EXPENDITURE WEIGHTS AND THEIR SOURCES 4

Introduction

4.1 A consumer price index (CPI) is usually calculated as a weighted average of the price changes for the consumption goods and services covered by the index. The weights are meant to reflect the relative importance of the goods and services as measured by their shares in the total consumption of households. The weight attached to each good or service determines the impact that its price change will have on the overall index. The weights should be made publicly available in the interests of transparency, and for the information of the users of the index.

4.2 The weights depend on the scope of the index which, in turn, depends on the main use, or uses, for the index. The uses and scope of a CPI have already been explained in some detail in the two previous chapters. This chapter therefore focuses on the derivation and compilation of the weights and the data sources that may be used to estimate them. In practice, the weights usually refer to expenditures on consumption goods and services by households, as distinct from the actual use of those goods and services to satisfy the needs and wants of households. Expenditure-based weights are appropriate for a CPI based on the *acquisitions approach*. The difference between the acquisitions and uses approach to CPIs was explained in the previous chapter.

4.3 In the special case of owner-occupied housing, however, many countries adopt the uses rather than the acquisitions approach. They measure changes in the prices of the flows of housing services consumed by households as distinct from changes in the prices of dwellings. It is shown in Chapter 23 of this manual that one important consequence of adopting the uses approach to owner-occupied housing is that its weight in the overall CPI is considerably greater than when the acquisitions approach is used. The reason is that the values of the housing services consumed by owner-occupiers have to cover not only the depreciation on the houses purchased but also the interest costs on the capital invested in the dwellings. Over a period of years, the uses approach may well give twice as much weight to owner-occupied housing as the acquisitions approach. Reference may be made to Chapter 23 for further details and explanation.

The weighting structure of the consumer price index

4.4 As explained in more detail in Chapters 7 and 9, the calculation of a CPI usually proceeds in two stages. In the first stage, elementary indices are estimated for each of the elementary aggregates. Elementary indices are constructed by (a) collecting a sample of representative prices for each elementary aggregate, and then (b) calculating an average price change for the sample. In the second stage, a weighted average is taken of the elementary indices using the expenditures within the elementary aggregates as weights.

4.5 Elementary aggregates are usually the smallest groups of goods and services for which expenditure data are available to be used as weights. They may cover the whole country or separate regions within the country. Likewise, elementary aggregates may be distinguished for different types of outlets. The nature of the elementary aggregates depends on circumstances and the availability of expenditure data. Elementary aggregates may therefore be defined differently in different countries. In general:

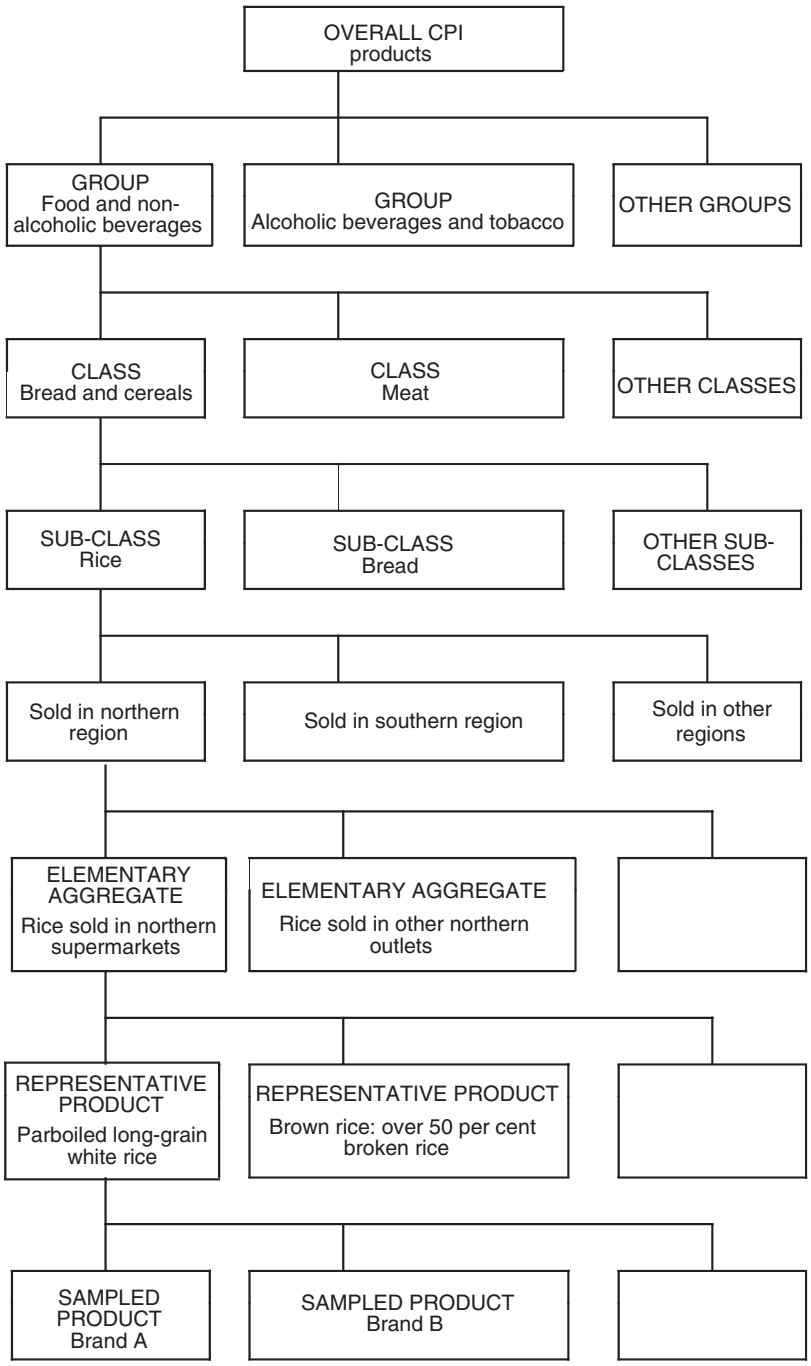
- Elementary aggregates should consist of groups of goods or services that are as similar as possible.
- They should also consist of goods or services that may be expected to have similar price movements. The objective is to minimize the dispersion of price movements within the aggregate.
- The elementary aggregates should be appropriate to serve as strata for sampling purposes in the light of the sampling regime planned for the data collection.

4.6 The aggregation structure for a CPI is illustrated in Figure 4.1 using the Classification of Individual Consumption according to Purpose (COICOP) described in Chapter 3, although similar national classifications may be used instead:

- First, the entire set of consumption goods and services covered by the overall CPI is divided into *divisions*, such as ''food and non-alcoholic beverages''.
- Each *division* is then divided into *groups*, such as ''food''.
- Each *group* is further divided into *classes*, such as ''bread and cereals''.
- Each class may be divided into more homogeneous *sub-classes*, such as ''rice''.
- Finally, a *sub-class* may be further subdivided to obtain the *elementary aggregates*, by dividing according to region or type of outlet, as illustrated in Figure 4.1. In some cases, a particular sub-class cannot be, or does not need to be, further subdivided, in which case the sub-class becomes the elementary aggregate.

The sub-classes and elementary aggregates are not part of COICOP itself but more detailed breakdowns of COICOP classes that are needed for CPI purposes.

Figure 4.1 Typical aggregation structure of a consumer price index (CPI)



4.7 Within each elementary aggregate, one or more products are selected to represent the price movements of all the goods and services in the elementary aggregate. For example, the elementary aggregate consisting of rice sold in supermarkets in the northern region covers all types of rice, from which parboiled white rice and brown rice with over 50 per cent broken grains are selected as *representative products*. Of course, more representative products might be selected in practice. Finally, for each kind of representative product, a number of individual products can be selected for price collection, such as particular brands of parboiled rice. Again, the number of *sampled products* selected may vary depending on the nature of the representative product.

4.8 The methods used to calculate the *elementary price indices* from the individual price observations collected within each elementary aggregate are explained in Chapter 9, and are not of immediate concern here. Working upwards from the *elementary price indices*, all indices above the elementary aggregate level are described as *higher-level indices* that can be calculated from the elementary price indices using the elementary

expenditure aggregates as weights. The aggregation structure is consistent, so that the weight at each level above the elementary aggregate is always equal to the sum of its components. The price index at each higher level of aggregation can be calculated on the basis of the weights and price indices for its components, that is, the lower-level or elementary price indices. The individual elementary price indices are not necessarily sufficiently reliable to be published separately, but they remain the basic building blocks of all higher-level indices. Above the level of the elementary aggregate, therefore, no new information is introduced into the calculation of the CPI.

Group, class and sub-class weights

4.9 The weights for the groups, classes and sub-classes are their shares in the total consumption expenditures of the reference population. They are most often derived from household expenditure surveys (HESs). These surveys are also described as household budget surveys (HBSs). As these surveys are sample surveys subject to reporting and non-response errors as well as sampling errors, the estimated shares for certain sub-classes are often modified or revised on the basis of supplementary or additional information from other sources.

Regional weights

4.10 Within a given sub-class, the regional weight shows the consumption expenditure in the region in proportion to the expenditure in the whole country for that sub-class. For example, if 60 per cent of the total expenditure on fresh fruit occurs in the North region and 40 per cent in the South region, then the regional weight for fresh fruit is 60 per cent for the North region and 40 per cent for the South region.

4.11 A region may also be a geographical area, a city or a group of cities, with a particular location or of a certain size. The rationale for introducing regional weights is to create more homogeneous entities which are likely to experience similar price movements and have similar consumption patterns. For example, there may be quite large differences in consumption patterns and price developments between urban and rural areas. It may be necessary to distinguish different regions in federal countries because CPIs for the provinces or local states may be required for administrative or political purposes. In addition, in federal countries indirect taxes and hence price development may differ between the provinces.

4.12 Regional weights may typically be obtained from the HES or they may be estimated from retail sales data or population data. Regional weights may or may not be introduced into the CPI, depending on the size and structure of the country, data availability, resources and the purpose of the index.

Outlet or outlet-type weights

4.13 Prices are collected from a variety of outlets and outlet types. Information about the sale or market share of the outlets may be used to form elementary aggregate weights specific to a given region and outlet type. One advantage from applying outlet weights is that it may allow prices to be collected centrally from supermarkets or other types of chain outlets.

Elementary aggregate weights

4.14 The elementary aggregate weights are the stratum weights according to expenditure class or sub-class, region and type of outlet. For example, expenditures within the sub-class "fresh fruit" may be divided into four regions, each having its own regional weight, as in Table 4.1. Assume further that it is known or estimated that 60 per cent is sold in supermarkets and 40 per cent in independent outlets, and that this same breakdown holds for all regions. Let the weight of fresh fruit in the CPI for the whole country be, say, 5 per cent. If no breakdown by region or outlet is carried out, then the sub-class as a whole becomes the elementary aggregate carrying a weight of 5 per cent in the overall index.

4.15 If weights are available by region but not by type of outlet, the 5 per cent is distributed over the four regions to obtain four separate elementary aggregates, one for each region. For example, the elementary aggregate for the North region will have a weight of $0.20 \times 0.05 = 1.0$ per cent in the overall CPI for the whole country. If a further division can be made according to type of outlet as well as region, then each region comprises two elementary aggregates: one for supermarkets and one for independent outlets. The weight for, say, the elementary aggregate for fresh fruit in the North region sold in supermarkets is then $0.12 \times 0.05 = 0.6$ per cent in the overall CPI for the whole country.

Data sources

4.16 The decision about what source or sources to use and how they should be used depends on an analysis of their respective advantages and disadvantages, and on the main purpose of the index. In most countries, the two main sources for calculation of the weights are the HES and the national accounts estimates for households' final consumption expenditures. Additional information may, however, be obtained from production and trade statistics, or from government departments, producers, marketing bodies and individual enterprises. Such additional information is particularly useful for estimating weights at the most detailed level. Although several of the sources may have been used to prepare the national

Table 4.1 Example of weights by region and outlet type for the sub-class "fresh fruit"

	Regional weights	Type of outlet	
		Supermarkets (60 per cent)	Independent (40 per cent)
North	20	12	8
South	40	24	16
West	30	18	12
East	10	6	4
Total	100	60	40

accounts estimates, they may be able to provide further details that were not used by the compilers of the national accounts.

Household expenditure surveys

4.17 As the HES may have been designed to serve more than one purpose, it is desirable to ensure that the survey design also meets the requirements for the CPI. The main requirements are that the survey should be representative of all private households in the country, and not exclude any particular group, and should include all types of consumption expenditures by households.

4.18 The HES may include payments that are outside the scope of the CPI: for example, payments of income taxes, life insurance premiums, remittances, gifts and other transfers, investments, savings and debt repayments. These should be excluded from the total used to calculate the expenditure shares that serve as the basis for estimating the CPI weights. There may also be a difference in the population coverage between the intended scope for the CPI and the actual scope of the HES, but the effects on the CPI of any consequent bias in the resulting weight estimates are likely to be very minor if the HES is designed to provide results for the whole population and not just a particular population group.

4.19 National food surveys are special surveys in which the primary emphasis is on collecting information on family expenditures for food products. These surveys provide a very detailed breakdown of food expenditures that can be used to derive the weights for elementary aggregates for food below the level of a COICOP class.

4.20 The HES may provide the basis for estimating specific weights for regions with different consumption patterns. These weights should be applied to the respective elementary price indices to calculate indices for the regions concerned.

4.21 In general, HES data for certain types of expenditures may not be sufficiently reliable and need to be checked against data from other sources. Certain types of expenditures may not even be covered by an HES so that they have to be estimated using other sources. The reliability of the CPI weights will obviously depend to a large extent on the reliability of the household expenditure data. As the HES is a sample survey, the estimates are bound to be subject to sampling errors, which may be relatively large for small or infrequent expenditures. The quality of the estimates will also suffer from non-response and from the under-reporting of some types of consumption. Under-reporting is probably the most serious and common problem affecting HESs. Some expenditures are not reported because the purchases are small or exceptional, and therefore easy to forget. Although large, estimates of expenditures on durable goods may also be problematic, since they are only purchased very infrequently. Some expenditures are not reported because the products have a social stigma or are illegal (e.g., drugs, alcohol and tobacco). When no adjustments are made for such under-reporting, the consequence is an underestimation of the weights for these items and an overestimation of the weights for the correctly reported items. For these reasons, to the extent possible, results from the HES should be compared and/or combined with the statistics from other sources when constructing CPI weights, especially when the HES sample is small.

4.22 For the purposes of the CPI, it is desirable for the HES to be conducted annually. This will allow countries to revise and update their expenditure weights each year. One advantage of annual updating of weights is that the differences between the results obtained from the use of different index number formulae tend to be reduced. Any bias which may follow from using a Lowe index that uses a fixed basket of goods and services will not have time to accumulate to a significant magnitude, as explained in Chapters 1, 9 and 15.

4.23 Some countries conduct continuous HESs with gradually rotating samples. A programme of annual surveys with samples large enough to provide the type of estimates required for CPI weights can, however, be very costly. For this reason, some countries conduct large-scale surveys at ten-year or five-year intervals, perhaps supplemented with a smaller annual sample. Other countries distribute a large sample over several years. The average of the results over several successive years of smaller-scale surveys may provide a set of satisfactory annual estimates. The weights derived in this way as the average rates of expenditure over periods of two or three years will also smooth any erratic consumer behaviour over a short period, for example as a result of events such as droughts or floods, civil strife, oil shocks, or exceptionally mild or cold winters.

4.24 It should be noted that in some countries it may be possible to experiment with new methods of recording expenditures in an HES by using scanner data generated by electronic points of sale. For example, by collecting the printed bar code receipts for cash which customers receive, the Icelandic HES could obtain, at virtually no cost to the surveyed households, precise information about types and brands of goods purchased in different outlets.

National accounts

4.25 There may be differences in the scope and definition of consumption between the national accounts and the CPI, and also a difference in the reference population of households between the national accounts and the HES.

4.26 First, in national accounts, the household sector consists of all resident households, including people living in institutional households. HESs, however, do not usually cover persons living permanently in institutional households, such as retirement homes or religious institutions. If the CPI is meant to cover all resident households, therefore, national accounts estimates may be used to adjust the HES data.

4.27 Second, as already explained in Chapter 3, it is possible to have two alternative concepts of total final consumption, *domestic* and *national*. The domestic concept refers to consumption on the economic territory, including the consumption of visiting foreign households but excluding the consumption of resident households when abroad. The national concept used in national

accounts refers to the consumption of all the residents of the country, whether at home or abroad, the consumption of non-residents being excluded. The HES usually covers only resident households, and may or may not cover their expenditures abroad, depending on the instructions given to the respondents.

4.28 National accounts data may be used to improve HES weights for products that are under-reported in the HES. Note that national accounts figures for households' final consumption are usually based on statistics from the HES *and* from several other sources. This means that national accounts estimates are likely to be useful for estimating weights for consumption categories that tend to be wrongly reported in the HES, and where results from the HES suffer from a significant and distorting partial or total non-response rate.

Retail sales data

4.29 Statistics on retail sales by region and type of outlet may be available for broad groups of items. One disadvantage is that some of the sales may be to groups outside the reference population, perhaps to the business sector or to the government. The corresponding purchases do not form part of household private consumption. Some sales may also be to non-residents, who may or may not be part of the reference population. Furthermore, for regional sales data, it needs to be kept in mind that sales may include sales to people living in other regions.

Point-of-purchase surveys

4.30 Point-of-purchase surveys may provide statistics that can be used to estimate weights for price data, as they permit the analysis of shopping patterns for various segments of the population. Households are asked, for each item purchased, about the amounts spent in each outlet where purchases have been made, and the name and addresses of these outlets. On this basis, a list of outlets can be established, with the total sales for all the different items to the sample of households. A sample of outlets is then drawn from this list, with probability proportional to the sales. Given that household surveys are expensive and that there is an overlap between the HES and point-of-purchase survey, it is possible to combine the two data-collecting activities in an integrated survey that elicits expenditure and outlet data at detailed levels, along with the demographic information about the households needed for sub-group indices.

4.31 A simpler version of this survey may be conducted to obtain weights for groups of products by outlet type. In this case, a purposive sample of each outlet type should be selected. As an alternative, in the absence of this type of survey, national retail sales statistics by outlet type from a survey of outlets could be used to estimate a breakdown of sales by outlet type.

Scanner data

4.32 In the last few years some countries have started to use statistics obtained from cash register data to derive CPI weights. These statistics are based on electronic data records that are stored as scanner data in the databases of sellers. Such scanner data sets include the quantities sold and the corresponding value aggregates. (The cash register receipts usually give the following information: name of the outlet, date and time of purchase, description of items bought, quantity, price and value, form of payment, and VAT amount where relevant.) A comparison of the results from the HES with the corresponding scanner data from the biggest supermarket chains indicates that the use of scanner data can add to the reliability of the weights (Guðnason, 1999). This strengthens the case for using such data to revise CPI weights more often than otherwise would be possible, and probably at lower cost. The limitations of this source of information should, however, be borne in mind. The first one is that scanned data cannot be connected to a specific type of household, whereas the data from the HES can. Another important difference between HES data and scanner data from sellers is that the HES data cover goods bought from outlets that are not using this technology, as well as goods and services that do not carry scanner codes, regardless of where they are sold. Although the use of electronic data records is increasing every year, significant components of the retail trade market are not using scanner data even in countries that are electronically most advanced.

Population censuses

4.33 Population censuses provide statistics on the geographical distribution of the population and households, as well as on the regional differences in household size and composition. Combined with estimates of regional levels of household expenditure, these statistics can be used to estimate regional expenditure weights, especially when such estimates are not available from an HES with a satisfactory degree of precision. In the absence of any expenditure statistics, population statistics might be used as the basis for regional weights. Such estimates for the weights usually have to assume that expenditures per capita or per household are the same in all regions, and have to ignore the fact that there are usually large differences between the urban and rural populations in the level and pattern of items that they consume.

Deriving the weights in practice

4.34 Once the reference population and the coverage of goods and services have been decided, the weights need to be derived. In principle, this is a relatively simple matter, as the weights are calculated as the proportions of the total consumption expenditure of all goods and services included in the index basket for the reference population during the reference period. In practice, however, the calculation of weights is not so straightforward and involves a series of steps.

Payments that are not consumption expenditures

4.35 Only *consumption expenditures* are relevant for the construction of CPI weights. As explained in

Chapter 3, outlays such as payments of social security contributions or income taxes, or repayments of debts, are irrelevant and should be ignored because they are not consumption expenditures.

Unimportant expenditures

4.36 Each elementary aggregate consists of a fairly homogeneous group of products from which one or more representative products are selected for pricing. Some products may have a weight which for all practical purposes is negligible and for which prices are unlikely to be collected in practice. The HES, which in most cases is the main source for deriving the detailed weights, usually includes observations on a much larger variety of goods and services than it is practical to collect prices for. The prices of very minor products may not be worth collecting if they contribute almost nothing to the CPI.

4.37 Even though it may be decided not to collect prices for a certain product, it remains within the scope of the CPI. Some price change has to be explicitly or implicitly assumed, or imputed, and weighted by expenditures. There are two options:

- The product and the expenditures on it remain within the elementary aggregate, even though no prices are collected for it. The elementary price index for the aggregate as a whole is estimated entirely by the prices of the representative products for which prices are collected. This is equivalent to assuming that the price of the product changes at the same rate as the average for the prices of the representative products.
- The alternative is to reduce the weight for the elementary expenditure aggregate by excluding the expenditures on the product. This is equivalent to assuming that the price of the excluded product would have moved in the same way as the overall CPI for all the products actually included in the index.

4.38 In principle, the CPI should cover all types of products and expenditures within its scope, even if prices are not collected for some products. It might be decided, for example, to exclude from the index calculations groups with weights lower than, say, 0.1 per cent for food groups and 0.2 per cent for non-food groups. A lower minimum threshold for the food items might be set because the prices for these products tend to display greater variability and because prices for food products are normally less expensive to collect. If an expenditure group is excluded, its weight may be redistributed to another expenditure group that is similar in terms of content and price development. Alternatively, the expenditures may be completely excluded from the calculation of the weights.

Products that are difficult to price

4.39 Among the consumption expenditures, there are likely to be a few products for which the prices, or price changes, cannot be directly or satisfactorily measured, for example, illicit drugs or payments for catering and other service charges for private receptions and parties. Even if reliable prices cannot be obtained, these products should be included in the calculation of the weights if they are within the scope of the index. For difficult-to-price products, the options available are the same as those used for unimportant expenditures.

Use and combination of different sources

4.40 In most countries, the main source for deriving the weights is the HES. As noted above, however, the results from the HES need to be carefully examined and adjusted to take account of under- or over-reporting of certain types of products. The usual strategy is to use supplementary information from other relevant sources to adjust the HES results in order to derive the weights.

4.41 In countries where national accounts data provide reliable estimates of household expenditures, these data can be used to derive the weights at an aggregate level. Detailed HES data can then be used to break down or adjust these weights. In this way, it is possible to reconcile the detailed data from the HES with the aggregate national accounts data to calculate the weights. Weights for the main consumption groups can be obtained from the national accounts down to a certain level of disaggregation, say, 70 consumption groups or classes. Each of these weights can then be further distributed by applying the detailed HES expenditure groups to the national accounts consumption groups or classes. The combination of national accounts and HES data ensures consistency between the CPI and the national accounts data on consumption expenditure of households at the level of the main consumption groups.

Adjusting the weights derived from household expenditure surveys

4.42 As, in most cases, the information from a household expenditure survey is only available with a lag – often around 18 months or more – the new weights will lag behind the new price reference period for the index, which is the period when the new weights are introduced.

4.43 Adjustments might need to be made to the estimates based on the HES results to take into account any significant changes in expenditure patterns in the period between the time that the survey was carried out and the time that the new weights were introduced. Adjustments will typically be made for products which are significantly losing or gaining in importance during this period. It is also possible that expenditure on some products may not be available from the HES because the products appeared on the market after the survey had been completed. One example is mobile telephones and the corresponding charges, which emerged as significant new forms of expenditure in the late 1990s in many countries. Necessary adjustments then need to be made to the survey data to take into account the changes that have occurred. The expenditures on these new products should be estimated on the basis of information available from other sources (e.g., import and retail trade statistics), taking into account the need to exclude expenditures by enterprises and for business purposes.

Weight reference period

4.44 The weight reference period is the time period to which the estimated weights relate. The choice of the period covered by the expenditure statistics used to derive the weights is crucial. Generally speaking, the period chosen as the base should be long enough to cover a seasonal cycle. Further, if the index is not annually chained, the year chosen should have economic conditions that can be considered to be reasonably normal or stable. To achieve this, it may be necessary to adjust some of the values to normalize them and overcome any irregularities in the data for the particular period that constitutes the source of the information. The weight reference period should not be too distant from the price reference period. The weight reference period is typically a single calendar year. A month or quarter is too short a period to use as a weight base period, since any one month or quarter is likely to be affected by accidental or seasonal influences. In some instances, data for a single year may not be adequate either because of unusual economic conditions or because the sample is not large enough. An average of several years of expenditure data may then be used to calculate the weights. Countries in which this method is applied include the United States and the United Kingdom. In the United States, the expenditure information from the Consumer Expenditure Survey over a three-year period is used. In the United Kingdom, an average of three years of Expenditure and Food Survey data is used for regional weights, for stratification and for a limited number of groups of products where prices tend to be particularly volatile.

4.45 During periods of high inflation, multiple year weights may be calculated by averaging value shares rather than averaging actual value levels. Averaging the value levels will give too much weight to the data for the most recent year. Another option is to update the values for each year to a common period and then to compute a simple arithmetic average of adjusted yearly data.

4.46 As the weight reference period usually precedes the price reference period, the expenditure weights may be price updated to take account of the relative price changes from the weight reference period to the price reference period. Price updating of weights is discussed in more detail in Chapter 9, paragraphs 9.95 to 9.104.

Need for revising the weights

4.47 Most countries calculate their CPI as the change in the value of a specified basket of goods and services. An index of this general kind is described in this manual as a Lowe index. Its properties and behaviour are explained in Chapters 1, 9 and 15. Although CPIs are often described as Laspeyres indices, they are usually not Laspeyres indices in practice. A Laspeyres index is defined as an index in which the basket of goods and services is that of the price reference period, but a typical CPI basket uses the basket of some weight reference period that precedes the price reference period, as just explained. As many countries continue to use the same fixed basket of goods and services over a period of years, the question arises of how often the basket should be revised in order to ensure that it does not become out of date and irrelevant.

4.48 In the short run, consumers will change consumption patterns in response to shifts in relative prices, mostly between products included in the same class or sub-class. Over longer time periods, consumption patterns are also influenced by factors other than price changes. Most importantly, changes in the level and distribution of household income will cause a shift in demand for goods and services towards goods and services with higher income elasticities. Demographic factors such as ageing of the population, and technological changes, such as the increase in the use of computers, are examples of other factors that affect spending behaviour in the longer run. Furthermore, new products will be introduced and existing ones may be modified or become obsolete. A fixed basket will be unresponsive to all these changes.

4.49 As a result of both relative price changes and long-term effects, the weights may become out of date and less representative of current consumption patterns. As shown in Chapter 15, the bias in a Lowe index is likely to increase with the age of the weights. At some point, it therefore becomes desirable to use the weights of a more recent period to ensure that the index is weighting appropriately the price changes currently faced by consumers.

Frequency of updating the weights

4.50 The 1987 ICLS resolution concerning consumer price indices recommended that the weights should be updated periodically, and at least once every ten years, to guarantee the representativity of the index. However, the 2003 ICLS resolution proposes more frequent updates of the weights, such as once every five years, to ensure their relevance. Countries which are experiencing significant economic changes and thus more rapid changes in consumption patterns should update their weights even more frequently, say annually.

4.51 The need to revise the weights generally increases as the length of time from the weight reference period increases. The decision when to update the weights depends, for the most part, on the differences observed between the current weighting structure and that for the weight reference year. Changes in the relative importance of each item can be observed through expenditure survey results. If these statistics are available only at irregular intervals, the frequency of weight revision may necessarily be linked to the availability of results from the HES.

4.52 The introduction of new weights each year might possibly cause an upward drift in the index if there are big fluctuations in consumption caused by factors such as an economic blockade, or extremely favourable or unfavourable weather conditions. In general, the profile of the index time series can be sensitive to the selection of the weight reference period. It might be best to use a ''normal'' consumption period, if possible, as the basis for weighting information and to avoid periods in which there are special factors at work of a temporary nature. All available information concerning the nature of consumption in a weight reference period should be taken into consideration.

4.53 When the weights are to be fixed for several years, the objective should be to adopt weights that are not likely to change much in the future rather than precisely reflect the activity of a particular period that may be abnormal in some way.

4.54 Each year it is desirable to carry out a review of the weights in order to ensure that they are sufficiently reliable and representative. The review, which may be confined to weights at the level of sub-indices and their major components, should examine whether or not there are indications that important changes may have taken place in the consumption pattern since the weighting reference period.

4.55 Whenever the weighting pattern has been updated, the new index using updated weights should be calculated for an overlapping period with the old one so that the two can be linked.

Classification

4.56 In deriving the weights, the detailed expenditure items identified in the HES must be mapped to the CPI expenditure classes. If HES classes do not match CPI expenditure classes, the HES results must be transformed to match the CPI categories. This can be done by aggregating or disaggregating the relevant HES headings over the relevant CPI expenditure classes. Such transformation is achieved much more easily and more reliably if the coding list for expenditure items in the HES is coordinated with the corresponding list of items used for collecting price observations for the CPI.

4.57 For the purposes of international comparison, the classification scheme of goods and services should, to the extent practical, be in line with the United Nations Classification of Individual Consumption according to Purpose (COICOP) (see Annex 2). To facilitate estimation and application of weights, it is also desirable that the classification used be consistent with the classifications used for HESs and other statistics (for example, retail sales statistics). In the interests of maintaining both coordination of the statistical system and international comparability, the HES should also use a classification for types of expenditure that will be consistent with COICOP, and it should also be possible to establish a mapping between products in the retail sales price collections and COICOP. Another important objective is that the aggregation structure employed by the classification system should meet the major needs of users.

4.58 Using COICOP as an example, the classifications have the following hierarchical structure:

– *groups*: there are 47 of these in COICOP;
– *classes*: sub-divisions of the groups;
– *sub-classes*: the lowest-level categories that are weighted and usually the most detailed level of the structure for which index series are published – these are the expenditure components and weights that remain fixed when using a fixed weight index;
– *individual products*: the lowest level of the CPI basket, that is, the individual goods and services for which prices are actually collected – this is the level at which the composition of the CPI basket can be adjusted between two major revisions of the weighting structure to reflect changes in product supply and consumer behaviour.

4.59 Upper-level indices are formed by weighting together lower-level indices through progressive levels of aggregation, as defined by the classification structure. Weights are fixed for a period (say one, three or five years) between index reweighting.

4.60 The selection of the level in the index hierarchy at which the structure and weights are fixed for a period is particularly important. The main advantage of setting the level relatively high is that the actual samples of products and their prices below this level can be adjusted and updated as needed. New products can be introduced into the samples, and the weights at the lower level re-established on the basis of more recent information. There is thus a greater opportunity to keep the index representative, through an ongoing review of the sample of representative products.

4.61 If the level is set relatively low in the index structure, there is less freedom to maintain the representativeness of the index on an ongoing basis, and there will be a greater dependence on the periodic index review and reweighting process. In such circumstances, the arguments for frequent reweighting become stronger.

Items requiring special treatment

4.62 Some products, such as seasonal products, insurance, second-hand goods, expenditures abroad, etc., may need special treatment when constructing their weights. Reference may be made to Chapters 3, 10 and 22 for further details.

4.63 *Seasonal products*. Various approaches may be used to deal with seasonal products, for example:

- a fixed weights approach, which assigns the same weight for the seasonal product in all months, using an imputed price in the out-of-season months. Seasonal products are treated in the same way as other consumption products;
- a variable weights approach, in which a changing (or moving) weight is attached to the product in various months. In this method, the weights of the seasonal products change monthly according to changes in the quantities consumed during the different months of the weight reference period. The principle of a fixed basket – i.e. fixed weights – should, however, be maintained at least at some level of aggregation.

4.64 The advantage of applying the fixed weights method is mainly that it is consistent with the methods used for other consumption goods and services, and with the fixed basket index formula. In contrast to the moving weights method, the fixed weights method reflects monthly changes in prices only, and not in quantities. Another disadvantage of the moving weights method is that the weights are based on the monthly seasonal fluctuations in the weight reference period, whereas the monthly fluctuations in consumption may differ every year.

4.65 The fixed weights method may also have disadvantages, a major one being that during the months that fresh fruits or vegetables disappear, prices and indices have to be estimated or imputed for these items (or, as is done in some countries, prices and indices have to be frozen throughout the period of disappearance). These imputations need not be made when applying the moving weights method. In addition, the average fixed weight determined for all months of the year does not actually reflect the monthly consumption. Therefore, if there is a negative correlation between prices and quantities, there may be an upward bias in the index.

4.66 The choice of measuring seasonal goods according to the fixed weights method or the moving weights method should be based on whether the focus is on month-to-month changes or on the long-term index changes. The use of an annual basket and the use of annual expenditure shares are appropriate where the main interest is in the longer-run trend of price changes. On the other hand, if the focus is on month-to-month changes, then the annual weights attached to each month-to-month price relative can be unrepresentative of actual transactions that are taking place in the two consecutive months under consideration. In the latter case, monthly price changes for items that are out of season can be greatly magnified by the use of annual weights.[1] To satisfy the needs of different users, it may be appropriate to construct *two* indexes: one for the short-term measurement of price changes (with variable monthly weights) and another longer-term index (with fixed annual weights). The issue of seasonal items is dealt with in detail in Chapter 22.

4.67 *Insurance*. As explained in the section on insurance in Chapter 3, the weights for non-life insurance could be based on either the gross premiums paid or on the implicit service charges. The implicit service charges for administering the insurance and providing the insurance services are estimated by the gross premiums *plus* the income from investment of the insurance reserves *less* the amounts payable to policy holders in settlement of claims.[2] The net premiums are defined as the gross premiums less the service charges: in other words, the net premiums equal the claims. The net premiums and claims can be regarded as transfers, or redistributions, between policy-holding households. In general, it seems preferable to base the weights for non-life insurance on the service charges. These are the estimated amounts paid by households for the services provided by insurance firms. However, a case can also be made for basing the weights on the gross premiums. This is a difficult area in which there is not yet a consensus.

[1]For example, the impact of change in tomato prices at the beginning of the season would be overstated in the general index. Similarly, its impact in the peak months would be understated.

[2]In the national accounts, the gross premiums *plus* the investment income *less* the estimated service charges are described as "net premiums". By definition, "net premiums" equal claims payable, both flows being treated as transfers, or redistributions, between policy-holding households. The "net premiums" are not regarded as expenditures.

4.68 *Second-hand goods, including used cars*. As already explained in paragraphs 3.127 to 3.129 of Chapter 3, the prices of used or second-hand durable goods purchased by households are included in the CPI in the same way as the prices of new goods. However, households also sell used durables, such as cars. If the price of a second-hand good rises, a purchasing household is worse off, but a selling household is better off. From a weighting perspective, sales constitute negative expenditures, which implies that price changes for used goods *sold* by households implicitly carry a *negative* weight in the CPI. In effect, purchases and sales of second-hand goods *between households*, whether directly or indirectly through a dealer, cancel out (except for the dealers' margins, see Chapter 3) and carry no weight in the CPI. However, households also buy from, and sell to, other sectors. For the reference population as a whole, namely the entire set of households covered by the CPI, the weight to be attached to a particular kind of second-hand good is given by households' total expenditures on it *less* the value of the households' receipts from sales to/from *outside the household sector*. There is no reason why these should cancel out on aggregate. For example, many of the second-hand cars purchased by households may be imported from abroad. The difference between total expenditures and total sales is usually described as households' net expenditures. This is the weight to be attached the second-hand good in question.

4.69 Except in the case of used cars, however, it is practically impossible to estimate the net expenditure because most HESs do not collect the data that would allow for a comparison between expenditures and receipts from sales of individual kinds of second-hand goods. Usually, only the total amount received from the sale of second-hand goods is collected. This information does, however, give an idea of the volume and significance of these transactions in the national economy. In countries where this volume is small, second-hand goods (except used cars) may be ignored when calculating the weights of the index.

4.70 Because the amounts spent on purchasing second-hand cars are usually large, they should be included in the CPI basket if the data are available. In the absence of reliable data, however, their weight can be added to the weight of new cars.

4.71 Most countries include expenditure on second-hand goods in the estimation of CPI weights, but second-hand goods are not covered in the price collection (because of the difficulty of pricing the same good each month or, where the goods are different, making an appropriate quality adjustment). It is therefore assumed that the prices of new and second-hand goods move in the same way.

4.72 In countries where second-hand purchases are important and their prices are believed to change at different rates from those of new goods, separate weights are needed for them. The information could be obtained, at least for some major durables, from HESs, if the surveys ask about expenditure on second-hand and new goods.

4.73 *Expenditure abroad and expenditures by non-residents*. If the objective is to construct an index which

is representative of price movements within a given country or area, the weighting system must reflect purchases by both resident and non-resident households. In practice, the proportion of total purchases that are made by visitors from abroad or other areas may be difficult to estimate, except for certain types of purchases in geographical areas where foreign tourism is the dominant economic activity. Sources other than HESs must be used in order to ensure that the weights include the expenditures made by foreign tourists and reflect all purchases of consumer goods and services made by resident or non-resident households within the country. These sources may be national accounts or commercial sales statistics.

4.74 Where the main purpose of the index is to measure price changes experienced by the resident population, the weights should include their expenditures abroad. This would require collection, through the HES, of data on expenditures made outside the country (for example, expenditures on hotels and meals during holidays, durables, health and education). Possible ways of constructing the index to cover expenditure abroad would be:

– price collection outside the country of residence;
– the use of appropriate sub-indices provided by the statisticians in other countries for the kinds of products purchased there by residents;
– establishing a panel of residents who would report prices paid for their purchases abroad.

4.75 Given the limitations of HESs to provide reliable data on expenditures abroad, and the practical difficulties of constructing an index for expenditure abroad, the weights may have to be based on expenditure surveys without adjusting for the place of acquisition, and prices may be collected only for the goods and services acquired in the economic territory of the country. Such an approach assumes that the price changes of the goods and services acquired abroad are the same as those for the same goods and services acquired at home.

Errors in weighting

4.76 If all prices moved in the same way, weights would not matter. On the other hand, the greater the variation in price behaviour between products, the greater the role of weights in measuring aggregate price change.

4.77 Small changes in the weights usually have very little effect upon the overall CPI. An error in the weight for a given sub-index only matters to the extent that the change in the sub-index differs from the average change in the overall CPI. In general, the higher a sub-index's weight, the lower is the tolerable percentage error in that weight. It follows that the tolerable error in the weights declines as the rate of *relative* price change for the relevant items increases. Finally, it is also clear that while errors in weighting may not have a large influence on the overall index, the sub group-level errors could be significant. Australian experience shows that even items with relatively large weights can tolerate errors of 20–30 per cent in the weights (Australian Bureau of Statistics, 2000). According to Eurostat's studies, CPIs are fairly insensitive to changes in weights. Eurostat has, however, suggested developing quality control procedures for monitoring the weights of items for which changes in prices have diverged from the movement of the overall index (Eurostat, 2001). The question of the effects of weighting errors on the sub-index and the overall index is discussed in Rameshwar (1998).