12 mths ago	128,796	0.55	0.75	0.25	0.9771	0.0069	51,912	17,709	69,621	480.39
273 mths ago	25,735	0.55	0.75	0.25	0.0240	0.0012	255	3,539	3,794	4.55
274 mths ago	25,555	0.55	0.75	0.25	0.0159	0.0012	168	3,514	3,682	4.42
275 mths ago	25,376	0.55	0.75	0.25	0.0079	0.0012	83	3,489	3,572	4.29
						1.0000				
Sum of debt per household over the 276 month period										40,000.00
× 76% for those owner-occupiers under 23 years (revised annually)										30,400.00
× 73% for those under 23 year owner occupiers with mortgage										22,192.00
× 72% for those index households which are owner occupiers										15,978.24
× average mortgage interest rate (5%)										798.91
= average payment per index household (£ week)										15.32

The calculation begins with the average price of new and existing dwellings (column a) bought on mortgages in each month over a finite history (currently 23 years, as shown in the table). The average house price is weighted to reflect a constant mix of house types across the UK, as described later. For each month in the 23-year calculation, house prices are then multiplied by the proportion of the purchase price which is borrowed to finance house purchase, fixed at 55 per cent for houses.

The resulting time-series for the value of the average mortgage advance is then used to calculate two separate current debt series, one for repayment mortgages and another for endowment-type mortgages. For repayment mortgages, debt is first multiplied by the current proportion of capital outstanding on a standard 23-year repayment mortgage started t months earlier (derived from a standard annuity calculation in which the initial debt is amortised over 23 years assuming a fixed interest rate throughout - column e). Debt outstanding on an endowment-type mortgage by contrast does not decline over time. The two series are weighted by the proportions of households holding repayment and endowment-type mortgages (columns c and d).

The resulting series (columns g and h) are summed to give average current debt outstanding on mortgages of 276 different vintages, weighted by mortgage type (column i). Multiplying by the proportion of index households holding mortgages of each vintage (column f - proxied by LCF data showing the length of time owner occupying index households have lived at their present address) and summing across all months yields the average mortgage debt currently outstanding per owner occupying index household with a new or existing mortgage.

This average debt figure is then scaled down to give an average over all index households, including outright owners and tenants. The scaling factors, derived from the LCF, are: the proportion of all index households who are owner-occupiers; the proportion who have been at the same address for less than 23 years; and the proportion with mortgages. (All other types of index household will have, or are assumed to have, zero mortgage debt in the model).

The resulting figure is multiplied by current period mortgage interest rates in deriving average weekly payments per index household (£15.32 in this example).

The estimated January average payment determines the weight of MIPs in the RPI for the current year (the average payment is expressed in weekly terms so that it can easily be combined with other LCF data used in the calculation of RPI section weights; see section 6.6). The MIPs index, based on the previous January = 100, is calculated simply as the current month's average weekly payment expressed as a percentage of the average weekly payment in January. In-year indices are chained in the usual way to provide a long-run MIPs index based on January 1987 = 100.

House price estimates

Following the completion of an independent review and peer group appraisal, the monthly house price index and associated average house price values published by the Department for Communities and Local Government (DCLG) was adopted as the primary source of house price data in the RPI from February 2005. The house price series is trimmed specifically for RPI purposes by removing house transactions where the mortgagors' household income given in the mortgage application is in the top 4 per cent threshold used to define index households. The DCLG index is characterised by:

- a significant increase in the underlying sample of mortgage completions underpinning the index (from around 3,000 to some 30,000 completions per month), permitting the publication of a monthly as opposed to a quarterly index
- improved quality adjustment of house prices through hedonic regression techniques, employing a relevant and robust selection of explanatory variables and offering improved flexibility and better use of partial data

Prior to 2005, as described in the 1998 edition of the Technical Manual, the main source of house price data for the RPI was the 'mix-adjusted' house price index compiled by the ODPM. The series was mix-adjusted to account for changes in the quality of houses traded each month by grouping and fixed weighting observed prices covering homes of similar characteristics.

The timeliness of the monthly DCLG house price series is such that it is not available for direct use in the RPI calculation of that month. The house price estimate used in the RPI is therefore calculated by combining the monthly change in the Halifax index with the latest available DCLG average house price value. Prior to 2004, the contemporaneous change in the Halifax index was used to estimate current period house prices. From 2004, based on an analysis of the two series, the Halifax index is assumed to 'lead' the DCLG index by one month, reflecting its construction with reference to mortgage approvals compared to mortgage completions as in the DCLG series. Calculation of the average house prices for the MIPs index in any month is, therefore, given by the following simple formulae:

$$HP_t = DCLG_{t-1}^{hp} \times \frac{Hfx_{t-1}^{ind}}{Hfx_{t-2}^{ind}}$$

$$HP_{t-1} = DCLG_{t-1}^{hp}$$

where:

HP_t	=	house price in the current period
HP_{t-1}	=	house price in period $t-1$
$DCLG_{t-1}^{hp}$	=	DCLG house price in period $t-1$
Hfx_{t-1}^{ind}	=	Halifax index in period $t-1$
Hfx_{t-2}^{ind}	=	Halifax index in period $t-2$

Sources of interest rate data

The interest rates used are a weighted average of interest rates charged by the largest banks and building societies. Up to January 2010, the interest rate was a weighted average of the Standard Variable Rate (SVR) of interest from the main bank and building society providers using data supplied by the Bank of England. However, the mortgage market had evolved with increased take up of alternative mortgage types including fixed rate, discount and tracker mortgages which were not covered in the SVR measure. The key concern was that few mortgages were on SVR rates and as such the SVR did not reflect the average rate that borrowers were paying.

As a result, an alternative measure of interest, the Average Effective Rate (AER) was developed jointly by the Bank of England and ONS. This is more representative of mortgage rates available, covering around 90 per cent of bank and building society lending. The AER is calculated using the same data as the Bank of England's published effective rate which includes various mortgage rates weighted together based on market share. For the RPI, these rates are weighted by the relevant stock of mortgages each January. (For the calculation of the 'effective rate', the Bank reweights the index each month.) The AER is in line with the RPI concept of a fixed basket with fixed weights within each year. The final MIPs series then reflects both new and existing mortgages and is able to follow the evolution of the mortgage market.

The AER for any month cannot be compiled in time to be included directly in that month's RPI. However, the Bank of England forecast the effective rate for the current month using the latest available data and this was extended to produce a forecast AER. Such an approach is consistent with the methodology used to estimate the change in house prices within the MIPs series. The forecast is produced by weighting together a combination of fixed and floating rate mortgage series. The fixed rate series uses 2 and 5 year quoted fixed rates weighted together after taking 24 month and 60 month rolling averages respectively. The SVR is used for the stock of floating rates. The use of forecasting does have an effect on both the MIPs series and the all items RPI but any error introduced is much smaller than the difference between SVR and AER based series.

Re-weighting MIPs

At the annual RPI re-weighting, the LCF-derived data and the relative weights for different mortgage interest rates are all assessed and revised as necessary.

The various parameters used in the MIPs model need to be revised from time to time to ensure that the model continues to represent the experience of RPI index households. Those factors which affect the quantity of owner-occupied housing are reviewed annually, while those which affect the quantity of mortgage financing are reviewed more infrequently, usually being kept fixed for at least five years at a time. Under these guidelines, the sources and frequency of updating the model parameters are shown below.

Reviewed annually:

House prices: the DCLG house price data supplied to ONS are specially tailored for RPI purposes by excluding those house transactions where the mortgagors' household income given in the mortgage application is over the top 4 per cent threshold used to define index households. This threshold figure comes from the LCF and is reviewed each year.

Profile of length of time owner-occupiers have lived in their present houses: these data are used as a proxy for the profile of time since the initial mortgage was taken out, excluding owner occupiers of more than 23 years residence. Data are obtained from the LCF on an annual basis, and ONS interpolate these data into monthly values.

The repayment of capital profile, ie for repayment mortgages, the proportion of the initial mortgage which is still outstanding for each month.

Proportion of index households who are owner-occupiers and who have lived at current property for less than 23 years: these are derived from the LCF.

Reviewed periodically:

Proportion of mortgage borrowed for house purchase: previously obtained from the General Household Survey.

Proportions of endowment-type versus repayment mortgages, average initial length of mortgage (currently 23 years): data are obtained from DCLG and the Council of Mortgage Lenders' survey of mortgage lending.

Proportion of owner occupiers with duration of residence under-23-years with mortgages: data are obtained from LCF.

9.5.2 Owner-Occupiers' Housing Depreciation

Since January 1995, as a result of the recommendations of an RPIAC review of the treatment of owner-occupiers' housing costs in the RPI, a house depreciation component has been included in the RPI. Its inclusion represents the expenditure that all owner-occupiers would find necessary to maintain their house at a constant quality, the intention of the RPI being to measure prices of goods of constant quality.

Depreciation is measured at current replacement cost. It represents the notional amount needed to be put aside to cover large infrequent renovations required to make good deterioration and obsolescence and does not include routine repairs and maintenance covered elsewhere in the RPI. The cost of depreciation to owner-occupiers is a measure of the amount of housing 'consumed' in the current period and, combined with mortgage interest payments, provides a good approximation of the current cost of shelter to owner-occupiers while excluding the investment element of house purchase.

The RPIAC recommended that an index of house prices is used as a proxy for the depreciation component. To understand why this index was chosen as the price indicator, it is necessary to examine first how the weight for depreciation costs is calculated. The market value of the UK housing stock represents the price at which housing could be purchased at current prices, so using a proportion of market value as an RPI weighting component is consistent with the use of a house prices index as the price indicator. Ideally, it would relate to the price of dwellings excluding land, but there is no such index suitable for RPI purposes. Instead, the monthly house price index used is based on the DCLG house price used for MIPs (section 9.5.1).

Smoothing the user price series

From January 1995 to June 1996, the depreciation component of the RPI was based on the monthly DCLG house price index. However, this series is volatile, leading to volatility in the all items RPI. As the

depreciation component represents only notional, rather than actual expenditures, a smoothed version of the DCLG house price index (*not* the index used for MIPs) has been used since July 1996. The smoothed index was scaled to have the same level in June 1996 as the unsmoothed index, so that no step change occurred. The smoothed index is also used for ground rent, which is also a notional measure. However, the unsmoothed index is still used for MIPs and estate agents' fees, as these represent actual expenditures.

The smoothing technique used is exponential smoothing. If H_t is the house price index for the current month, S_t the smoothed index and H_{t-i} the index i months ago, then:

$$S_t = \alpha H_t + \alpha (1-\alpha)H_{t-1} + \alpha (1-\alpha)^2 H_{t-2} + \dots$$

For calculating the index, the following algebraically equivalent formula is used:

$$S_t = \alpha H_t + (1-\alpha)S_{t-1}$$

In practice, the DCLG house price index is not available until a month after it is needed. The current month's index for housing depreciation is therefore the smoothed index for the previous month calculated using the previous month's DCLG data. Each January, the resultant series is re-scaled to 100. The parameter α is currently set at 0.5. It is reviewed periodically. If the DCLG index is rising (or falling) steadily, the smoothed series will be systematically below (or above) the original. This does not introduce bias, as only the change in the smoothed index affects the RPI.

The weight of the depreciation component in the RPI is calculated by multiplying the previous end-year's average house price, excluding land, by a rate of depreciation derived from UK National Accounts data. This is then converted to obtain the notional weekly expenditure on depreciation by the average index household.

The rate of depreciation derived from UK National Accounts' data is the ratio of the capital consumption of household sector dwellings at current replacement cost to the gross capital stock of household sector dwellings for the previous year, expressed as a percentage. The rate of depreciation actually used is the average of the rates over the last ten years. This is reviewed annually.

The previous end-year's average house price is calculated by dividing the total value of owner-occupied housing stock (obtained from ONS National Income and Expenditure Division) by the total number of owner-occupied dwellings (obtained from DCLG). Then the average value of a small plot of building land, obtained from DCLG, is subtracted to arrive at an average value of an owner-occupied dwelling excluding land. This is recalculated during the annual RPI re-weighting.

9.5.3 Council Tax

The index is based on the average Band 'D' council tax bills across all households in Great Britain. Council tax bills for other bands are set as fixed proportions of the Band D bill and so the percentage change experienced by households occupying these homes will be the same as for a Band D property.

Information for England, Wales and Scotland is supplied by DCLG, the Welsh Assembly Government and the Scottish Government respectively. The average figures are weighted together using the number of chargeable properties in each country to give the overall figure for Great Britain. The index measures households' liability for council tax, rather than actual payments made, and is usually fixed for 12 months from April of each year, so the index increases only in April. However, "charge capping" of some local authorities' expenditure plans can cause the index to drop after April when the caps are implemented.

The average *level* of payments is slightly lower for index households than for all households. However, analysis of several years of LCF data shows no significant difference in year-on-year percentage *changes* in bills for index and for non-index households so no adjustment needs to be made to the price index. Use of the same sources for deriving the *weight* for council tax would, however, overstate the

expenditure. The weight is thus adjusted using data from the LCF so that only index households are included. The figures are also adjusted for discounts reflecting householders' status. Since the RPI weight should reflect actual expenditure rather than liability, a final adjustment is made to the weight to allow for the proportion of households that evade paying council tax.

Northern Ireland Rates

In Northern Ireland, domestic rates are still levied and there has been no community charge or council tax. The Department of Finance and Personnel in Northern Ireland supplies the average net domestic rates bill annually and an index is derived by comparing the current year's bill with the previous year's bill. The calculation involves working out the gross domestic poundage rate, and then multiplying this by the average domestic valuation to get the average gross rates bill per year. The average discount across all households is then removed from the gross figure to obtain the average net domestic rates bill per year.

9.5.4 Estate Agents' Fees

Estate agents normally quote a price for selling a house as a percentage of the house sale price, rather than as a fixed price. The price collection is done locally, and price collectors therefore collect the percentages charged (excluding VAT) by estate agents for average house prices for the region in which each location falls. The regional average house prices are obtained from the DCLG mix-adjusted house price indices by region. The percentage fees are then averaged to form regional stratum average percentage charges. These stratum percentages are then weighted together using HMRC data on total value of house transactions by region, to construct a national average percentage charge. This is applied to the national average house price (using the same house price as for MIPs, section 9.5.1), to work out an average cash price, onto which VAT is then added. These monthly average prices are then compared as usual with the previous January price to construct the item index.

9.6 Weights

As with the CPI, all of the weights used in compiling the RPI are updated annually to coincide with general review of the representative items in the basket (section 3.4). Chapter 6 describes how the RPI weights are calculated – many of the procedures are similar to those applied to the CPI. Where this is not the case, this is made explicit.

Differences in weights

Since the RPI includes expenditure relating to owner-occupied housing costs, additional weight information is sourced to represent housing depreciation, council tax and domestic rates and mortgage interest payments. Details of the calculation of the weights are provided below:

Mortgage Interest Payments

The basis of any weight used in the RPI is the average expenditure per index household per week in the base period. For mortgage interest payments, this is the current January figure produced by the model used to calculate the average weekly index household expenditure on mortgage interest payments (section 9.5.1).

Council Tax and Domestic Rates

The section weight for council tax and domestic rates is derived from the most recently available LCF data from the financial year of the current January. LCF data give the weekly average council tax liability after status discount among index households for each Government Office Region in Britain. It is necessary to stratify by region to take account of the differential survey response rates across regions. Otherwise, the lower response rates for some regions for which council tax liability is typically higher (eg London) would bias the result downward. A weighted average of the average liabilities in the nine English regions is derived using estimates from the Department for Communities and Local Government (DCLG) of the total number of households in each region. (These are not restricted to index households.) The figures giving the average liability for England, Wales and Scotland are adjusted to

reflect actual expenditure by using estimates of the respective non-payment rates (supplied from the DCLG, the Welsh Government and the Scottish Executive). In Northern Ireland, rates are still levied. The average level of rates (including water and sewerage charges) applicable in Northern Ireland, and an estimate of the number of households, are provided by the Northern Ireland Department of Finance and Personnel. The figures for average expenditure on council tax or rates (as appropriate) for England, Wales, Scotland and Northern Ireland are then combined to form a weighted average using the estimates of total number of households in each area.

Housing Depreciation

The section weight for owner occupiers' depreciation costs is calculated from an estimate of the previous end-year's market value of the owner occupied housing stock (from ONS National Accounts) divided by the number of owner occupied dwellings in the United Kingdom (from DCLG) with an estimate of the average land value per plot (also from DCLG) deducted. The resulting average owner occupied dwelling value excluding land is then multiplied by a rate of depreciation derived from UK National Accounts data (section 9.11.2). This is currently 1.4% per annum, but is reviewed every five years. The product is then multiplied by a factor, obtained from the LCF, representing the proportion of all households (owners and tenants) which are owner occupiers, and divided by 52 to give the notional weekly household expenditure on depreciation.

Insurance

As detailed in section 6.6.3, in the RPI, gross expenditure on insurance premiums is assigned to the relevant insurance heading when calculating the weights. In the CPI, only the difference between expenditure on insurance premiums and the amount paid out in claims (ie the service charge) is allocated to the relevant insurance heading; the amount paid out in claims is allocated to other relevant headings according to the nature of the claims (for instance, expenditure on repairing a car is attributed to the heading for maintenance and repair of vehicles). This calculation is based on the average of the most recent three years data.

This difference in approach means that the weight of insurance in the RPI is significantly higher than in the CPI, and so the impact of changes in the cost of insurance at the all-items index level is correspondingly larger. Overall, the combined weight for car, health, house contents and foreign holiday insurance in the RPI is around four times that in the CPI. However, note that the insurance indices themselves are constructed with reference to gross premiums paid both in the RPI and CPI.

9.7 Publication

The RPI is published in the *Consumer Price Indices Statistical Bulletin* and in the accompanying detailed *Briefing Notes* and data are also available electronically on the ONS website. Official indices for the RPI and its components are available monthly back to January 1947 and are based on 1987 = 100.

9.7.1 Annual and Quarterly Averages

The RPI approach to the calculation of quarterly and annual average indices differs from the CPI (see section 8.3). The RPI quarterly and annual indices are calculated as an average of the published rounded monthly indices. The resulting indices are then published rounded to one decimal place with changes over 12 months in the quarterly and annual average indices being calculated from these rounded quarterly and annual average indices.

9.7.2 Average Prices (RPI only)

Averages of prices collected for selected items (mostly food) can be found on the ONS website as part of the latest RPI Release as a downloadable Excel file. The items are those which are likely to be reasonably homogenous across all outlets and over time, so that an average price is reasonably meaningful. For each January, the number of valid prices for each item, the average and the 10th and 90th percentiles of the distribution of prices are calculated (these are weighted averages and percentiles, using stratum weights: section 6.4).

For subsequent months up to and including the following January, the figures are the January average price uprated by the price index for that item. Thus if the January average price is 94p and the May index (based on January = 100) is 103.0, the average price published is $94 \times 103.0 / 100 = 97\text{p}$. This method is used to avoid spurious changes in the published average price due to an inability to get all the necessary matching prices in months subsequent to the base month. However, it means that there may be discontinuities between the prices published for each January (uprated from the previous January) and those published for each February.

Historical average prices, with some series going back to 1914 in the RPI, are available from the Consumer Prices tables held in the Time Series section of the ONS website: <http://www.ons.gov.uk/ons/datasets-and-tables/data-selector.html?dataset=mm23>

9.7.3 Rounding Policy and the Effects of Rounding

Section 8.4 described how unlike the CPI, the RPI calculations are based on the published rounded indices, which can lead to some extreme rounding effects when publishing rounded indices to 1 decimal place, and then calculating percentage changes from these rounded indices which are then themselves rounded to 1 decimal place. Consider the example below illustrating this. It appears from published, rounded figures that the inflation rates for RPI excluding mortgage interest payments (MIPs) and RPI excluding Housing have both fallen by 0.1 percentage points (from 2.0 to 1.9 and 1.1 to 1.0 respectively). However, the picture based on unrounded figures shows RPI excluding MIPs to have increased by 0.1 percentage points (from 1.9 to 2.0) and RPI excluding Housing to have fallen by 0.3 percentage points (from 1.2 to 0.9).

Series		Unrounded	Rounded to 1 dp	% change (based on unrounded)	% change (based on rounded)
RPI excluding MIPs	Jul 2002	174.75	174.8	1.931=1.9	1.984=2.0
	Jul 2001	171.44	171.4		
RPI excluding MIPs	Aug 2002	175.34	175.3	1.966=2.0	1.919=1.9
	Aug 2001	171.96	172.0		
RPI excluding Housing	Jul 2002	165.44	165.4	1.156=1.2	1.100=1.1
	Jul 2001	163.55	163.6		
RPI excluding Housing	Aug 2002	165.65	165.7	0.920=0.9	0.975=1.0
	Aug 2001	164.14	164.1		

Note: These figures are fictitious examples only and should not be taken as being the real RPI unrounded figures in those months.

9.7.4 Internal Purchasing Power of the Pound (RPI only)

Changes in internal purchasing power of a currency are the inverse of changes in the levels of prices: when prices go up, the amount which can be purchased with a given sum of money goes down. The most appropriate way to measure changes in purchasing power depends on the periods between which the comparison is to be made and the context in which the figures are to be used. However, many people find it helpful to have a general indicator of changes in purchasing power which can be used for comparison over any period chosen. For a number of years, ONS has provided estimates of this kind. Because questions about changes in the purchasing power of the pound are usually asked in terms of what the domestic consumer can buy, the indicator must be one which reflects movements in the prices of goods and services purchased by the private domestic consumer, rather than those purchased by businesses or public authorities. Furthermore, these questions often relate to comparisons spanning several years. Continuity in the chosen indicator is therefore important.

In the UK, the RPI has measured changes in the level of consumer prices since 1947. It is therefore preferred to other sources (such as the CPI which has a much shorter history), for comparing the purchasing power of the pound over this period. In making comparisons, note that the figures relate to

national averages; they are not necessarily valid for any particular group or region. Also, because of continual changes in the pattern of household expenditure, comparisons over longer periods can only be regarded as approximate.

Examples

To find the purchasing power of the pound in one month, given that it was 100p in a previous month, the calculation is:

$$100 \times \frac{\text{Earlier month's RPI}}{\text{Later month's RPI}}$$

For example, if the purchasing power of the pound is taken as 100p in January 1993, its purchasing power in August 2002 is:

$$100 \times \frac{137.9}{176.4} = 78.2\text{p}$$

Longer term comparisons

For comparisons with years prior to 1947, a composite index back to 1800 is available at table 3.6 here: <http://www.ons.gov.uk/ons/datasets-and-tables/data-selector.html?dataset=mm23>

This index is not within the scope of National Statistics. It is obtained by linking together several different indices on different bases and can only be taken as showing approximate price movements over the whole period. The further you go back in time, the more approximate the comparisons are. An article on the ONS website describes and assesses in more detail the sources which make up this composite price index:

<http://www.ons.gov.uk/ons/rel/cpi/consumer-price-indices/1750---2003/index.html>

The sources for the period prior to 1947 are set out below.

1870-1947

During this period, the implied deflator for consumers' expenditure is used. This is derived from estimates of consumers' expenditure valued at current and constant prices taken from the unofficial National Accounts of the United Kingdom, prepared by the Department of Applied Economics at Cambridge University (source: C H Feinstein, *National Income, Expenditure and Output of the United Kingdom 1855-1965*, 1972, tables 24 and 25). During the period 1914-1947, an alternative index, the Cost of Living Index (COLI) produced by the former Ministry of Labour, also exists. The implied consumers' expenditure deflator is preferred to the COLI, mainly due to the latter's relatively limited coverage in terms of both products and population, together with concern about the quality of the weights. The COLI uses the same fixed weights during the entire period, based on a survey of expenditure patterns of urban working class households conducted in 1904. The weights were influenced by a highly subjective assessment of what constituted legitimate expenditure for a working-class family; beer was completely excluded and the weight used for tobacco was much less than the proportion of expenditure on tobacco.

1800-1870

For 1850-1870 a retail price index produced by G H Wood is used. This is constructed partly from statistics in the Board of Trade's Report on Wholesale and Retail Prices, and partly from data collected by Wood himself from Cooperative Society records (see Layton and Crowther, *An Introduction to the Study of Prices*, Appendix E. Table I, p 265). For years prior to 1850, the price index used is one compiled by Phelps-Brown and Hopkins (Seven centuries of the prices of consumables, *Economica*, November 1956, p 311). This covers the prices of consumables, drawn from a variety of sources: until the early 19th century, prices are generally based on the records from local markets or colleges in the South East of England. Subsequent to that, they are generally wholesale prices.

9.7.5 How to Construct Aggregates

As with the CPI, the indices for RPI groups and sections can be combined to suit users' particular requirements where the standard aggregates are not appropriate. The aggregate indices are calculated in a similar way to the CPI (as described in section 8.5), with the exception of part **a.**, where it is not necessary to divide the January index for each year by the previous year's December's index, since the RPI series is only chained-linked once a year.

9.7.6 Contribution to Changes in the All Items RPI

Like the CPI, it is often of interest to estimate the effect of a group or section on the change in the RPI. The contribution of a component to a change in the all items RPI over a given period of time is defined as the change that would have occurred in the all items index if that component had undergone its observed change but all other component indices had remained frozen at their values at the start of the period (and all weights are kept the same). The effect of each component depends on both the size of its change and its weight.

The formula for calculating the contribution of a component to the monthly change in the RPI is given below (note this formula differs from that used for the CPI):

Contribution of component i to monthly change in all items RPI =

$$\left(\frac{I_t^i}{I_{t-1}^i} - 1 \right) \times 100 \times \frac{I_{t-1}^a}{I_{t-1}^i} \times \frac{w_t^i}{1000}$$

For items with seasonal weights (such as fresh fruit and vegetables and unprocessed potatoes), the following formula is used:

Contribution of seasonal component i to monthly change in all items RPI =

$$100 \times \frac{\frac{w_t^i}{1000} \times I_t^i - \frac{w_{t-1}^i}{1000} \times I_{t-1}^i}{I_{t-1}^a}$$

The formula for calculating the contributions of components to the all items RPI 12 month rate is as follows:

Contribution of component i to annual change in all items RPI =

$$\frac{w_{t-12}^i}{1000} \times \frac{(I_L^i - I_{t-12}^i)}{I_{t-12}^a} \times 100 + \frac{w_t^i}{1000} \times \frac{(I_t^i - 100)}{I_{t-12}^a} \times I_L^a$$

where:

i = component i

a = all items RPI

I_t^i = index for component i (base previous January = 100) in month t

I_L^i = index for component i in 'Link' month, ie index for current January based on previous January = 100

w_t^i = weight (parts per 1000) of component i in all items RPI in month t

As the definition of the variables above makes clear, it is important that these calculations are performed using unchained (ie base period January =100) indices. The following example illustrates this point.

Example calculation

Using the formula above, the contribution of housing to the RPI all items annual rate for October 2003 can be calculated using the following steps.

The published (chained) index values, based on January 1987=100, for housing and the all items RPI are as follows:

Published (chained) index (Jan 1987=100)

	Jan 2002	Oct 2002	Jan 2003	Oct 2003
Housing	218.4	232.8	236.7	248.3
All items	173.3	177.9	178.4	182.6

In order to work out the contribution of housing to the all items RPI 12-month rate for September 2003, it is necessary to unchain the indices so that they are based on the most recent January. This is done by dividing the current month's index by the previous January's figure. For instance, the housing index for Jan 2003 (the link month) is calculated as:

$$I_L^j = \frac{236.7}{218.4} \times 100 = 108.38$$

Performing this calculation for each of the dates gives the following set of unchained index values.

Unchained index based on previous January

	Jan 2002	Oct 2002	Jan 2003	Oct 2003
Housing	100.00	106.59	108.38	104.90
All items	100.00	102.65	102.94	102.35

The contribution of housing to the 12-month rate for October 2003 can then be calculated as follows, given that the weights for housing in 2002 and 2003 are 199 and 203 parts per thousand respectively:

$$\text{contribution} = \frac{199}{1000} \times \frac{(108.38 - 106.59)}{102.65} \times 100 + \frac{203}{1000} \times \frac{(104.90 - 100)}{102.65} \times 102.94 = 1.34\%$$

Thus housing contributed 1.34 percentage points to the all items RPI 12-month rate in October 2003. The way that these contributions to the annual rate are usually used is as follows: for any given month (eg October 2003) the contribution of each group to the 12-month rate is calculated. This is also done for the previous month (September 2003 in this case). The October contribution less the September one is described as the contribution to the *change* in the all items 12-month rate between the two months. Thus housing contributed 1.40 points to the 12-month change to September and 1.34 points to the change to October, so it contributed $1.34 - 1.40 = -0.06$ points to the change in the 12-month rate between September and October which was $2.6 - 2.8 = -0.2$ percentage points.

Contributions are derived with maximum precision at every stage of the calculation and, in order to provide meaningful analysis, are published to 2 decimal places. However, the RPI is given as a unique official figure which, while also computed to maximum precision, is published rounded to the nearest single decimal place.

9.7.7 Reconciliation of RPI and CPI Annual Rates

There is often interest in understanding the factors contributing to differences between the RPI and CPI 12-month rates of change. ONS publishes each month a reconciliation of these differences. The reconciliation between the headline rates is performed using contributions (see sections 8.7 and 9.7.6), based on the contributions of the following elements:

- *housing components included in the RPI but excluded from CPI*: this shows by how much the annual rate for the RPI would be different if it did not include the following housing elements which are excluded from the CPI: mortgage interest payments, council tax, housing depreciation, buildings insurance and ground rent, surveyors' fees, estate agents' fees and conveyancing costs.

Within this category, the contributions from mortgage interest payments and the other housing components are shown separately

- *other differences in coverage of goods and services*: this shows the effect of other differences between the RPI and CPI in the coverage of goods and services (section 9.2). This includes items such as unit trust and stockbroker charges, overseas students' university fees and accommodation costs in university halls of residence, which are included in the CPI but excluded from the RPI. Prior to 2012, vehicle excise duty, trade unions' subscriptions and TV licences would have also contributed to the difference in coverage, since these were previously not included in the CPI but are included in the RPI
- *formula effect*: this shows the effect on the CPI annual rate of using the geometric mean for elementary aggregation, as opposed to the arithmetic means used in the RPI. This is derived by recalculating the CPI using arithmetic means and subtracting the result from the actual CPI. In general, the geometric mean of a given set of values is lower than the corresponding arithmetic mean. This means that, for a given set of price relatives, the geometric mean formula used in the CPI will produce a lower estimate of price change for an elementary index than one based on an arithmetic mean. For this reason the formula effect is consistently negative
- *other differences, including weights*: this is then calculated as the residual of the additive components above. Some of the main contributors to the component tend to be differences in weights for insurance, petrol and oil, air fares, food and clothing and footwear

Further detail of this method can be found at <http://www.ons.gov.uk/ons/guide-method/user-guidance/prices/cpi-and-rpi/consumer-price-index-and-retail-price-index---analysing-differences.pdf>

Prior to June 2010, a different method was used to reconcile the difference between the RPI and CPI annual rates of inflation. This is detailed in the 2010 version of the Consumer Prices Technical Manual.

Chapter 10 Alternative Inflation Measures

10.1 Introduction

The ONS publishes two main measures of consumer price inflation: the CPI, which is the main measure of inflation for macroeconomic purposes and for international comparisons, as well as its other uses by government, businesses and society in general (see section 1.4); and the RPI, whose uses include the indexation of index-linked gilts. Each provides, for the different populations covered by the two indices, an average measure of the change in the prices of goods and services bought for the purpose of consumption in the United Kingdom. However, it is well recognised that particular types of household, and indeed each individual person, may experience different rates of inflation, and that summary inflation measures like these cannot meet all users' needs. The ONS therefore produces other inflation measures, which may be more suitable for particular purposes. These include the following indices, based on the CPI:

- CPIY, which excludes the effect of indirect taxes (eg tobacco duty)
- CPI-CT, which holds tax rates constant at the rate prevailing in the base period and is used to show the effect of changes in indirect taxes on the inflation rate
- special aggregates, which relate to areas of the CPI where price movements are typically more volatile or are influenced by specific factors such as changes in commodity prices, including oil (eg fuels and seasonal food) or government policy changes (eg alcohol and tobacco that are subject to duty)

The ONS also publishes the following indices, based on the RPI:

- RPIY, which excludes the effect of mortgage interest payments (MIPs) and indirect taxes
- Tax and Price Index, which allows for the effect of changes in direct taxes (eg income tax)
- Rossi Index, which is used to uprate income-related benefits
- Pensioner Price Indices, which measure the inflation rate of pensioner households mainly dependent on the state for their income

Other price indicators prepared by the ONS, such as the Producer Prices Index, the Service Producer Prices Index and the GDP deflator, measure inflation as it affects various parts of, or the whole, economy. For some specialist purposes, measures produced by other bodies, such as an index of commercial rents, may be appropriate.

Even if the CPI or RPI is the best measure for a particular purpose, they are, like most statistical indicators, only estimates, subject to sampling and non-sampling errors.

10.2 CPI and RPI Special Aggregates

Each month, the ONS publishes detailed indices for the CPI and RPI at the level of detail shown in appendices 3 and 4. In addition to these, a number of special aggregates are published in the '*Consumer Price Indices Statistical Bulletin*' and accompanying '*Briefing Notes*' to aid analysis and interpretation of the inflation figures.

For the CPI, these additional indices include more detailed analysis of goods and services inflation, together with indices calculated by excluding various components from the all items CPI. These indices have been constructed by aggregating together relevant CPI classes, and use the same principles underpinning the compilation of all other published CPI aggregates (as explained in section 2.5).

A range of special aggregates are also published for the RPI. This includes a breakdown by various categories of goods and services, and a selection of indices derived by excluding certain components from the all items RPI. The latter includes RPIX – the all items RPI excluding mortgage interest payments (MIPs) - which was the basis for the Government's inflation target until December 2003.

10.3 CPIY

CPIY is an index designed to measure movements in “underlying” prices, excluding price changes which are directly due to changes in indirect taxation. The purpose of the index is to get a better indication of inflationary pressures at times when other price indices are directly influenced by Government-driven changes.

Taxes and duties that directly affect retail prices are excluded, namely excise duties (on tobacco, alcohol and petrol), VAT, Insurance Premium Tax, Air Passenger Duty, vehicle excise duty and Stamp Duty on share transactions. For simplicity, all of these are referred to below as taxes.

The all items CPIY index is published monthly, based on 2005=100.

10.3.1 Methodology

CPIY does not model the actions of retailers in phasing in changes to tax rates. At all times, the prices used for CPIY are the residual prices after excluding the relevant level of applicable taxation in that month. If, for example, the duty on a pint of beer is increased by two pence per pint in the Budget (with immediate effect), CPIY assumes that the prices collected from that moment onwards will include the increased duty, whereas in reality, retailers may hold their current prices for a period (especially while they continue to sell pre-Budget stocks still held in shops) and may even absorb a taxation increase completely. This feature is unavoidable as it would be very hard to distinguish between a genuine price change and a change due to tax changes. In consequence, CPIY is not completely unaffected by tax changes; delays in passing on a tax increase can mean that CPIY can fall following a tax rise.

10.3.2 Weights

CPIY does not use a model of economic behaviour, so does not predict what prices or demand would be in the absence of taxes. This is important in deriving the weights. The approach adopted is to remove that part of expenditure from the weights which is due to tax, then to pro-rate up to 100 per cent. Consequently, a commodity like tobacco, which has high levels of tax, has a much reduced weight compared to the CPI.

Like the CPI, CPIY class weights change with effect from the January index each year, while the CPIY item weights change in February to take account of changes in the basket and updating of the CPI item weights on which the CPIY weights are based.

10.3.3 CPIY item indices

The CPI compares prices in a given month with January base prices; CPIY compares prices excluding indirect taxes in a given month with prices excluding indirect taxes in the January base month.

CPIY is calculated from individual price quotes from which taxes are deducted. The calculation proceeds in the same way as for the CPI. Stratum level indices are computed which are then arithmetically weighted to give CPIY item indices (each item has one or more strata - items are stratified by region, shop type, both or neither). The stratum weights are the same as those used in compiling the CPI.

Taxes deducted are an average for the item in question. This means that the same average tax rate is deducted from each price quote within an item, regardless of the product specification of the individual quote. For most items this is not an issue because the actual tax paid is the same as the average rate. However, for alcohol, the duty payable depends on the volume of pure alcohol being purchased. Although the alcohol content and volume of drink are recorded, this information is not held in a way that is readily usable in calculations. Instead, average alcohol content and volume are estimated for each item and an average duty payable is calculated.

10.3.4 Aggregation

Aggregation of CPIY item indices and higher aggregate indices proceeds in a similar way to the CPI. As for the CPI, item indices are calculated with reference to the previous January. They are then aggregated to class and higher level indices, which are then chained to provide indices based on 2005=100.

10.3.5 Comparing CPIY with CPI

As the weights are different, CPIY can move differently from CPI even if taxes are unchanged. For example, fruit has a higher weight in the CPIY (because there is no VAT on unprocessed food), so if fruit prices rise more than other prices, CPIY will grow faster than CPI. For those items subject to duty, retailers sometimes temporarily delay implementing a duty rise. The calculation of CPIY assumes that duty changes are passed on immediately and in full. If the increase in duty has not been applied by the retailer, stripping out the new rate of duty may mean that the CPIY will fall initially, and then recover. Thus CPIY can be more volatile than CPI after a tax change.

For items not subject to taxes, the CPIY item indices are the same as CPI item indices. This is also the case for items subject only to proportional taxes, such as VAT, as long as there are no changes in tax rates. For items subject to flat rate taxes, such as alcohol or tobacco duty, the CPIY and CPI item indices can differ even when there are no changes in taxes. This is because price changes represent a greater proportion of the price excluding taxes used in the CPIY calculation, than the price including taxes used for the CPI. However, this effect does not distort CPIY to the same extent, since any item with high tax levels will also have a reduced weight.

It is found that when the prices excluding average taxes are calculated, a very small number of price quotes (typically, one or two out of more than 110,000 per month) are found to have negative prices, ie the price including taxes is less than the average tax applied. These negative prices are excluded from the CPIY calculations. They can occur if the product is a loss leader, or the product is on sale where the actual tax payable on the product is less than the average for the item.

It is also found that some of the prices excluding taxes are very low. These have the effect of reducing the geometric mean price, and hence the CPIY item index, relative to the CPI index. This is illustrated in the following example where the CPI and CPIY indices are calculated for an item comprising two equally weighted products, where the average tax for the item is £2.30 in both the current and base periods.

Worked example of CPIY calculation

	CPI: Including taxes			CPIY: Excluding taxes		
	Base price	Current price	Price relative	Base price	Current price	Price relative
Product 1	£4.00	£4.50	1.13	£1.70	£2.20	1.29
Product 2	£3.00	£2.50	0.83	£0.70	£0.20	0.29
Geometric mean price	£3.46	£3.35		£1.09	£0.66	
Item index			96.8			60.8

	RPI: Including taxes		RPIY: Excluding taxes	
	Base price	Current price	Base price	Current price
Arithmetic mean price	£3.50	£3.50	£1.20	£1.20
Item index		100.0		100.0

The geometric mean formula implicitly assumes that consumers will switch purchases of particular brands to cheaper alternatives when price relatives change. In the example above, this implies a greater degree of substitution towards Product 2 when taxes are excluded. The table also shows that the equivalent RPI/RPIY calculation, using the ratio of arithmetic means, leads to both indices being 100. This illustrates another point, that differences between CPI and CPIY do not necessarily imply similar differences between RPI and RPIY.

10.4 CPI-CT

CPI-CT is defined as an index where tax rates are kept constant at the rates that prevail in the base period. The index is chain linked annually, and the base tax rates updated accordingly. CPI-CT uses the same weights as the CPI. The analytical value of CPI-CT arises when it is compared against the CPI. Differences in the rates of change of the two indices show the contribution of tax changes to the overall CPI inflation figures.

Like CPIY, the CPI-CT calculation assumes that tax changes are passed on immediately and in full. It works backwards from the observed average price in the period following the tax change, stripping out the new taxes and adding on the base period taxes. To the extent that increases in taxes are not passed on immediately to customers (eg until existing stocks are run down), CPI-CT will over-estimate the effect of tax changes in the first month. This is because it will strip out too much tax, leading to a lower monthly change in CPI-CT than would apply. The difference in monthly rates between CPI and CPI-CT from the tax change would therefore be higher in the first month (ie over-estimated).

The all items CPI-CT is published monthly, along with the following sub-indices: all goods, all services and energy. All indices are based on 2005=100. Comparable measures of CPI-CT are constructed in other countries of the European Union, and Eurostat publish EU and Eurozone averages.

10.4.1 Calculation and interpretation of CPI-CT

CPI-CT class and item weights are the same as those used for the CPI and aggregation of the CPI-CT item indices proceeds in an identical way to the CPI.

The CPI-CT item indices are obtained by deducting current period taxes, using average tax rates for the item, and then adding back in the average tax rates prevailing in the previous base month. This is then compared against the corresponding geometric mean price in the base period. This is illustrated in the simple example below, where the base month is December and flat rate taxes increase in February.

As noted earlier, the analytical value of CPI-CT arises when it is compared against CPI. As the same weights are used in each index, differences in their inflation rates can, in the main, be attributed to the

effect of tax changes. In the table below, the final column compares the one-month changes in CPI and CPI-CT. It shows that, in February for example, 2.67 percentage points of the total change of 6.67 per cent is attributable to the change in tax rates.

Worked example of CPI-CT calculation

Month	Basic Price	Flat rate tax	Observed Price	Price Constant Tax Amount	at Index of observed prices	Index with Constant Tax Amount	Observed price monthly rate (CPI)	Constant tax amount monthly rate (CPI-CT)	Difference (CPI-CPI-CT)
	(a)	(b)	(c)=(a)+(b)	(d)=(a)+(b) _{Dec}	(e) _t =(c) _t / _{(c)_{Dec}}	(f) _t =(d) _t / _{(d)_{Dec}}	(g) _t =(e) _t / _{(e)_{t-1}}	(h) _t =(f) _t / _{(f)_{t-1}}	(i)=(g)-(h)
Dec	3.00	0.60	3.60	3.60	100.0	100.0			
Jan	3.15	0.60	3.75	3.75	104.2	104.2	4.17%	4.17%	0.00%
Feb	3.30	0.70	4.00	3.90	111.1	108.3	6.67%	4.00%	2.67%
Mar	3.45	0.70	4.15	4.05	115.3	112.5	3.75%	3.85%	-0.10%
Apr	3.60	0.70	4.30	4.20	119.4	116.7	3.61%	3.70%	-0.09%

The table also illustrates two other features of CPI-CT:

- when there are no changes in tax rates during the course of the year, CPI-CT monthly rates are the same as CPI
- small differences in CPI and CPI-CT monthly rates can arise in the months following a change in flat rate taxes, such as fuel duty (in the example, CPI-CT rises slightly faster than CPI, although the gap narrows over time). The discrepancies do not arise if it is proportional taxes that are changing

CPI and CPI-CT 12-month rates can also be compared to show the impact of tax changes on the annual inflation rate. As with the monthly rates, small changes in the differences in CPI and CPI-CT annual rates can arise in months following tax rate changes, even when there are no further changes in the tax rate.

10.5 RPIY

RPIY – the all items RPI excluding mortgage interest payments (MIPs) and indirect taxes - is an index designed to measure movements in core prices, excluding price changes which are directly due to changes in indirect taxation and interest rates. The purpose of the index is to get a better indication of inflationary pressures at times when other price indices are influenced by Government-driven changes.

The following items in the RPI are excluded from the RPIY calculation: mortgage interest payments, local authority taxation (domestic rates, community charge, council tax) and vehicle excise duties. Also excluded are all taxes and duties that directly affect retail prices, namely other excise duties (on tobacco, alcohol and petrol), VAT, Insurance Premium Tax, Air Passenger Duty and, previously, Car Purchase Tax. For simplicity, all these are referred to below as taxes, although technically some are not.

10.5.1 Methodology

The methodology used to construct RPIY follows that of the equivalent index calculated for the Consumer Prices Index (see section 10.3). Like CPIY, RPIY does not model the actions of retailers in phasing in changes to tax rates. At all times, the prices used for RPIY are the residual prices after excluding the relevant level of applicable taxation in that month.

There are some issues in the construction of RPIY which are not clear-cut, as there is no standard methodology to follow. Some items, such as prescription charges and television licences, are

determined by the Government but are included in RPIY because they represent elements of a payment for a good or service.

Direct taxes on factors of production (eg employers' national insurance contributions) or on intermediate production stages (eg petroleum revenue tax) have no direct effect on retail prices and are not removed. There is a case for identifying and excluding subsidies since a subsidy is in effect a negative tax, but it is virtually impossible to track individual subsidies and determine their effect on price movements. Thus RPIY is not a 'factor cost' index.

10.5.2 Weights

RPIY does not use a model of economic behaviour, so does not predict what prices or demand would be in the absence of taxes. This is important in deriving the weights. The best way to do this is debatable - the approach adopted is to remove the part of expenditure which is due to tax from the weights and also remove the weights of those items excluded, then to pro-rate up to 1000. Consequently, items like tobacco, which has high levels of tax, has a much reduced weight. The justification for this approach is that RPIY does not predict what would have happened if there were no indirect taxation; changing weights to reflect the likely increase in tobacco consumption if there were no taxation imposed would lead to changes in tobacco prices overly affecting the index.

Weights are obtained from the RPI weights; those derived from the Living Costs and Food Survey (LCF) are adjusted using the tax rates prevailing at the date of the survey. The 2012 weights use LCF data from July 2010 to June 2011, so were adjusted using average tax rates for that period.

10.5.3 Calculation of RPIY

The starting points are the item level indices from the RPI and the modified set of weights. The same prices, stratum weights and aggregation up to and including item level indices are used as for RPI. However, RPI item indices must be converted into RPIY item indices before further stages of aggregation. All items fall into one of four categories:

- a. subject to neither VAT nor other taxes
- b. only subject to VAT
- c. only subject to a tax/duty other than VAT
- d. subject to both VAT and some other tax

Most items are in one of the first two categories; few categories of goods have taxes other than VAT. Most items liable for some tax are liable for VAT, so items in category c are rare (not subject to VAT may mean that the item is zero rated, exempt or out of scope).

The RPI compares prices in a given month with base prices; RPIY compares prices excluding indirect taxes in a given month with prices excluding indirect taxes in the base month. Only average prices for each item can be used to calculate exclusion/conversion factors (characteristics used to define each item); it is impossible to remove tax levels from every individual price since, in some cases, the relevant information is not collected. For example, to remove tax from the price of a particular alcoholic drink requires the alcohol content to be known, and although this is recorded, it is not held in a way that is readily usable in calculations. Instead, an estimate of average alcohol content is calculated for each item, and the relevant tax rate applied.

For items not subject to taxation, the RPI indices are used unchanged. For items subject only to VAT, which is levied as a percentage of the retail price, it is easier to use index numbers than average prices for the calculation. The index less the proportional tax level in the current month is expressed as a percentage of that in the base month to derive a new index. However, it will only differ from the RPI index if the VAT rate has changed inbetween. If VAT is imposed on a previously untaxed item, this is treated as a change in VAT rate from 0% to the appropriate rate.

Other taxes and duties are usually levied in cash terms (say £1.60 on a bottle of wine) rather than as a percentage. Thus, for items subject to duties, it is necessary to use price levels rather than index numbers to remove the effects of duties. Also, an inflationary rise on an item (due to factors other than change in duty) has more effect if tax is excluded, so the RPIY index will differ from the RPI index. For example, for a good which retails at £2.50 (including 50 pence tax in the base period) increased in price by 25 pence:

	RPI:			RPIY:		
	base price	=	£2.50	base price	= £2.00	
	current price	=	£2.75	current price	= £2.25	
So	RPI Index	=	110.0	<i>but</i>	RPIY index	= 112.5

It follows that for items with higher levels of taxation, there will tend to be larger differences between the RPI index and the RPIY index. However, this effect does not distort RPIY to the same extent, since any item with high tax levels will also have a reduced weight.

The table below shows a hypothetical price calculation for cigarettes, which are subject to both VAT and duty. In practice, the data allow more disaggregation, so several brands (representative items in this example) can be treated separately. For the weight calculation, the RPI weights are multiplied by the ratio of net price to average price each January; after all weights have been calculated, they are re-scaled to sum to 1000.

Analysis for cigarettes

Month:							
Jan	RPI	Average	VAT	Price	Duty	Net	RPIY
	index	price, £	rate, %	ex-VAT	£	price	index
1987	100.0	1.43	15.0	1.24	0.95	0.29	100.0
1988	101.7	1.45	15.0	1.26	0.96	0.30	102.5
1989	105.9	1.51	15.0	1.31	0.99	0.32	110.1
1990	108.4	1.55	15.0	1.35	1.00	0.35	118.5
1991	118.4	1.69	15.0	1.47	1.10	0.37	125.9
1992	138.0	1.97	17.5	1.68	1.27	0.41	138.5
1993	150.8	2.16	17.5	1.84	1.40	0.44	149.3
1994	167.8	2.40	17.5	2.04	1.61	0.43	147.4

As for the RPI, all of the item indices are calculated for each year based on the previous January equalling 100, then aggregated to section and higher level indices, which are then chained back to provide indices based on January 1987 = 100.

10.5.4 Comparing RPIY with RPI

As the weights are different, RPIY can move differently from RPI even if taxes are unchanged. For example, fruit has a higher weight in RPIY (because there is no VAT on unprocessed food), so if fruit prices rise more than other prices, RPIY will grow faster than RPI. For those items subject to duty, retailers sometimes temporarily delay implementing a duty rise. The calculation of RPIY assumes that tax changes are passed on immediately and in full. If the increase in duty has not been applied by the retailer, stripping out the new rate of duty may mean that the RPIY will fall initially, and then recover. Thus RPIY can be more volatile than RPI after a tax change.

10.6 Tax and Price Index (TPI)

The RPI measures the change in the amount of money required to purchase a given basket of goods and services. The TPI measures how much the average person's gross income needs to change to purchase the basket, allowing for the average amount of income tax and national insurance paid on

earnings. The TPI calculation involves a number of simplifying assumptions, and there is no distributional analysis even though the net impact of changes in incomes, prices and taxes may vary widely across different income groups.

The TPI is almost unaffected by a shift between direct and indirect taxation, which can distort the RPI. When income tax or national insurance is raised, the TPI will increase faster than the RPI and vice versa. It is thus answering a different question from the one for which the RPI is relevant and is appropriate for different uses. It is mainly used by economists for comparison with average earnings. If these rise more slowly than the TPI, then there has been a decline in the real purchasing value of gross earnings.

10.6.1 Calculation of the TPI

The data used for calculating the TPI is sourced from the HM Revenue & Customs' (HMRC) Survey of Personal Incomes (SPI). This is a representative sample of taxpayers' records that is used by the HMRC to model the effects of tax changes. The SPI produces estimates of tax revenues and hence post-tax net income for a given aggregate gross income level. For the composition of the TPI, the calculation is reversed: we calculate the gross income that will yield a given net income after tax. HMRC supply tables showing tax revenue and net income for a range of gross income levels. To be consistent with the RPI, the sample used for the TPI calculations excludes persons with incomes in the top 4% of the income range.

The base net income for people, excluding the top 4% and non-taxpayers is multiplied by the change in RPI from January of the current year and matched to the corresponding gross income by using SPI tables and then interpolating. An index is calculated by comparing this gross income level with that corresponding to base net income. The resultant series is annually chained in the same way as RPI.

To see how incomes are changing in real terms, it is necessary to look at the quarterly series of real personal disposable income. Calculations of the real net income of families at different multiples of average earnings are prepared by the HMRC, although these figures are not regularly published. Both of these show how real after-tax incomes are changing on average, taking account of direct tax changes. However, a change in the level of real income can be produced either by a change in the costs facing consumers (changes in prices or changes in direct tax deductions) or by a change in gross incomes, unconnected with any change in costs.

The TPI supplements existing statistics by encompassing the combined effects of changes in prices and taxes on households. Measures of real levels of income thus retain their separate function of showing how real incomes have actually changed, after taking account of changes in prices and taxes.

As changes in tax rates do not affect people who do not pay tax, the coverage of the index is confined to those who do pay tax. The coverage also excludes the highest income groups who are affected by income tax differently from the majority of people. Otherwise, all taxpayers are represented in the index and tax is calculated for all types of income.

The TPI can be formulated in two different ways:

- a. As an index of taxes and prices formed by weighting together changes in prices (measured by the RPI), with a weight equal to average net income, and changes in taxes, with a weight equal to average taxes. The indicator of taxes is the ratio of the tax liability in a particular month to that in a base period for taxpayers whose net income is maintained in real terms
- b. As an index of the gross income which maintains net income in real terms, allowing for changes in prices (through the RPI) and changes in taxes

It can be proved that these two approaches are equivalent.

The starting point for the calculation of the index is a sample survey of tax records which provides the basic data on income and taxes. Because the latest available data are not up-to-date, they are projected to the current period. The coverage is then restricted so as to correspond with the population to which the TPI is intended to represent.

10.6.2 Description of the Survey of Personal Incomes

The most convenient data source for tax calculations is the SPI. This survey, which in 2007/08 comprised about 595,000 tax returns, forms the basis of the HMRC calculations of the cost of Budget changes. For this purpose, the data relating to the taxpayers covered by the survey in the latest survey year are projected to the current financial year, based on the latest HM Treasury's economic assumptions.

Details of the SPI are published on the HMRC Website: www.hmrc.gov.uk. The SPI consists of a stratified sample of all taxpayers about whom information is available to the local offices of the HMRC. To obtain accurate information on the total income of the individuals in the sample, it is necessary to wait beyond the end of the tax year to which the sample relates. Survey results are normally available in the summer a year from the end of the financial year.

HMRC has a detailed system for projecting the level of income of the persons in the sample from the survey year to any later date. Projection factors are applied to each element of the income of each individual in the base sample. Different factors are applied to wages and salaries, self-employment income, national insurance pensions, company dividends, etc. Factors are available for nine items of income and also for certain deductions available for tax purposes. For wages and salaries, the factor that is applied depends on size of income, which is split up into six bands. The factors are derived from the ONS Annual Survey of Hours and Earnings (approximately 1% sample of employees' PAYE records) and are updated annually. For the other income elements no differentiation is made for size of income – ie no attempt is made to forecast changes in the distribution of income other than those arising from different movements in the different elements of income.

This system is used for constructing the TPI, which is intended to measure changes in gross income which would maintain net income in real terms. The RPI measures the changes in net income which would maintain its purchasing power, and the weighting for the index is adjusted each January. For this reason the projected gross incomes on which the TPI is calculated are also changed each January.

More detailed notes on the projection are given in the next section but, in essence, the income of the sample of tax units in the latest available SPI is projected forward to each January to form the base for calculation of the tax component of the TPI in each year. For each tax unit in the sample, an estimate is then made of the annual rate of receipt of income at the turn of each calendar year, and the tax liability appropriate to this level of income is calculated. With knowledge of the tax structure and of the changes in prices through the year, the gross income which maintains the real net spending power of each tax unit in the base period is obtained.

First, however, some restrictions have been applied to the coverage of the index to increase its representativeness. The index is intended to add taxes to the domestic costs covered by the RPI. It would therefore not be appropriate to include non-taxpayers, for whom the RPI or the associated indices for pensioner households give the appropriate measure of the changes which would maintain the purchasing power of both net and gross incomes.

The changes in income tax payments for high income tax units are not necessarily representative of those for the majority of taxpayers. Exclusions have therefore also been made at the top of the income distribution: the top 4% are excluded, as in the RPI (though tax units are not necessarily identical to households).

The SPI covers both taxable income and non-taxable components of earned income. The latter includes gift aid, covenanted payments to charities and the imputed value of employees' superannuation

contributions. This means that the index is measuring the effect of changes of prices and tax in relation to income, comprising earnings, self-employment income, pensions, and investment income. If the level of tax-free social security benefits is changed, this will have no effect on the index, since these are not changes in either taxes or prices.

10.6.3 Calculations

The starting point for the calculation of the TPI is therefore the sample obtained in the SPI, with the appropriate exclusions, and with the incomes of the tax units in the sample projected forward to represent the position of January of the year for which the index is calculated. Next, it is necessary to calculate the level of gross income which will maintain net income in real terms. For the purposes of HMRC costings of Budget changes etc, computer programs were already available to calculate the tax liability for each taxpayer, and to calculate the change in taxation resulting from increases in gross income or changes in the tax allowances and rates. The standard programs permit the income of each taxpayer in the sample to be increased by a given percentage and for the tax then to be recalculated. Thus the changes in net income resulting from a particular percentage change in gross income are readily available.

This calculation is not precisely appropriate to the TPI where the converse is required, ie the change in gross income which would yield a given uniform change in net income derived from the application of the RPI. The difference arises because tax units with different marginal rates of tax will have different changes in net income for the same increase in gross income. Nevertheless, this calculation has been used. It can be shown that the likely bias resulting from this method of estimation is negligible.

In all the calculations, employees' national insurance contributions are taken to be an element of taxation.

10.6.3.1 Date at which Budget changes take effect

Problems arise in deciding from which month Budget changes should be taken to have effect. Individuals' tax liabilities, of course, are based on the tax rates and allowances which finally obtain for the financial year. Even if these are introduced some way into the financial year, they take effect retrospectively from the beginning of the financial year. Even where changes are announced in the Budget of a year, they cannot be implemented immediately for administrative reasons. Normally, changes in allowances are implemented about a month after the date of their announcement, but other changes, such as a change in the basic rate of tax, require longer to implement.

It is not appropriate for month-to-month movements in the TPI to reflect purely administrative delays in the implementation of new tax rates. However, where changes in tax rates are deliberately made some way into the financial year, it seems appropriate that this timing should be reflected in the index.

The procedure adopted, therefore, is that changes in tax rates and allowances are assumed to operate from the beginning of the financial year in question, unless their announcement is not connected with the annual Budget. In the period covered by the TPI, this means that all tax rates and allowances are assumed to operate from the beginning of the financial year.

A large number of detailed points were considered in deciding on the appropriate method of calculating the TPI. Notes on the more important of these are given below.

10.6.3.2 Accruals of tax

Tax is calculated on annual income, and therefore the tax calculations in the TPI have been made on the annual rate of income each month. That is, the income at the January base has been estimated at an annual rate and the appropriate tax calculated on this annual income at the tax rates and allowances in force. For subsequent months, the appropriate percentage increase in gross income has been estimated in order to produce the required percentage increase in net income, with the tax calculations continuing in annual terms. Therefore, in a sense, the tax calculations represent accruals of tax, or the

rate of incurring tax liability at a particular level of income if it were continued over a whole financial year. In fact, if a taxpayer's marginal rate does not change during the course of the year, his or her tax deductions under PAYE would be the same as those given by the present calculation.

10.6.3.3 Tax credits

Tax credits can take a variety of forms. They often involve an element which reduces the amount an individual pays in tax; they may also include an element of benefit payments. Examples are the Working Families' Tax Credit, the Disabled Person's Tax Credit Benefit and the Children's Tax Credit each of which existed until March 2003, and their replacements, the Working Tax Credit and the Child Tax Credit, which came into effect in April 2003.

Tax credits which are integrated into the tax system are treated as negative taxation in the TPI for the amounts where the credit is less than or equal to the tax liability. Otherwise, they are treated as benefit payments and not included in the TPI. The Working Tax Credit and the Child Tax Credit are taken into account in the TPI because entitlement is based on annual income in a tax year; the measure of income is closely aligned with the measure of income used for tax purposes; and entitlement and payments adjust during the year to reflect changes in income and circumstances. This is not the case for the tax credits they replaced, which are treated as benefit payments for TPI purposes.

A different type of tax credit is the Dividends Tax Credit. Dividends on shares are paid net of a tax credit, which is calculated at a rate of 10% of the gross dividend payable. This credit is available as a deduction against the tax liability arising from the income from dividends, and is imputed as additional gross income and additional tax paid in the SPI.

10.6.3.4 National Insurance Contributions

Information on national insurance contributions is not available in the SPI. Therefore, for the purpose of deriving the TPI, calculations of liability for national insurance contributions are made on the basis of the rates of receipt of wages and salaries and of self-employment income in the projected sample. It has necessarily been assumed that income is earned uniformly over the year, and the contributions have been calculated on this basis.

10.6.3.5 Self-Employed Persons

The self-employed form a group whose current tax is not related to their current level of income or profit. Tax liabilities are generally calculated on income in accounting periods ending in the previous financial year.

For the purpose of the TPI, it is appropriate to estimate current levels of income in the January base period. It does not seem appropriate, however, to calculate tax either on the basis of tax payments currently being made by the self-employed (which relate to income in an earlier period) or to tax which will eventually be paid on the current income (which will be paid in a future year quite possibly at different levels of tax rates and allowances). Tax has in fact been calculated at current levels of tax rates and allowances, on the assumption that where these are different from the tax actually paid, self-employed persons can be thought of as making provisions for tax at the appropriate current rate.

10.6.3.6 Base Month

January has been chosen as the date on which the index will be linked in each year, figures for successive years being chained together at their January levels. This is consistent with the treatment in the construction of the RPI, where new weights are introduced following each January's index.

10.6.3.7 Other Points

Between Budgets, the TPI will increase faster than the RPI because increases in income are taxed at the full marginal rate. At the time of a Budget, the TPI will often fall back. If, in the long term, tax allowances and thresholds were revalorised in line with prices, the TPI would rise on average at the

same rate as the RPI, though with a 'saw-tooth' movement. To remove the 'saw-tooth' movement, it is advisable to concentrate on annual changes each month rather than month-to-month changes.

As mentioned earlier, two groups have been excluded from the coverage of the TPI: tax units who are not liable to income tax (that will look to the RPI rather than the TPI as an indicator), and high income tax units whose position may not be the same as for most taxpayers. After these exclusions, the TPI is expected to give a reasonable indication of the movements in taxes and prices for the population covered, taken in aggregate. Even when one considers groups at different income levels, so long as there are not major changes in tax structure, the tax indicators for all the groups will in year-on-year terms move up at similar rates, though the movements month-to-month may vary somewhat. Changes in the tax structure, however, can affect different income groups differently and this variability is probably greater than the variability of price movements faced by groups at different levels of expenditure. It is likely that the increases which would maintain net spending power for most household groups will be within about 1 percentage point of the year-on-year change in the TPI. The increase in the TPI is not such a good indicator of the tax and price position of the lowest income groups or the higher income groups, though the margin of variability over these is restricted to some one to two percentage points.

10.6.4 Worked Example of a Monthly TPI Calculation

The calculation can be thought of as a 3-stage process.

Stage 1: Calculate the net income required to keep up with changes in prices.

Stage 2: Convert this using look-up table derived from the SPI to calculate the gross income required to produce this net income.

Stage 3: Calculate the change in gross income since the base period and, then using standard chain-linking procedures, convert this to a January 1987=100 index.

A demonstration of these calculations follows:

Stage 1:

Required net income for March 2010 = change in RPI between January 2010 and March 2010, multiplied by base net income figure derived from the SPI:

$$\frac{220.7}{217.9} \times £494,500m = £500,854m$$

Stage 2:

Required gross income for March 2010 can be calculated from SPI look-up tables which show the correspondence between gross income and net income at various points, together with marginal factors of tax to use in interpolation between these points. In the example below, the look-up table gives a correspondence of £610,100m gross income to £500,000m net income, with a marginal rate of tax at this level of 0.7612:

$$£610,100m + \frac{£500,854m - £500,000m}{0.7612} = £611,222m$$

Stage 3:

Calculate *change* in gross income since base period (January 2010) and chain-link this figure to obtain January 1987=100 index. In the example below, the TPI for January 2010 is 194.7.

$$\frac{£611,222m}{£602,900m} \times 194.7 = 197.4$$

10.7 The Rossi Index

This is the index that was used, prior to April 2011, to uprate state income-related benefits, named after Sir Hugh Rossi, Minister for Social Security in 1981-83. The index excludes most of the housing sections; it was used because recipients of these benefits are unlikely to be paying significant housing costs. The percentage increase in this index over the 12 months to September of each year was used to uprate benefits for the year beginning the following April. Note that as of April 2011, the CPI is now used to uprate benefits, replacing the use of the Rossi index.

The definition of the Rossi index, or for that matter any other index to be used in uprating social security benefits, is a matter for the Secretary of State for Work and Pensions, not the ONS, and the definition of the Rossi index had changed several times since it was first used. Upratings up to and including April 1991 used all items RPI excluding housing. For April 1992 and 1993, the Rossi index was defined as all items RPI excluding MIPs, rent and 80% of community charge (the 80% was because supplementary benefit levels were set assuming recipients would pay 20% of community charge). Since April 1994, it had been defined as all items RPI excluding MIPs, rent and council tax.

The section added to the RPI in 1995, owner-occupiers' depreciation costs, was excluded from the definition of the Rossi index used for uprating benefits in April 1996, so the coverage of the Rossi index remained unchanged.

10.8 Pensioner Indices

The weights for the RPI explicitly exclude LCF data on households where the head of the household is retired (at least 65 years of age for men and 60 years or more for women) and economically inactive, and where at least three quarters of the household's income is from state benefits. Separate indices are produced for one-pensioner and for two-pensioner households, whose expenditure is excluded from the RPI weights (there are very few private households consisting solely of three or more pensioners). These indices use the same price data as the RPI.

The indices are only published quarterly, rather than monthly (section 8.3 defines quarterly indices).

The main differences from the RPI in the construction of the pensioner indices are as follows: section weights are derived from information on expenditure by one-pensioner and two-pensioner households respectively (section 6.6); canteen meals (including state school meals) and all housing sections are excluded. The exclusion of housing sections was made on the grounds that the price indicators used in the all items RPI would not be appropriate and would overstate the price increases experienced by these pensioners as they would mostly be cushioned against some rises by rebates. Also, it would be technically difficult to compile separate house price indicator items for these households.

Other items are also excluded, including NHS prescription, dental and eyesight test charges, which are not paid by pensioners. For rail and bus fares, special pensioners' rail and bus fare indices are substituted for the normal index household indices to allow for fare concessions available in some areas.

The item weights differ from those in the RPI sections where there is evidence that expenditure patterns within the section are very different for pensioner households. Examples are:

- a. Domestic services - pensioner weights exclude child minding costs
- b. Fees and subscriptions - pensioner weights exclude house purchase costs and education fees
- c. Personal services - pensioner weights exclude eyesight test charges and dental charges
- d. Rail and bus fares - special indices are used for pensioners and
- e. TV licence/rent - special indices are used for TV licences

10.9 Regional Price Indices

There are two types of regional price indices which could be produced: one would measure change in prices over time within a region, the other would measure differences in price levels across regions. An index could be constructed for each region which would be an average measure of change in the prices of goods and services bought for the purpose of consumption by the vast majority of households in the region under consideration. Such indices would measure the change over time of the cost of local goods and services to local people. They would not provide a good basis for comparing differences in price level between regions. To produce regional price indices which could be compared across regions we would have to ensure that identical items are costed in all parts of the country.

In 1968 the RPIAC considered the issue of regional price indices and recommended that there should be a study of the technical problems which would be involved in comparing price levels in different regions or areas. The technical committee which was appointed as a result of this recommendation reported back to the Advisory Committee in 1971. Its conclusion was that the production of regional price indices was possible but costly. Not all the members of the Advisory Committee agreed that the publication of regional price indices was desirable and as a result the Department of Employment did not take the matter further.

More recently, there has been a growing demand for information on regional data. The ONS publish a range of data, covering the nine Government Office regions of England, Northern Ireland, Scotland and Wales, which is available on the ONS website (www.ons.gov.uk).

10.9.1 Regional Inflation Figures

At present, the ONS do not calculate regional inflation figures. This is because the data currently available are not suitable for the compilation of reliable figures. To produce reliable estimates would require increasing the sample size for the locally collected prices dramatically, perhaps by a factor of five or more for some parts of the country. In addition, many of the centrally compiled indices (eg housing, cars, personal computers, etc) are designed as national indices. It would be a difficult task to decompose such data into appropriate regions.

The data used for the weights (such as the LCF) would also have to be significantly enhanced to ensure that detailed regional expenditure categories (by type of good or service, and by type of outlet) were being weighted appropriately and represented in the sample of prices being collected.

A number of conceptual issues would need to be resolved before we could calculate regional inflation rates. These include whether the items to be priced should be representative of national or regional baskets (different users will have different needs), and also the treatment of regional boundaries. Households do not necessarily restrict their shopping to the region where they live; they may physically cross regional borders for shopping or do so via Internet or mail order shopping.

10.9.2 Regional Price Level Comparisons

Many of the conceptual and technical issues which make it difficult to construct regional inflation figures are also relevant for regional price level comparisons. Nonetheless, some very approximate results were produced in 2000 as a by-product of an exercise designed to produce price level comparisons for London against the UK as a whole, for use with the ONS' work on Purchasing Power Parities (PPP) (*Economic Trends* no 578, January 2002).

This exercise involved a specially commissioned survey to obtain prices in a variety of locations across London, and in two or three towns in the other regions of the UK. This was supplemented by a special analysis of RPI data, for those items which were sufficiently well defined that price level comparisons were not distorted by differences in the quality or quantity of the items being priced. For PPP purposes, it was not necessary to collect price level differences for some categories of expenditure, including owner-occupiers' housing costs and insurance. These were either omitted from the calculation entirely

or, where appropriate, assumed to have uniform national pricing. The weights used for aggregation were based on national average expenditure patterns

This analysis was partially updated in 2003. The special analysis of RPI data was repeated and prices were collected for those categories of expenditure where price level comparisons were not produced in 2000. Results were calculated using both national average expenditure patterns for the weights, and weights based on regional expenditure patterns, obtained by averaging the most recent three years of LCF data. A further update in 2004 included refreshed data and technical improvements.

During 2010, work was undertaken to calculate revised regional relative consumer price levels (RRCPLs). This work was published in July 2011. There were several differences to the previous calculation of the price levels comparisons conducted in 2004, namely:

- a different set of goods and services were included in the RRCPL basket
- a different methodology was applied to calculate and aggregate the RRCPLs
- a change in classification - COICOP was used in 2010, whereas for 2004 the RPI classification was used

The article '*UK Relative Regional Consumer Price levels for Goods and Services for 2010*' (see Bibliography for link to article) provides more detail on the work carried out.

10.10 Seasonal Adjustment

Consumer expenditure on seasonal items (eg foods and clothing) can vary significantly over the year. This type of behaviour would advocate the production of a seasonally adjusted series, corrected for this pattern. However, separate measures for the CPI and RPI are not produced for two principal reasons. Firstly, in seasonal adjustment the entry of a new month's data can potentially change the level of previous months, as the seasonal pattern is re-estimated. This violates the strict rule of never revising the RPI. Secondly, not all of the changes are due to true seasonal patterns. Many are due to the annual changes in VAT and excise duty, as determined by government, which are not regarded as seasonal effects.

For most uses of the CPI and RPI, which involve the annual change in the indices, this pattern has little effect, as changes over twelve months are unaffected. However, any shorter-term comparisons can be distorted by the seasonality.

The ONS produce a seasonally adjusted measure of consumer price inflation, seasonally adjusted RPIY (SARPIY). This takes the individual section series from RPIY - which excludes VAT and duty - and adjusts those that exhibit a seasonal pattern, before aggregating the components using RPIY weights. The purpose of this measure is to provide an estimate of underlying inflation.

By comparing RPIY and SARPIY, it is possible to identify, on average, that the all items index is 0.9% below trend in January and 0.6% above trend in May. This behaviour may be more exaggerated for individual items; however, RPIY and SARPIY are only published at the all items level.

10.11 The Household Final consumption Expenditure Deflator

The implied deflator for household final consumption expenditure (HHFCE) is sometimes used as a measure of inflation as it affects households. It is different from the CPI and RPI in both coverage and construction. The goods and services covered in total household final consumption expenditure are as defined by the European System of Accounts (1995), and close to that used by the CPI. Like the CPI, they are classified according to COICOP and do not include, for example, expenditure on council tax. Unlike the CPI, which does not use imputed measures, they do include the estimated rent imputed to owner-occupiers. Expenditure by all UK resident households is included whether within the UK or abroad. This contrasts with the CPI, which covers spending within the UK, whether by UK or foreign

nationals. Unlike the RPI, there are no deductions for households at the top and bottom of the income scale.

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 number of the indices used to deflate components of HHFCE are compiled from component indices of the CPI, weighted together to reflect the COICOP classification. The HHFCE deflator is thus implicitly a current weighted (ie Paasche) index whose components are in large part CPI component indices.

The HHFCE deflator is produced quarterly (unlike the CPI and RPI, which are published monthly) and is available on the ONS website (www.ons.gov.uk).

10.12 The Cost of Living

The CPI and RPI are specifically not intended to measure what people often refer to as “the cost of living”. In popular usage, what this means is ill defined. Some use it to mean a measure of the cost of buying sufficient quantities of various items to maintain some minimal standard of living. However, defining this standard is very subjective. Also, if the minimal acceptable standard rises over time, such an index would rise more rapidly than the CPI or RPI.

Another definition is an index calculated as at present, but restricted to basic essentials. However, it would be difficult to reach a consensus on what constitutes “basic essentials”. For example, items such as tobacco could be excluded because tobacco may or may not be considered an essential item. Others would consider it essential. Also, many former luxuries such as telephones are now usually considered essential.

The economic definition of the cost of living is the answer to the question “What is the *minimum* cost, at this month’s prices, of achieving the level of utility actually attained in the base period?” Due to the stress on *minimum*, a cost of living index will usually give a lower rate of inflation than the CPI or RPI.

10.13 The Personal Inflation Calculator

In January 2007, the ONS launched an on-line personal inflation calculator (PIC). This is a web-based tool that allows users to calculate an inflation rate based on their personal expenditure patterns, rather than the averages used in published statistics. The PIC re-assembles the price indices used to calculate the RPI, to reflect something closer to the user’s personal expenditure patterns. The expenditure groups in the calculator have been chosen to balance users’ ability to make meaningful estimates with the level of detail needed to identify differences in price movements.

In most cases, users are asked to estimate monthly expenditure. But, for categories where purchases tend to be relatively infrequent, total expenditure in the last year or last three years is requested. These estimates are then scaled so that they can be compared to average monthly expenditure.

The personal calculator is designed to allow users to understand more about inflation and how it affects them, and also to contribute to the debate about inflation measurement. Users are, however, warned to exercise a degree of caution in interpreting the results. In particular, the calculator only adjusts for differences between an individual’s or individual household’s expenditure patterns and the national pattern at a fairly broad level. It is not practical to produce an index which precisely reflects an individual’s or individual household’s inflation experience. To do this would require account to be taken of the following effects, each of which may raise or lower the price change experienced by a particular individual compared to the national average:

- the pattern of expenditure within each high level expenditure group
- choices of brand and variety of product

- choices about where to shop
- shopping behaviour – shifting from brand to brand seeking out special offers or sticking with discounts etc

The accuracy of the PIC is highly dependent on the accuracy of the expenditure estimates entered by the user. The PIC is published on the ONS website (www.ons.gov.uk) alongside the latest CPI release.

An article has recently been published, '*Perceptions of Consumer Price Inflation*', which considers the extent to which the PIC addresses users' perceptions of consumer price inflation. See Bibliography for a link to the article.

Glossary: Terms, Concepts and Abbreviations

Terms and Concepts

All items index	An index which is constructed using price indices which represent every type of expenditure within the scope of the Retail Prices Index or the Consumer Prices Index. It is an average measure of the change in the prices of goods and services bought for the purpose of consumption in the United Kingdom.
Back check	Where quality auditors visit outlets no later than three days after a price collection to check that the price collector has recorded the correct prices (section 5.4.2).
Centiles	The n^{th} centile of a distribution is the number such that $n\%$ of items in the distribution are less than that figure.
Central shops	Central shops are major chains of shops with national pricing policies. Branches of these chains are excluded from local collection as their prices are sent directly to ONS by their headquarters (section 4.4).
Class	In the CPI, all categories of expenditure on which significant amounts of money are spent are arranged into twelve divisions, which are subdivided into groups and then into classes. Examples of classes are bread and cereals, water supply and transport insurance. Price indices are published for each class. Classes are listed in Appendix 3.
Coverage	Those transactions which it is possible to identify and measure in practice. This is determined by the expenditure categories for which weights are compiled.

Democratic weights

If each household had equal weight in the calculations then the weights would be democratic (section 6.2).

Division	In the CPI, all categories of expenditure on which significant amounts of money are spent are arranged into twelve divisions, such as clothing and footwear, transport and recreation and culture. Price indices are published for each division. Divisions are listed in Appendix 3.
Enumeration	Detailed listing of all outlets in a location, giving address, size, outlet type and range of products sold.
Group	<p>In the CPI, all categories of expenditure on which significant amounts of money are spent are arranged into twelve divisions, which are subdivided into groups. Examples of groups are food, postal services and insurance. Price indices are published for each group. Groups are listed in Appendix 3.</p> <p>In the RPI, all categories of expenditure on which significant amounts of money are spent are arranged into 14 groups, such as food, housing and motoring costs. Price indices are published for each group. Groups are listed in Appendix 4.</p>
Index day	The CPI and RPI are intended to reflect prices on one particular Tuesday of the month (either the second or third Tuesday) which is known as Index Day. Index Day is therefore the day on which the majority of prices are collected (section 4.2.1).

Index households

Index Households are all households which are included in the scope of the RPI; these are all private households in the United Kingdom except pensioner households which derive at

least three-quarters of their income from state pensions and benefits and high-income households whose total household income lies in the top 4%, as measured by the Living Costs and Food Survey (LCF) (section 1.6.2).

Indicator codes Codes entered into the hand-held computer by price collectors if there are any special features in the prices recorded. For example, collectors enter an S if the item is on sale or special offer (section 4.3.3).

Indicator items Indicator items are those items that are in the basket of goods and services.

Inflation rate The percentage change on a year earlier of a price index. It is usually used to mean the all items inflation rate.

Items An item is any type of consumer good or service that can be purchased, for example women's jeans. A number of different brands of that item may be available, for example women's Levi 501s.

Laspeyres A base weighted index, i.e. one where the prices are combined using weights derived from data from the base period (section 2.2).

$$I_{t,0} = 100 \times \frac{\sum_i P_{it} Q_{i0}}{\sum_i P_{i0} Q_{i0}}$$

where: P_{it} = price for i^{th} item at time t

P_{i0} = price for i^{th} item at base rate, time 0

Q_{i0} = quantity of i^{th} item purchased in the base period, time 0

Laspeyres-type An index such as the CPI or RPI which has the basic characteristics of a Laspeyres index. In other words it is a fixed base weight index, being the price of the basket at a given time as a percentage of its price on the base date. The CPI and RPI are not true Laspeyres as the base period does not coincide with time 0 (see Laspeyres) but is the most recent available 12 months (section 2.3).

Locations Locations are clusters of enumeration districts, broadly representing a central shopping area. Since 1995, out-of-town shopping centres have been included.

Outlets An outlet is anywhere from which goods or services can be purchased. For most items, it is usually a shop or market stall. However, for some items, outlets include restaurants, pubs, solicitors' offices or a sole trader operating from home.

Pensioner households

Households, where the head of the household is retired (aged 65 or more for men, 60 or more for women) and economically inactive, and where the household derive at least three-quarters of its income from state pensions and benefits. Separate price indices are produced for one and for two pensioner households (section 10.8).

Plutocratic weights

Each index household contributes to the weights by an amount proportional to its expenditure (section 6.2).

Price indicators See Indicator items.

Products/Varieties

These are the varieties in good or service available within an item specification. For example, there is a number of different firms producing automatic washing machines, each firm produces a number of models each with different specifications, but they are all automatic washing machines.

Regional central shops

Regional central shops are chains of shops without a national pricing policy but for which it can be assumed that prices collected in a branch in one region apply to all the branches in that region (section 4.5).

Representative items

See Indicator items.

Retailing inquiry

Produced by the ONS, the Annual Retailing Inquiry supplies data on sales by shop type broken down into commodity and service groups and then outlet type, i.e. whether they are independents or multiples.

Rossi index The index used to uprate state income-related benefits. (section 10.7).

Sampling frame A complete list of the objects to be sampled, together with sufficient information on each object to stratify if required (section 3.3).

Scope All those transactions which one would ideally want to measure.

Section In the RPI, all categories of expenditure on which significant amounts of money are spent are arranged into 14 groups, subdivided into about 85 sections. Examples of sections are bread, cigarettes, postage, footwear and rail fares. Price indices are published for each section. Sections are listed in Appendix 4.

Strata Strata are classifications that the raw data can be separated into. In the case of the CPI and RPI the strata used are region and shop type within item. The data within each stratum are combined and the resulting indices for each of the strata are then combined together using stratum weights (section 6.4).

Subvention to income

This is when a transfer payment, for example housing benefit, which is given to the consumer appears to reduce the price of an item for a consumer, but is in fact an increase in income.

Tukey algorithm The Tukey algorithm identifies and invalidates price movements which differ significantly from the norm (section 5.3.4).

Weight A factor by which a component is multiplied to reflect the level of consumers' expenditure on that component (Chapter 6).

Abbreviations

AER	Annual Effective Rate (section 9.5.1)
AR	Average of Relatives (section 9.3)
BT	UK telecommunication company formerly known as British Telecom (section 7.4.5)
CD	Compact Disc (section 4.3.6)
COICOP	Classification of Individual Consumption by Purpose (section 2.2)
COLI	Cost of Living Index (section 9.7.4)
CPI	Consumer Prices Index (Chapter 2)
DCLG	Department for Communities and Local Government (section 9.5.1)
DIY	Do It Yourself (sections 3.3 and 6.5)
DVLA	Driver and Vehicle Licensing Agency (section 7.4.3)
DVD	Digital Versatile Disc (section 4.3.6)
EFS	Expenditure and Food Survey (section 6)
EU	European Union (section 2.1)
GDP	Gross Domestic Product (section 1.4.1)
GIS	Geographic Information System (section 3.2.1)
GM	Geometric Mean (section 2.4)
GOR	Government Office Region (section 6.4.2)
HFMCE	Household Final Monetary Consumption Expenditure (section 1.5.2)
HHFCE	Household Final Consumption Expenditure (section 6.6.3)
HICP	Harmonised Index of Consumer Prices (section 1.3)
IDBR	Inter Departmental Business Register (section 3.2.1)
IFS	Institute of Fiscal Studies (section 6.2)
IPS	International Passenger Survey (section 7.4.4)
ISP	Internet Service Provider (section 7.4.6)
LCF	Living Costs and Food Survey (section 1.6.2)
MIPs	Mortgage Interest Payments (section 9.5.1)
MoT	(Former) Ministry of Transport; the MoT test is the annual test of a vehicle's road-worthiness (section 7.2)
NHS	National Health Service (section 1.5.5)
ODPM	Office of the Deputy Prime Minister (section 3.2.1)
OFCOM	Office of Communications (section 7.4.5)
ONS	Office for National Statistics (section 1.1)
PAYG	Pay As You Go (section 7.4.5)
PC	Personal Computer (section 7.2)
PPP	Purchasing Power Parity (section 10.9.2)
PPS	Sampling with probability proportional to size (section 3.2.2)
Q	Query (section 4.3.3)
RA	Ratio of Averages (section 2.4)
RPI	Retail Prices Index (Chapter 1)
RPIAC	Retail Prices Index Advisory Committee (section 1.7)
RPIX	All items RPI excluding mortgage interest payments (section 10.2)
RPIY	All items RPI excluding mortgage interest payments and indirect taxes (section 10.5)
SPI	Survey of Personal Incomes (section 10.6.1)
SRS	Simple Random Sampling (section 3.3)
SVR	Standard Variable Rate (section 9.5.1)
TfL	Transport for London (section 7.3.2)
TPI	Tax and Price Index (section 10.6)
UK	United Kingdom (section 1.4.1)
VAT	Value Added Tax (section 4.3.2)

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Appendix 1: Historical Background to the Development of Consumer Price Indices in the UK

Cost of Living Index

Although there were occasional official comparisons of prices for food in the late 19th century and early 20th century, the Government first began a systematic, continuous check on the increase in the cost of living in 1914. From July of that year, the Board of Trade instituted a regular monthly inquiry into the retail prices of the principal items of working class family expenditure, publishing the percentage change each month in its *Gazette*. The published figures initially related only to food prices, but after June 1916 the index was expanded and calculated retrospectively to cover clothing, fuel and some other items.

The new index was accepted as a valuable aid towards protecting ordinary workers from what were initially expected to be temporary economic consequences of the First World War. The information used for weighting together the components of the index was crude in the extreme, based on data obtained from a 1904 survey of urban working class household expenditure. Moreover, it was influenced by highly subjective assessments of what constituted legitimate expenditure for a working class family; beer was completely excluded and the weight used for tobacco was much less than the actual proportion of expenditure on tobacco.

Between the World Wars

This 'cost of living index', with unchanged weights, was produced throughout the 1920s and 1930s. Criticism mounted, especially in relation to its out-of-date weights (by the 1930s, candles and lamp oil were grossly over-weighted, while electricity was completely excluded, and ready made clothing was under-weighted). In 1936, the Ministry of Labour announced the introduction of a large-scale household expenditure inquiry to update the weights; this was carried out in 1937-8. However, by the time the results became available, war had broken out and further action on the revisions was deferred until the war had finished.

After World War 2

In 1946 a new committee, the Cost of Living Advisory Committee, was set up. An interim report in 1947 advised that as a short-term measure, the results of the 1937-8 expenditure inquiry should be used to update the weights until a new inquiry, reflecting vastly different post-war spending patterns, could be carried out. The report also recommended fundamental changes in the selection and number of representative items for which prices should be collected, as well as the removal of the name 'cost of living index' and the associations it implied. This new index, the Interim Index of Retail Prices, started in June 1947 and continued (with some minor modifications and a re-basing in January 1952) to January 1956. The new index laid many of the foundations for the way the modern RPI is compiled.

By early 1955, sufficient information from the Household Budget Inquiry became available to allow the committee to formulate a new index. This became the first official Retail Prices Index (RPI) and began in January 1956. Among the changes brought in at this stage were:

- expansion of scope of households included in the RPI from working classes to all wage earners, but excluding very high and low-earning households
- a firm definition of the RPI for the first time
- a definition of the scope of the index in terms of which goods and services should be included, and a new structure for spending categories that, by and large, continued to 1987; and
- the first serious attempt to measure owner-occupiers' housing costs

The committee also recommended that the Household Budget Inquiry should become a continuous survey. This led to the creation of the regular Family Expenditure Survey (FES) from 1957. Once the survey was established the weights could be revised annually and this process, which continues to the present day, began with a re-basing of the RPI in January 1962. A new Expenditure and Food Survey (EFS) was launched in April 2001 to replace the FES and the National Food Survey.

The 1960s and 1970s

Various minor changes were made to the RPI through the 1960s and 1970s, including:

- abolition of the name 'Cost of Living' and the associations it implied (Chapter 10.12)
- introduction of a 'meals out' group (now called 'catering') from 1968
- construction of separate 'pensioner' indices from 1969
- several changes to the methods of calculating owner-occupiers' housing costs, including the introduction of a new method for calculating mortgage interest payments from 1975
- introduction of 'seasonal' weights for fresh fruit and vegetable items from 1975
- introduction of a new index, the Tax and Price Index (TPI) in 1979

The 1980s

A new advisory committee was convened in the early 1980s to review the RPI. It produced a wide-ranging report in 1986, which led to many changes to the RPI from January 1987, when it was again re-based. Their recommendations largely form the basis of today's RPI, including the definition, scope and coverage, treatment of subsidies and discounts, and treatment of owner-occupiers' housing costs. In 1989, responsibility for the production of the RPI moved from the Employment Department to the newly re-organised Central Statistical Office (CSO).

The 1990s

Two further advisory committees met during the 1990s, leading to the introduction of a component for foreign holidays from 1993 and UK holidays from 1994. The latter committee produced a report in 1994 which led to the introduction of a new element of owner-occupiers' housing costs, the 'depreciation costs' component, from January 1995. At the same time, the collection of prices was contracted out to a market research company (previously, it had been carried out by civil servants from the Employment Service). In 1996, the Central Statistical Office became part of the new Office for National Statistics.

Two new indices based on the same data that are collected for the RPI were also introduced. These were RPIY (RPI excluding mortgage interest payments and indirect taxes) and the Harmonised Index of Consumer Prices (HICP), which were first published in 1995 and 1997 respectively. The HICP was developed as a comparable measure of inflation across European Union Member States and is specified in a series of legally binding European regulations.

2000 onwards

The HICP's coverage of goods and services was extended in stages in the areas of health, education, childcare and insurance, with effect from the January 2000, 2001 and 2002 indices, respectively. In 2000, there was also a change to the population base for the weights, which was broadened from private households to include expenditure by foreign visitors and residents of institutional households.

In 2003, the HICP was renamed the Consumer Prices Index (CPI) to reflect its new role as the main UK domestic measure of inflation for macroeconomic purposes.

In 2006, CPIY (CPI excluding indirect taxes, see Chapter 10.3) was introduced together with CPI-CT (CPI at constant tax rates, see Chapter 10.4).

Recent Developments

The Statistics and Registration Services Act 2007 established new arrangements for the governance of the RPI. Proposed changes now require the approval of the UK Statistics Authority.

In 2009 the Consumer Prices Advisory Committee (CPAC) was established to provide advice to the UK Statistics Authority on methodological issues and improvements relating to the CPI and RPI.

The following changes to methodology have been introduced since 2010:

- the use of an average effective rate instead of the standard variable rate in the measurement of mortgage interest payments in the RPI
- the way in which prices of seasonal items are measured within the CPI and RPI

From 2012, the following changes have also been introduced:

- the measurement method for new car prices, which changed from an approach that used 'list' prices to an approach based on using transaction prices from car dealer websites
- coverage of the CPI was extended to include TV licence fees, vehicle excise duty and trade union subscriptions

Price indices in the UK continue to evolve and to face the challenges of products which are more complex, both in their attributes, and in the ways in which they are sold and priced. ONS conducts a continuous programme of research designed to maintain the relevance of the CPI and other price indices in relation to changing consumer spending patterns and product market developments, and also to ensure that price changes across the range of goods and services represented in the indices are estimated according to best statistical practices.

Appendix 2: Main RPI and Consumer Prices Advisory Committee Recommendations

RPI Advisory Committee Recommendations

1947 Report (Cmd 7077)

Recommended that the old 'cost of living' index should be terminated and a new price index be constructed based on the 1937-38 expenditure enquiry. The new index started in June 1947.

1951 Report (Cmd 8328)

Recommended that only one official index of retail prices should be published each month, relating to all wage earners and moderate salary earners, and that a new expenditure enquiry should be undertaken as soon as possible to provide up-to-date weighting information.

1952 Report (Cmd 8481)

Recommended certain modifications which could be introduced immediately, as temporary expedients, until such time as a new index could be produced on the basis of the forthcoming expenditure enquiry. These modifications included the use of improved weights derived from the estimated pattern of expenditure in 1950, and incorporation into the index of information about the rents of houses built since 1947. The reweighted index was introduced in January 1952.

1956 Report (Cmd 9710)

Recommended that the interim index produced since 1947 should be replaced by a new index, based on the large scale Household Expenditure Enquiry of 1953. The new index was to be designed to cover all households except for those consisting of pensioners mainly dependent on state benefits and those whose head had a gross income of £20 a week or more in 1953. This committee also established the group and section structure of the index which, with some changes, is still in use. Finally, it recommended certain additions to the list of items for which prices were to be collected and some improvements to the methods of obtaining information, particularly as regards the housing group with the introduction of 'equivalent rents' as a measure of owner-occupiers' housing costs.

1962 Report (Cmd 1657)

Recommended that the index weights should be revised every year, on the basis of information from a new continuous enquiry, the Family Expenditure Survey (FES), which was instituted at the beginning of 1957. Some changes were proposed in the precision and frequency with which indices were published.

1968 Report (Cmd 3677)

Recommended that 'meals outside the home' (now called the 'catering' group) should be included in the index as a separate group, that special indices should be compiled and published for the pensioner households excluded from the coverage of the index (but not for any other special social or income groups) and that certain changes should be made in the level of detail in which existing indices were published. The Committee also recommended that there should be a study of the technical problems which would be involved in comparing price levels in different regions or areas. A technical committee was appointed to carry out the study envisaged.

1971 Report (Cmd 4749)

Recommended, on the basis of a report from the Technical Committee, that the compilation of regional price indices would be feasible although costly. In addition, the Committee was not

unanimous as to whether their publication would be desirable and thus the Department of Employment, which at that time was responsible for the RPI, did not proceed with regional indices.

1974 Report (Cmd 5905)

Recommended that owner-occupiers' housing costs should be represented in the index by mortgage interest payments, instead of the equivalent rents formerly used, that the RPI weights should in general be based on FES results for the latest twelve months rather than the latest three years, and that variable monthly weights should be introduced for fruit and vegetables. The recommendations were implemented almost immediately.

1977 Report (Employment Gazette, February 1978 article)

Recommended that certain component indices should be published in more detail and that when combining price quotations, there should be stratification by region and shop type.

1986 Report (Cmd 9848)

This report covered a wide range of issues and consolidated much of the general documentation on the compilation of the RPI. Recommendations included: changing the reference date for the RPI to January 1987=100; updating the group and section structure of the RPI; the production of indices for holidays as soon as possible subject to resolution of technical problems and to include and publish among other things, indices for more services, whenever they could be separately identified; that the income limits used to define index households should relate to the household as a whole rather than the head of a household; that component indices with a weighting of more than five parts per thousand should be published; that no allowances should be made for subsidies and discounts provided on a selective basis and funded by a third party (eg means tested benefits) although discounts and reductions made to all purchasers should be included; further recommendations on the construction of indices for owner occupiers' housing costs; further modifications on the weighting and definition of seasonal foods; and recommendations on the treatment of quality changes. Most of these recommendations were implemented with effect from 1987.

1989 Report (Cmd 644)

Recommended that the community charge be included in the RPI, subject to the principles on the treatment of discounts and subsidies established by the previous Committee. This Committee, like many before it, also defined the exact price indicator to be used for the new item. Although the Committee was asked to look at other issues, due to the urgency of the community charge issue, they decided to make their recommendations for this in this report and then to deal with the other points in a subsequent report which became the 1990 report. The community charge was introduced in April 1989 in Scotland and the following year in England and Wales.

1990 Report (Cmd 1156)

The Committee, under a new chairman (Sir Jack Hibbert, then director of the GSS and the CSO), and reporting to a different Minister (the Chancellor of the Exchequer, due to the transfer of responsibility for the RPI to the CSO) recommended the compilation of 'pilot' indices for holidays in both the UK and abroad with a view to including them in the RPI at a later date, subject to the resolution of certain technical problems. The committee also made several recommendations on the coverage of financial services in the index and reviewed the progress on some of the long-term improvements suggested by the 1986 Committee.

1993 Reports (Cmd 2142 and 2153)

When the community charge was replaced by the council tax, another committee was set up to review the treatment of local taxation in the index. It recommended that the council tax be included, and made several recommendations on the measurement of the price indicator. The Committee's Terms of Reference were then extended to look at the inclusion of a holidays index and the treatment in the RPI of new cars and owner-occupiers' housing costs. The committee also recommended the introduction of a holidays index. They continued to look into the other issues, which led to a further set of reports.

1994 Reports (Cmd 2716 and 2717)

The first of these command papers recommended that direct measurement of new car prices could not yet be brought into the RPI but that the Department should continue technical investigations. Meanwhile, it recommended certain small changes to the way that used car prices were measured and that these should be used as a proxy for new car prices. The second paper looked at the treatment of owner-occupiers' housing costs and recommended the introduction of a second component to go alongside mortgage interest payments, a 'depreciation costs' component, of which the price indicator should be a house price index. The depreciation indicator was introduced into the RPI with effect from February 1995.

Consumer Prices Advisory Committee (CPAC) Recommendations***Terms of Reference for CPAC***

Section 21 of the Statistics and Registration Service Act 2007 requires the Statistics Authority to compile and maintain the RPI and publish it every month. It further requires that before making any change to the coverage or the basic calculation of the index, the Authority must consult the Bank of England as to whether the change constitutes a fundamental change in the index which would be materially detrimental to the interests of the holders of relevant index-linked gilt edged securities. If the Bank of England considers that that change is a fundamental change in the index which would be materially detrimental to the holders of index-linked gilts, the Authority may not make the change without the consent of the Chancellor of the Exchequer.

Any methodological changes to the RPI therefore require the approval of the Authority before being referred to the Bank of England. To facilitate this, the Authority established a body to advise it on proposals for change to the RPI. This body is called the Consumer Prices Advisory Committee and it has three distinct roles:

1. To advise the UK Statistics Authority on the implication for the Retail Prices Index (RPI) of the improvements to this index recommended by the Office for National Statistics (ONS).
2. To provide the UK Statistics Authority with advice on RPI methodological issues.
3. To advise the UK Statistics Authority on improvements to the UK Consumer Prices Index (CPI) recommended by ONS.

2009 Annual Report to the UK Statistics Authority

The Committee recommended that the interest rate measure used in the calculation of mortgage interest payments in the RPI should be changed from the Standard Variable Rate (SVR) to an Average Effective Rate (AER) and that the choice of rate should be kept under review in future and changed, if necessary, at the annual RPI reweighting. The Committee further recommended that the AER should be introduced into the published RPI in March 2010, at the same time as the annual update of the basket of goods and services that underpin the RPI (and CPI).

2010 Annual Report to the UK Statistics Authority

The 2010 CPAC report included the first publication of work by ONS to develop measures of owner occupiers' housing costs (OOH) for inclusion in an expanded CPI. The Committee recommended that OOH measures using the internationally recognised rental equivalence and net acquisitions approach should be developed further by ONS and should be in a position to be included in an expanded CPI within two years. The Committee also recommended that the method used to measure seasonal items in the RPI and CPI be changed from a 'carrying the index forward' method to an improved imputation based method. Finally, the Committee recommended that ONS undertake a programme of work for the further development and maintenance of the CPI and RPI.

2011 Annual Report to the UK Statistics Authority

The 2011 CPAC report recommended that the UK Statistics Authority endorsed the view of CPAC that the inclusion of owner occupiers' housing costs in the Consumer Prices Index (CPI) and the further improvement of the measurement of clothing inflation in both the CPI and RPI should remain the top priorities for the development of consumer price statistics.

The report also included a recommendation to change the method used to measure new car prices in the CPI and RPI, using transaction prices from car dealer websites instead of the current approach of using 'list' prices. It was recommended that this method should be used for both the CPI and RPI (currently, two different methods are used) and introduced for the February 2012 CPI and RPI, published on 20 March 2012. In addition, the Committee recommended that ONS extends the CPI item coverage from early 2012 to include TV licence fees, vehicle excise duty and trade union subscriptions. Finally, the Committee asked the Authority to note progress made by ONS against the forward work plan for consumer price statistics and the plan to develop a strategy for consumer price statistics.

Appendix 3: Consumer Prices Index – Structure and 2012 Weights

<i>Divisions</i>	<i>Weight</i>		
01 Food and Non-Alcoholic Beverages	112	05.3 Household appliances, fitting and repairs	9
02 Alcoholic Beverages and Tobacco	42	05.3.1/2 Major appliances and small electric goods	8
03 Clothing and Footwear	65	05.3.3 Repair of household appliances	1
04 Housing, Water, Electricity, Gas and other Fuels	144	05.4 Glassware, tableware and household utensils	5
05 Furniture, Household Equipment and Maintenance	61	05.4.0 Glassware, tableware and household utensils	5
06 Health	24	05.5 Tools and equipment for house and garden	5
07 Transport	162	05.5.0 Tools and equipment for house and garden	5
08 Communications	27	05.6 Goods and services for routine maintenance	15
09 Recreation and Culture	134	05.6.1 Non-durable household goods	6
10 Education	19	05.6.2 Domestic services and household services	9
11 Restaurants and Hotels	114	06.1 Medical products, appliances and equipment	10
12 Miscellaneous Goods and Services	96	06.1.1 Pharmaceutical products	6
		06.1.2/3 Other medical and therapeutic equipment	4
Groups and classes	Weight	06.2 Out-patient services	5
01.1 Food	98	06.2.1/3 Medical services and paramedical services	3
01.1.1 Bread and cereals	17	06.2.2 Dental services	2
01.1.2 Meat	22	06.3 In-patient service	9
01.1.3 Fish	4	06.3.0 Medical and paramedic services	9
01.1.4 Milk, cheese and eggs	14	07.1 Purchase of vehicles	43
01.1.5 Oils and fats	2	07.1.1A New cars	24
01.1.6 Fruit	9	07.1.1B second-hand cars	16
01.1.7 Vegetables including potatoes and tubers	15	07.1.2/3 Motorcycles and bicycles	3
01.1.8 Sugar, jam, syrups, chocolate and confectionery	12	07.2 Operation of personal transport equipment	89
01.1.9 Food products nec ¹	3	07.2.1 Spare parts and accessories	5
01.2 Non-alcoholic beverages	14	07.2.2 Fuels and lubricants	46
01.2.1 Coffee, tea and cocoa	4	07.2.3 Maintenance and repairs	22
01.2.2 Mineral waters, soft drinks and juices	10	07.2.4 Other services	16
02.1 Alcoholic beverages	18	07.3 Transport services	30
02.1.1 Spirits	5	07.3.1 Passenger transport by railway	9
02.1.2 Wine	9	07.3.2 Passenger transport by road	12
02.1.3 Beer	4	07.3.3 Passenger transport by air	8
02.2 Tobacco	24	07.3.4 Passenger transport by sea and inland waterway	1
02.2.0 Tobacco	24	08.1 Postal services	1
03.1 Clothing	56	08.1.0 Postal services	1
03.1.2 Garments	52	08.2 Telephone and telefax goods and services	26
03.1.3 Other clothing and clothing accessories	3	08.2.0 Telephone and telefax goods and services	26
03.1.4 Cleaning, repair and hire of clothing	1	09.1 Audio-visual, photographic and information processing equipment	23
03.2 Footwear including repairs	9	09.1.1 Equipment for the reception and reproduction of sound and pictures	6
03.2.0 Footwear including repairs	9	09.1.2 Photographic, cinematographic and optical equipment	4
04.1 Actual rentals for housing	64	09.1.3 Data processing equipment	6
04.1.0 Actual rents	64	09.1.4 Recording media	6
04.3 Regular maintenance and repair of the dwelling	14	09.1.5 Repair of audio-visual equipment & related products	1
04.3.1 Materials for maintenance and repair	8	09.2 Other major durables for recreation and culture	10
04.3.2 Services for maintenance and repair	6	09.2.1 Major durables for in/outdoor recreation	10
04.4 Water Supply and misc. services for the dwelling	10	09.3 Other recreational items, gardens and pets	35
04.4.1 Water supply	5	09.3.1 Games, toys and hobbies	20
04.4.3 Sewerage collection	5	09.3.2 Equipment for sport and open-air recreation	3
04.5 Electricity, gas and other fuels	56	09.3.3 Gardens, plants and flowers	4
04.5.1 Electricity	20	09.3.4/5 Pets and related products and services	8
04.5.2 Gas	32	09.4 Recreational and cultural services	29
04.5.3 Liquid fuels	3	09.4.1 Recreational and sporting services	8
04.5.4 Solid fuels	1		
05.1 Furniture, furnishings and carpets	20		
05.1.1 Furniture and furnishings	16		
05.1.2 Carpets and other floor coverings	4		
05.2 Household textiles	7		
05.2.0 Household textiles	7		

09.4.2 Cultural services	21
09.5 Books, newspapers and stationery	13
09.5.1 Books	3
09.5.2 Newspapers and periodicals	5
09.5.3 Misc. printed matter, stationery and drawing materials	5
09.6 Package holidays	24
09.6.0 Package holiday	24
10.0 Education	19
10.0.0 Education	19
11.1 Catering services	97
11.1.1 Restaurants and cafes	86
11.1.2 Canteens	11
11.2 Accommodation services	17
11.2.0 Accommodation services	17
12.1 Personal care	28
12.1.1 Hairdressing and personal grooming establishments	8
12.1.2/3 Appliances and products for personal care	20
12.3 Personal effects nec ¹	13
12.3.1 Jewellery, clocks and watches	8
12.3.2 Other personal effects	5
12.4 Social protection	13
12.4.0 Social protection	13
12.5 Insurance	8
12.5.2 House contents insurance	3
12.5.3 Health insurance	2
12.5.4 Transport Insurance	3
12.6 Financial services nec ¹	23
12.6.2 Other financial services nec ¹	23
12.7 Other services nec ¹	11
12.7.0 Other services n.e.c	11

¹ nec - not elsewhere covered

The following are included in the RPI but excluded from the CPI: council tax, mortgage interest payments, house depreciation, buildings insurance, ground rent and other house purchase costs such as estate agents' and conveyancing fees.

Appendix 4: Retail Prices Index – Structure and 2012 Weights

Broad groups	Weight		
Food and catering	161	Housing	237
Alcohol and tobacco	85	Rent	75
Housing and household expenditure	412	Mortgage interest payments	29
Personal expenditure	84	Depreciation	56
Travel and leisure	258	Council tax and rates	41
The sections have not changed since 1987, although three new ones have been added:		Water and other charges	13
Foreign holidays in January 1993		Repairs & maintenance charges	9
UK holidays in January 1994		DIY materials	8
House depreciation in January 1995		Dwelling insurance and ground rent	6
		Fuel and light	46
Groups and sections	Weight	Coal and solid fuels	1
Total food	114	Electricity	21
Non-seasonal Food	95	Gas	21
Seasonal Food *	19	Oil and other fuels	3
Bread	4	Household goods	62
Cereals	4	Furniture	22
Biscuits and cakes	7	Furnishings	9
Beef	4	Electrical appliances	6
Home-killed lamb *	1	Other household equipment	4
Imported lamb	1	Household consumables	13
Pork	1	Pet care	8
Bacon	2	Household services	67
Poultry	4	Postage	1
Other meat	7	Telephones, telemessages etc	24
Fresh fish *	2	Domestic services	13
Processed fish	2	Fees and subscriptions	29
Butter	1	Clothing and footwear	45
Oils and fats	2	Men's outerwear	9
Cheese	4	Women's outerwear	16
Eggs *	1	Children's outerwear	5
Milk, fresh	4	Other clothing	6
Milk products	4	Footwear	9
Tea	1	Personal goods and services	39
Coffee and other hot drinks	2	Personal articles	10
Soft drinks	11	Chemists goods	15
Sugar and preserves	1	Personal services	14
Sweets and chocolates	11	Motoring expenditure	131
Unprocessed potatoes *	2	Purchase of motor vehicles	39
Potatoes products	3	Maintenance of motor vehicles	20
Fresh vegetables other than potatoes *	7	Petrol and oil	47
Processed vegetables	2	Vehicle tax and insurance	25
Fresh fruit *	6	Fares and other travel costs	23
Processed fruit	2	Rail fares	6
Other foods	11	Bus and coach fares	4
Catering	47	Other travel costs	13
Restaurant meals	27	Leisure goods	33
Canteen meals	3	Audio-visual equipment	7
Take-away meals and snacks	17	CDs and tapes	3
Alcoholic drink	56	Toys, photographic and sports goods	10
Beer	26	Books and newspapers	8
on sales	21	Gardening products	5
off sales	5	Leisure services	71
Wines and spirits	30	Television licence and rentals	12
on sales	16	Entertainment and other recreation	17
off sales	14	Foreign holidays	33
Tobacco	29	UK holidays	9
Cigarettes	25		
Other tobacco	4		

* Seasonal food items

Appendix 5: National Statistics Publication of Consumer Price Indices

The primary source of ONS data including Consumer Price Indices and Retail Price Indices can be accessed via the ONS website:

<http://www.ons.gov.uk/ons/index.html>

A quick route to CPI current and historic information can be accessed via the following link:

<http://www.ons.gov.uk/ons/taxonomy/index.html?nscl=Consumer+Price+Indices>

A quick route to RPI current and historic information can be accessed via the following link:

<http://www.ons.gov.uk/ons/taxonomy/index.html?nscl=Retail+Prices+Index>

The latest CPI and RPI release page can be found on the ONS website via Key Figures on the Homepage. This release page will provide the latest Statistical Bulletin, Detailed Briefing Notes, downloadable associated data (in XLS format) plus any other information released for that period.

Time Series Data Sets can be found at:

<http://www.ons.gov.uk/ons/rel/cpi/consumer-price-indices/july-2011/tsd-june-2011.html>

Other publications containing Consumer Price Indices are also available on the ONS website including:

- *Consumer Trends*
- *Social Trends*
- *Annual Abstract of Statistics*

Specific information relating to CPI and RPI can be found using the search facility on the ONS website.