
Contents

1.	Introduction.....	1
	Historical background.....	1
	Recent developments	1
2.	Objectives of the resolution	5
3.	The nature and meaning of a consumer price index (CPI).....	6
4.	The uses of a consumer price index	7
	CPI as an overall measure of inflation	8
5.	Scope of the index.....	9
	Acquisition, use and payment	11
6.	Basket and weights.....	13
7.	Sampling for price collection.....	18
8.	Index calculation.....	21
	Elementary aggregates	21
	Upper level indices.....	24
9.	Price observations	28
	Collection.....	28
	Replacements	30
10.	Quality change	31
11.	Accuracy	33
12.	Dissemination.....	34
13.	Consultation and integrity.....	37
	Bibliography	38

Appendices

Appendix 1.	Proposals for a draft resolution concerning consumer price indices	41
	Annex 1. Terminology and definitions	52
	Annex 2. Quality adjustment methods	54
	Annex 3. Types of errors.....	55
	Annex 4. Classification of individual consumption according to purpose (COICOP)	56
Appendix 2.	Resolution concerning consumer price indices adopted by the Fourteenth International Conference of Labour Statisticians, 1987.....	58

1. Introduction

1. The consumer price index (CPI) is possibly the most important single statistical number produced on a regular basis by national statistical agencies. It has played and will continue to play an important role in determining national economic and monetary policies and is followed closely by businesses and households, as contractual obligations, interest rates and pay are often adjusted according to CPI movements or influenced by them. Given the importance of the CPI, it is not surprising that measurement issues have attracted considerable attention over the years.

Historical background

2. It has been the long-standing tradition of the International Labour Office (ILO), the agency responsible for the subject of consumer price indices within the United Nations system, to ensure that the international standards on the topic reflect current best practices and methodological advances. The first ILO resolution was adopted in 1925 by the Second International Conference of Labour Statisticians (ICLS), and subsequent revised resolutions were adopted by the Sixth (1947), Tenth (1962) and Fourteenth (1987) ICLS.
3. At the time of the 1925 resolution, the main reason for compiling a CPI was its use for adjusting wages to compensate for changes in the cost of living. The first set of standards therefore referred to “cost-of-living” indices rather than CPIs. The terms “cost-of-living index” and “consumer price index” were then usually used interchangeably as synonyms.
4. Later on, a distinction was drawn between the concept of a “cost-of-living index”, designed to measure the change in the cost of maintaining a given standard of living, and the concept of a “pure price index” designed to measure the change in the cost of purchasing a specific set, or “basket”, of consumer goods and services. For this reason, the Tenth ICLS in 1962 decided to adopt the more general term “consumer price index” which may be understood to refer to both concepts.
5. The 1987 resolution covered such important aspects of a CPI as its scope, definition of elementary aggregates, the derivation of weights, sampling, procedures for collecting price data, substitution problems, etc. In 1989, the ILO published a manual on methods, which provided guidance to countries on the practical application of the standards.

Recent developments

6. In the years after the publication of the 1989 manual, it became clear that a number of outstanding and controversial methodological problems needed further investigation and analysis. Many comments have been made about the possible sources of bias in the CPI estimates. Questions have been raised concerning the treatment of quality changes and new goods, about the choice of index formula, relevance and age of the weights used, etc. The possibility that the CPI may not adequately represent true price movements has led many statistical agencies to reconsider and make significant changes to the methodology used to prepare CPI estimates.
7. A considerable amount of work on the methodology of price indices has been undertaken at the international level as a result of the formation of the International Working Group on Price Indices. This group, also known as the “Ottawa Group”, was established in 1994 under the auspices of the United Nations Statistical Commission with the objective of promoting technical discussions on conceptual aspects of the CPI, and in particular on the

possibility of estimating CPI biases associated with quality changes, the appearance of new products, etc., as well as on the possible advantages (e.g. for the collection of price information) and consequences of using data generated by scanning bar codes at points of purchase. During the course of seven meetings of the “Ottawa Group” between 1994 and 2003, over 100 papers on the theory and practice of price indices were presented and discussed. One outcome was that it became apparent that there were ways in which existing CPI methodology could be improved and strengthened.

- 8.** The final report of the United States Advisory Commission to study the CPI, the “Boskin Commission”, which was established by the Finance Conference of the United States Senate in 1995, generated a lot of discussion on measurement bias in the CPI. It discussed possible sources of bias in the CPI such as item substitution bias, retail outlet substitution bias, quality bias and new goods bias. This report drew attention to the issue of accuracy and the relevance of the CPI among a variety of users in the academic and business community as well as among politicians.
- 9.** The Boskin Commission report also highlighted the fact that, owing to the widespread use of the United States CPI for index-linking of government benefits such as pensions and social security payments, even small potential biases can have considerable cumulative financial consequences for the government budget over the long term.
- 10.** Research undertaken in a number of other countries (Australia, Canada, France and United Kingdom) has shown that it is difficult to both quantify and assess the direction of potential bias. Hence the extent, the direction and even the existence of bias remain something that will depend upon the specific circumstances of each set of CPI estimates and cannot always be determined with certainty.
- 11.** A further reason for concern with these issues is the high priority given to the control of inflation as a policy objective in most countries, after the experience of high inflation, or even hyperinflation, during the last three decades of the twentieth century. The slowing down of the rates of inflation in many parts of the world in the 1990s, compared with those of the 1970s and 1980s, did not lead to a loss of interest in measurement issues; on the contrary, it stimulated a demand for more accurate and reliable measures of inflation. Whereas an error or bias of one, or even two, percentage points in the annual rate of inflation may not be considered important when inflation is running at 10 or 20 per cent or more per year, it becomes very significant when the rate of inflation itself is estimated to be only 1 or 2 per cent.
- 12.** Within the European Union, Eurostat, together with the statistical authorities in Member States, has recently developed procedures and standards for a Harmonized Index of Consumer Prices (HICP). HICP is one of the main indicators used in setting interest rates in the European Monetary Union (EMU). The HICPs are also being prepared by the statistical authorities in non-EMU member countries and the pre-accession countries of Eastern Europe.
- 13.** The research and discussions described above have generated a wealth of material for a better understanding of both the meaning and the limitations of a CPI. There is now an increased awareness of the fact that, in order to provide reliable, objective and credible price indices, there is a need to review the following elements of importance for the quality and accuracy of the CPI:
 - (a) the formula used: the question of what is the most appropriate formula to use to estimate an elementary price index was comparatively neglected until a number of papers in the 1990s provided much clearer insights into the properties of elementary

indices and the relative strengths and weaknesses of different procedures for their calculation;

- (b) the frequency of weight updates;
 - (c) the procedures for quality adjustment, introduction of new goods and new outlets;
 - (d) the sampling methods used.
- 14.** Other issues that have been discussed include: (i) the need for constructing and publishing more than one index to meet specific requirements; and (ii) the need to compute sub-indices for different regions or socio-economic groups, as well as analytical indices.
- 15.** In response to the various developments outlined above, the need to revise, update and greatly expand the ILO manual was gradually recognized and accepted during the late 1990s. An Intersecretariat Working Group on Price Statistics (IWGPS) was established in 1998 to coordinate the efforts and expertise of the major organizations concerned with prices so as to successfully revise the international standard on prices, in particular the CPI manual.¹
- 16.** The Sixteenth ICLS, meeting in 1998, recommended that the international standard in CPI should be reviewed, updated and further developed to take into account recent developments. On this basis the Governing Body of the International Labour Office convened a Meeting of Experts on Labour Statistics (Geneva, 22-31 October 2001), the second part of which (from 26 to 31 October) was devoted to consumer price indices. On the basis of a report prepared by the ILO Bureau of Statistics (ILO, 2001), the Meeting discussed issues involved in the measurement of CPI. The Meeting's conclusions (ILO, 2001) have been taken into consideration in the preparation of the present report and the draft resolution on the CPI presented in Appendix 1.
- 17.** The preparation of this report has benefited too from the material prepared for the revised manual on CPI² and the discussion that the members of the TEG-CPI have had during the process of finalizing the chapters on the practical procedures for the CPI. It has also benefited from the comments made by many statistical offices on the practicability of the methods/procedures proposed and discussed in the manual. It is organized as follows. Chapter 1 provides general background information and Chapter 2 the objectives of the resolution. Chapters 3-5 outline the nature of a CPI, its uses and the relationship between a CPI intended to measure pure price change and one intended to measure changes in the "true" cost of living. Chapter 5 covers the scope and coverage of CPIs and the implications of using the acquisition, use or payment approach in defining consumption. Chapters 6-8 concern the compilation of a CPI, and cover weighting and sampling procedures and calculation of elementary and upper level indices. Price collection and treatment of quality changes are covered in Chapters 9 and 10. Chapter 11 reviews several sources of error, either in price collection or in index construction, which can potentially lead to error in the

¹ The IWGPS is composed of representatives from the International Labour Office, the International Monetary Fund, the Organisation for Economic Co-operation and Development, the UN Economic Commission for Europe, the World Bank and the Statistical Office of the European Communities (Eurostat). A Technical Expert Group (TEG-CPI) was established to provide IWGPS with advice on the revision of the 1989 ILO manual on CPI. For more information on the membership of the two groups, see: <http://www.ilo.org/public/english/bureau/stat/guides/cpi/index.htm> .

² Scheduled to be published for 2003.

overall CPI, along with some methods to reduce or eliminate such errors. Chapter 12 covers dissemination of the index and the last one some other matters. Finally, proposals for a new draft resolution concerning CPIs and its annexes are presented in Appendix 1. The 1987 resolution adopted by the Fourteenth ICLS is reproduced in Appendix 2.

- 18.** The draft resolution has been developed in parallel with the manual on the CPI. Although this practice is unusual, the pressure for international guidance on CPI compilation was such that it was impossible to wait for the ICLS's adoption of a new resolution before starting the work on the manual, as the work then might have been completed only a couple of years later. The decision, therefore, was to proceed with both in tandem, while making sure that they are consistent in their recommendations. As a result the guidelines developed and proposed in the draft resolution are intended to be flexible, multi-purpose and applicable in all countries, whatever their economic circumstances and level of development. The CPI Manual provides considerably more detail, information, explanation and justification of the recommended CPI methodology and the relevant economic and statistical theory than can be included in the resolution or in this report. The manual also provides an overview of conceptual and theoretical issues that should be carefully considered when making decisions on the various problems in the daily compilation of the CPI. The manual documents/elaborates on different practices currently in use and points out alternatives to existing practices whenever possible, along with their advantages and disadvantages. Given the comprehensive nature of the manual, it is expected that the conclusions reached at this conference should be covered in the printed version of the manual. However, as the electronic version of the manual is intended to be "a living document", it could, if necessary, be amended to address in more detail particular points emerging from the discussions and recommendations adopted by this conference.

2. Objectives of the resolution

19. The objectives of the proposed resolution are multipurpose. Its primary objective is to provide guidelines of best practice when developing or revising the procedures for a CPI. A secondary objective is to promote the international comparability of the national CPIs. The 2001 Meeting of Experts pointed out that: applying best practice automatically promotes international comparability, and that international comparability is very important when the CPI is used as an indicator for inflation, and desirable for indices used for estimating real wage trend (*cf. 2nd and 3rd paragraphs of the Preamble*).
20. The need to ensure the professional independence of the institution compiling the CPI was also emphasized by the Meeting. *This is reflected in the 4th paragraph of the Preamble*. The Meeting also stressed the objective of the resolution to promote better understanding of the index by the users and to ensure confidence in the index (*cf. 5th paragraph of the Preamble*).
21. The need to help countries to produce as accurate an estimate of CPI was also emphasized as one of the objectives of the resolution. *This is implicitly reflected in the 2nd and 5th paragraphs of the Preamble*. This requires that international standards are modified and broadened in the light of recent methodological and computational developments.
22. It was also recognized that a set of indices may be required to meet the needs of different users and, therefore, a single standard could not be applied universally.

3. The nature and meaning of a consumer price index (CPI)

23. The CPI is a current indicator defined to measure changes over time in the general level of prices of goods and services for consumption that a reference population acquires, uses or pays for. As the prices of different goods and services do not all change at the same rate, a price index is designed to reflect their average movements. A price index is typically assigned a value of 100 in some selected index base period, and the values of the index for other periods of time are intended to provide an estimate of the average percentage change in prices compared with the base period (*cf. paragraph 1 of the draft resolution, Appendix 1*).
24. The objective of the index may be: (i) to measure the average change in the price of a fixed set of goods and services purchased by households for their own consumption; or, alternatively, (ii) to measure the change in the amount that the households need to spend in order to maintain a given standard of living. These measures may differ because consumers do not go on purchasing the same set of goods and services over time, but adjust their expenditures to take account of changes in relative prices and other factors.
25. The following discussion examines the differences between a CPI defined to measure changes in the cost of maintaining a given standard of living and one designed to measure the price change of a fixed set of goods and services. *It is reflected in paragraphs 2 and 3 of the draft resolution.*
26. Changes in consumer prices affect the real purchasing power of households' money incomes and hence the real wealth and standard of living, or welfare, that a given sum of money represents. Instead of simply trying to summarize the price changes for a specified set, or basket, of goods and services, the purpose of a CPI may be to estimate what effect the price changes have had on the cost of achieving a certain standard of living. Such an index is called a cost-of-living index, or COLI. When prices are rising, a COLI is intended to measure the minimum percentage by which households' incomes and expenditures would need to be increased in order to enable the households to continue to enjoy the same standard of living.
27. A COLI will allow for the fact that households seeking to maximize their welfare from a given expenditure can benefit by adjusting their expenditure patterns to take account of changing relative prices, by substituting goods that have become relatively cheaper for goods that have become relatively dearer.
28. An index, defined as a measure of the change in price of a fixed set of goods and services with constant quality and characteristics, is an index of price change only. It does not take into account the changes in consumption patterns that consumers make in response to relative price changes. It can therefore provide only an approximation to a true cost-of-living measure. The 2001 Meeting of Experts discussed the issue and concluded that there was no contradiction between the two concepts. The COLI should be regarded as a theoretical framework, an ideal target for the CPI, while a fixed basket may be regarded as an operational concept, and serve as an approximation of the COLI. This was the situation in many countries.
29. However, bearing in mind that a new ICLS resolution would need to stand for a long time and that new methods, data and tools for producing a COLI may become available, national statistical offices may be in a better position to move towards a COLI and produce both indices at some time in the future.

4. The uses of a consumer price index

30. The CPI is used for a wide variety of purposes. It serves as a key indicator of an economy's performance and for evaluating the results of a country's monetary and fiscal policy. The CPI is often used to adjust wages and social security benefits (including pensions) to compensate for changes in the cost of living. CPI sub-indices are used for deflating sub-components in the national accounts' estimates of total household consumption at current prices.
31. The main uses of the CPI have been changing over time, and their importance may differ between countries. In most countries, CPIs were originally compiled to enable adjustment of wages to compensate wage earners for changes in the prices of goods and services purchased and, as such, they have played an important role in the income adjustment process. Recently, the principal use of the CPI in many countries has shifted to providing a general measure of price inflation for the household sector as a whole. An example of an index developed for this purpose is the European HICP.
32. There is a debate about which of the two types of index (i.e. a fixed-basket index and COLI) should be given preference as a means of measuring inflation. There are two diametrically opposed views. One view is that a clear distinction needs to be made between a fixed-basket index and COLI and that a fixed basket is preferred as a means for measuring inflation. A second view is that a COLI does provide precisely that information which is required of an inflation measure.
33. The arguments for the first view are as follows: the fixed basket approach adheres to the principle of a straightforward comparison of prices, therefore only indicating a change in prices, whereas a COLI provides information about how, given price changes and the substitution processes, expenditure would have to change to maintain the original standard of living or level of utility. A fixed basket is therefore a pure price index, while a COLI is an index which may show change even when all prices stay at the same level. As such, the latter cannot be considered as an appropriate measure of inflation.
34. The argument for the second view is as follows: the COLI is a price index whose weights change to reflect changes in consumer preferences. It is intended to measure the change in the cost of maintaining a given standard of living and takes into account substitutions in response to changes in relative prices. However, it can "also be interpreted as measuring the change in the value of a fixed basket of goods and services where the fixed basket is a particular blend of the baskets in the two periods compared" (Hill, 1997). A COLI is preferred because in practice fixed-basket indices may be biased estimates of inflation (especially in the indices with weights that are updated infrequently) and therefore are measuring changes in the value of a basket of goods and services that is no longer representative.
35. It is unlikely that a single CPI can perform equally satisfactorily for all of its many applications. Different users have different needs. For example, some users may require monthly timely information on the price movements. This requirement leads to a standard Laspeyres-type index calculated with the weights from the earlier of the two periods compared. However, other users may be more interested in the price changes of a more representative set of items and may prefer increased accuracy to timeliness. Another example where multiple indices would be useful arises in the context of the treatment of owner-occupied housing. Different approaches usually give quite different numerical results. It might be reasonable for a statistical agency to choose one approach for their "headline" index but make available to the interested users the alternative indices. A third example where multiple indices would be useful concerns seasonal commodities

(described later). It may therefore be appropriate to construct a number of price indices that can serve specific purposes, if there is sufficient demand and funding and appropriate indices can be efficiently calculated (*cf. paragraph 6 of the draft resolution*).

- 36.** It should be recognized, however, that the publication of more than one CPI can be confusing, and for many users the coexistence of different measures may undermine the credibility of them all. Therefore the recommendation in the draft resolution (*paragraph 6 of the draft resolution*) is that each index should be properly named and only one should be referred to as the “headline” CPI. The labelling and providing documentation on the differences between different CPIs should make clear the appropriate use of each of them.
- 37.** In practice, however, most CPIs are used for a variety of purposes, which can create conflicts of interest. This means that compromises have to be made in the construction of the CPI. One such area, for example, is the coverage of the index: when using the CPI as an indicator of general inflation its coverage should be extended to include elements that are not goods and services consumed by households, but this would undermine its role as an index for consumer prices. With such conflicts, it is the main use, as well as considerations of costs and practicalities, that should determine whether the type of index produced should be a fixed-basket index or COLI, the range of goods and services covered, its geographic coverage, the type of households it relates to. Each of these issues is discussed later in Chapters 5 (Scope of the index) and 8 (Index calculation). The users should be informed of the compromises made and of the consequent limitations of the resulting index for different applications (*cf. paragraph 7 of the draft resolution*).

CPI as an overall measure of inflation

- 38.** The CPI is often used as a general indicator of inflation (or deflation). However, it is only a partial indicator, in the sense that it relates to a particular segment of the economy i.e. goods and services purchased by households. It does not include, for example, goods and services consumed by private enterprises or governments nor capital purchases.
- 39.** An inflation index that covers all (market) transactions in the economy would be expensive to produce, could not be as timely as the CPI, and may be more difficult to interpret. Only a few countries compute a broader price index that provides a measure of inflation for the whole economy (and even then with a delay of several months after the reference period).¹ For the analysis of inflation in the economy and for its full understanding, it may be more meaningful to produce a set of price indices that provide complementary views of the price developments for different types of markets and expenditures (consumer and capital).²
- 40.** In most countries the CPI is regarded as the best available measure of inflation, often since there are currently no other measures that would be acceptable to users. *This situation is reflected in paragraph 5 of the draft resolution.*

¹ i.e. the UK’s final Expenditure Prices Index, developed in response to user needs for an inflation measure which would cover the economy more widely than existing indices.

² Australia’s Economy-wide Price Index Frameworks, Discussion paper, Oct. 1999.

5. Scope of the index

41. The scope of a CPI depends on the use for which it is intended, and can be defined in terms of the type of households, geographic areas, and the types of consumer of goods and services acquired, used or paid for by the reference population (*cf. paragraph 8 of the draft resolution*).
42. Consumption expenditure can be defined to cover the consumption expenditure of the resident population (resident consumption), consumption expenditure made within the country (domestic consumption) or consumption expenditure of national households (national consumption).
43. The concept of domestic consumption is linked to the economic territory of the country and includes the consumption of both residents and those temporarily present. On the other hand, the concept of resident consumption refers to the consumption expenditure made by resident households, regardless of their nationality, at home and abroad. Finally, the concept of national consumption takes into account only the consumption expenditure of the households that are defined as “national”, e.g. on the basis of citizenship, irrespective of the place of acquisition. This is illustrated in the table below.

Households	Place of acquisition	Domestic consumption	Resident consumption	National consumption
National, resident	In the country	yes	yes	yes
National, resident	Abroad	no	yes	yes
National, non-resident	In the country	yes	no	yes
National, non-resident	Abroad	no	no	yes
Foreign, resident	In the country	yes	yes	no
Foreign visitors	In the country	yes	no	no

44. If the primary purpose of the index is to measure domestically sourced inflation, the purchases by both resident and non-resident households made in the country should be within the scope of the index. Such an index would measure the changes in prices faced by all consumers in the country, with the weights that represent consumption expenditure within the country of both resident and non-resident households. Where the main purpose of the index is to measure price changes experienced by the resident population, the expenditure abroad should be included in the scope. *Paragraph 9 of the draft resolution provides guidelines on the scope of the index depending on the main use of the index.*
45. In general, the reference population should be defined as broadly as possible. For reasons of practicality or costs, consumption by certain types of households, such as the relatively very rich or poor households or those living in some remote or inaccessible geographical areas, may be excluded, in which case this should be explicitly stated (*cf. paragraph 10 of the draft resolution*).
46. Geographic coverage may refer to either the geographic coverage of price collection or of consumption expenditures of the reference population, and both should be defined as widely as possible, and preferably consistently. With respect to geographic coverage of price collection, in most countries price collection is restricted to major cities/urban areas, because most of the purchases are made in urban areas and because price movements in

these areas are considered to be representative of the price movements in rural areas as well. In these cases national weights are applied and the resulting index can be considered a national CPI.¹ If price movements in urban and rural areas are expected to be significantly different² but, due to resource constraints, price collection is restricted to urban areas, then urban weights should be applied and the resulting index must be designated as an urban and not a national CPI (*cf. paragraph 11 of the draft resolution*).

- 47.** While there may be interest in a CPI that covers all households in the country, separate CPIs might also be computed for particular sub-population groups or regions for particular analytical or policy purposes. Movements in such indices are likely to be different from the national index, given that both expenditure patterns and prices faced can differ. For example, older persons are likely to spend more on medical care while younger persons may spend more on education and recreation. Older persons may be able to make purchases at subsidized prices (transport, rents, utilities, performances, etc.) while middle-aged or younger persons may not. Differences can also occur through the varieties and qualities of the specific items consumed: e.g. older persons are likely to purchase different clothing items than those purchased by younger persons. There may also be regional differences in expenditure patterns and/or price movements (*cf. paragraph 12 of the draft resolution*).
- 48.** All goods and services that are acquired, used or paid for by the reference population for non-business purposes should be within the scope of the index. The 2001 Meeting of Experts strongly supported the point that no goods or services should be excluded from the CPI scope based on moral or social considerations, e.g. tobacco, alcohol or games of chance. The Meeting was less united on the treatment and services that are not legally available, e.g. prostitution or narcotics. However, the dominant feeling was that, although operationally it might be difficult to obtain reliable estimates for the weights and prices, conceptually such items should be in the scope of the index. Moreover, some of these items may in time be legalized, and therefore should not be explicitly excluded. Efforts should be made to include them if and when possible, provided the total expenditures on them can be expected to be as important as those on other, less controversial items. *This is reflected in paragraph 13 of the draft resolution.*
- 49.** Not all goods and services purchased by consumers are in-scope and those that are not should be excluded: e.g. goods and services purchased for business purposes; expenditures on assets such as works of art; financial investment (as distinct from financial services); and payments of income taxes, social security contributions and fines. Payments of income taxes should be excluded because it is impossible to associate a specific amount of tax paid with a specific quantity of services received. (Note, however, that property taxes are considered to be an integral part of the cost of owning and using a dwelling and for this reason may be included in the CPI, although they are not directly connected with specific quantities and qualities of goods and services obtained by homeowners.) The other categories referred to above should be excluded on the grounds that they are not considered to be consumer goods or services. For example, life insurance should be excluded because it is seen as a financial transaction (*cf. paragraph 14 of the draft resolution*).

¹ It should be noted that, to maintain public confidence in the index, there is pressure to expend the price collection to the rural areas even though this may have little impact on the actual movements shown by the index.

² In the developing countries, with big differences in households' incomes across regions, and absence of good transport systems, the CPIs are likely to show different trends over the longer term.

Acquisition, use and payment

- 50.** There are three different, conceptually valid approaches for defining consumption expenditure:
- (a) *Acquisition* – where the total value of all goods and services actually acquired during a given period, whether or not they were wholly paid for during the period, is taken into account. The expenditure weights are derived from the value of the goods and services at the time goods and services are actually acquired by households. No attention is paid to the timing of the actual money payments or when the item is consumed. The prices enter the CPI in the period when consumers accept or agree prices, as distinct from the time payment is made.
 - (b) *Use* – where the total value of all goods and services consumed (or used up) during a given period is taken into account. The expenditure weights are therefore derived from the value of the goods and services consumed during the period rather than the amount of money paid during the period or when they were acquired. The prices (opportunity costs) enter the CPI in the period of consumption.
 - (c) *Payment* – where the total payments made for goods and services during a given period, whether or not they were delivered, is taken into account. The expenditure weights are therefore derived from payments for access to goods and services, without regard to the time period in which the goods and services were actually acquired or consumed. The prices enter the CPI in the period or periods when the payment is made.
- 51.** The approach taken should be based on the main use of the index. In general, the “acquisition” approach is regarded as the most appropriate for an index intended to be used as macroeconomic indicator while the “payment” approach is the most appropriate for a compensation index. For the purposes of an index intended to measure changes in the cost of living, the “use” approach may be most suitable (*cf. paragraph 15 of the draft resolution*).
- 52.** In practice, these conceptual differences are unimportant for a large proportion of items covered by the index. This is because most goods and services are purchased at full market price and are fully consumed in the same period. Differences between the three approaches are most pronounced in dealing with items such as owner-occupied housing, items acquired on credit, goods and services produced for own-account consumption, remuneration in kind and goods and services provided without charge or at prices subsidized by government and non-profit institutions serving households (NPISHs) (*cf. paragraph 16 of the draft resolution*).
- 53.** The most complex of these items is owner-occupied housing. Its treatment in the CPI differs widely between countries. Some countries regard expenditures on owner-occupied housing entirely as capital investment and exclude them from the index. For others, owner-occupied housing consists of both a capital and a consumption element and the main difficulty is how to separate them. The decision regarding the approach to follow should be based on the purpose of the index, as well as on the costs and the acceptability of the decision to the users (*cf. paragraph 17 of the draft resolution*).
- 54.** The “acquisition” approach attempts to measure the change in the price of acquiring a dwelling. Therefore, the purchase of owner-occupied dwellings is treated in the same way as the purchase of other major consumer durables (such as cars and furniture). Thus, the full price of the dwelling is included in the index at the time of purchase or acquisition, and

the weight for this price is based on the net value of the dwellings acquired by the reference households in the weight reference period.

55. The “use” approach attempts to measure the change in the price of consuming the service of owner-occupied housing. Therefore, the actual consumption of the service of the dwelling is included in the CPI with a weight based on the estimated cost of using an owner-occupied dwelling. The most common estimation and pricing method is the “rental equivalent” approach where the cost and price of owner-occupied housing is estimated using the market rent for rented dwellings with similar characteristics (in terms of size, facilities, geographical location, year of construction, etc.). This method may be impractical if the rental market is very small compared with the owner-occupied market, or if rented dwellings tend to be different from owner-occupied dwellings. This method might also be unsuitable for countries where there is a question as to which rent to use: the market rent or the state-controlled rent. Estimated costs may be significantly different where state-controlled rents are considerably lower. A further problem in many countries is that there is no reliable information available on actual market rents. Very often, there is a double contract between landlord and renter, and information is only provided on the one which reflects current regulations
56. The “payment” approach attempts to measure the change in households’ current actual outlays on owner-occupied housing. In principle, all payments related to the dwelling may be covered: cash outlays for the purchase, conversion or extension of the dwelling, and insurance, mortgage and mortgage interest payments.
57. For items acquired on credit, the associated interest payments are not included in an acquisitions index but are in a payments index. The total amount of interest charged in a period bears no direct relationship to actual quantities of goods or services acquired by households during the period. Therefore, interest charges should not be included in an acquisitions index. However, because interest charges are incurred as a consequence of consumption decisions, they should be included in a payments index. ***No explicit recommendation has been made in the draft resolution on this issue. The general recommendation made in paragraph 15 of the draft resolution may be applied.***
58. *Paragraph 18 of the draft resolution* contains self-explanatory recommendations regarding goods and services produced for own-account consumption, remuneration in kind and/or goods and services provided without charge or subsidized by governments and NPISHs. Therefore, they are not discussed in this document.

6. Basket and weights

59. Decisions on the composition of the basket and the weights follow directly from the choice between the “acquisition”, “use” or “payment” approaches, and the choice of reference population and of geographic coverage. The CPI basket of items for which prices are to be observed should contain the goods and services that fall within the scope of the index and which are important to households for private household consumption (*cf. paragraph 19 of the draft resolution*).
60. To select the basket of items one needs a classification that will serve a number of important purposes: it provides the weighting and aggregation structure; it provides a scheme for stratification of products selected for price observations, whether by random or non-random sampling. It also dictates the possible set of sub-indices that can be prepared for publication, and it facilitates the production of indices for analytical purposes. The Boskin Report recognized the importance of getting the index classification right from an index construction viewpoint.¹
61. There are several factors that must be taken into account when a CPI classification system is being developed. First, it must be possible to incorporate into its detailed group new goods and services in a manner that minimizes the need for restructuring higher level categories. Second, the needs of users for sub-indices should be given a high priority. Third, the categories must be unambiguously mutually exclusive and at the same time provide complete coverage of all items within the scope.
62. There are a number of classification systems in use for CPIs among statistical agencies. While the resolution does not recommend a particular classification scheme, it does recommend that for the purposes of international comparison, the national classification scheme should conform to, or be reconcilable with, the standard international *Classification of individual consumption according to purpose* (COICOP), at least at its division level (*cf. paragraph 20 of the draft resolution*). This recommendation was strongly supported by several participants at the 2001 Meeting of Experts.
63. To provide users with important additional information and to facilitate the analysis and interpretation of the results of the index other supplementary classifications may also be useful, such as:
- (a) classification of the goods and services according to their source of supply, in order to determine the domestic and imported components of price changes;
 - (b) classification based on a distinction between goods and services, and according to their durability;
 - (c) classifications based on distinctions such as degree of seasonality, degree of price control, etc.

This is reflected in paragraph 21 of the draft resolution.

64. The weight assigned to a particular category in the classification should stay fixed from one period of reweighting to the next. When these weights are to remain fixed for several

¹ The Boskin Report (1996), stated that “items which are the closest substitutes for others in how they are used, must be in the same group, the lowest level at which indices are constructed”.

years, the objective should be to use weights that are most likely to remain representative of contemporary behaviour of household consumers, rather than be a precise reflection of the consumption pattern in a particular period of observation that may have been abnormal in some way (for example, affected by economic blockades, extremely favourable or unfavourable weather conditions, etc.). This means that it is legitimate to make adjustments to the results from, e.g. household expenditure surveys to take into account circumstances that have affected consumption in the survey period. *This is reflected in paragraph 22 of the draft resolution.*

- 65.** The movement of the CPI is influenced by the weights assigned to different items in the basket. The quality of the weights used is important for the objectivity and reliability of the CPI estimates.² For this reason the choice of sources from which the weights are constructed is crucial. Information on the composition of household consumption expenditure can be obtained from a number of sources, the two main sources being the results from household expenditure surveys (HESs) and national accounts estimates of household consumption (HC). The results from a HES can normally provide more detailed information than the national accounts estimates which are normally based on a combination of HES results and statistics from other sources. The estimates from the national accounts may nevertheless be important when estimating weights for consumption categories which tend to be significantly underreported in HESs, or where the HES results are likely to be particularly imprecise (for example, because the expenditures occur as large “lumps” at long intervals), or when HES results suffer from a significant and distorting partial or total non-response rate. The decision on the main source depends on an analysis of their respective advantages and disadvantages and on the main purpose of the index (*cf. paragraph 23 of the draft resolution*).
- 66.** Additional information may also be needed from production and trade statistics, from government departments, producers, marketing bodies and individual enterprises, particularly when weights are assigned to the most detailed items. It is likely that the data obtained from different sources will have different reference periods. Therefore, it is important to ensure, before weights are allocated, that expenditures are price updated so that they have the same reference period. *This is reflected in paragraph 24 of the draft resolution.*
- 67.** Price updating may also be required where the weight reference period differs from the price reference period. In most cases the HESs are conducted some time before the weights are introduced in the index. If consumers are likely to have kept constant quantities, i.e. if there has been little or no substitution, the weights should be price updated. In cases where quantities and prices have tended to move in opposite directions, price updating may not be desirable. For example, if high-technology products for a period have experienced below average price increases (or price falls), price updating will result in a too small expenditure weight of high-tech products if households have increased the quantities of high-tech products purchased.³ It is up to the statistical agency to decide: (i) whether or not to price update the weights; and (ii) whether the weights in the new index should preserve the quantities from the weight reference period or the expenditures from the weight reference period. *This is reflected in paragraph 25 of the draft resolution.*

² Although the errors in weighting may not have a large influence on the all-item index, the subgroup level errors could be significant.

³ Price-updated weights from a weights reference period would keep the quantities consumed constant (of, for example, the number of personal computers or mobile telephones), but due to price decreases their relative importance in the total consumption would decrease. Such price-updated weight for PCs would not reflect the real consumption share of this product.

-
- 68.** The current resolution on CPI recommends that the weights be revised at least once every ten years. In a number of countries the basket of goods is traditionally updated every five years, in others it is updated each year. At the 2001 Meeting of Experts, the secretariat proposed to recommend that weights should be updated at least once every five years. Although some of the Meeting's participants noted some countries have difficulty meeting the current ten-year recommendation, it is considered that the resolution should point out the best practices. However, the recommendation was made less firm by replacing "at least once every five years" with "preferably once every five years" (*cf. paragraph 26 of the draft resolution*).
- 69.** The lowest level weights are likely to become out of date more quickly than upper level weights. Therefore, it is pointed out that the selected products or varieties and lower level weights, for at least some categories, need to be reviewed and updated more frequently than upper level weights to reflect changed consumption patterns.⁴ The best use of the available statistical information (i.e. market research, small annual surveys, etc.) should be made for this purpose. *This is reflected in paragraph 26 of the draft resolution.* It should be noted that while changes and/or errors in weighting may not have a large influence on the all-items index, the subgroup level indices could be significantly affected.
- 70.** When new baskets and weights are introduced, a continuous CPI series should be created by linking together the index numbers based on the new basket of goods and services, together with their respective weights, to the previous one. To calculate a continuous index series, the last period of the old index should be used as a price reference period in the calculation of the new index (*cf. paragraph 27 of the draft resolution*).
- 71.** The introduction of new weights and the chaining of the new index with the old one should be combined with other operational and methodological improvements to the greatest extent possible: e.g. the introduction of new items, new samples of outlets, new data sources, new compilation practises, new elementary aggregates, new higher level indices or new classifications.
- 72.** Completely new types of goods and services (those that represent new purposes) should normally be considered for inclusion only during one of the periodic reweighting exercises. A new model or variety of an existing product that can be fitted within an existing elementary aggregate should be included at the time it is assessed as having a significant and sustainable market share. A common way to include such new models is to treat them as a quality change of an existing product and to link⁵ them into the existing series (*cf. paragraph 28 of the draft resolution*).
- 73.** For a number of items, estimating an appropriate weight is not straightforward. Such items include seasonal items, insurance, second-hand goods, expenditures abroad, interest payments, own production, social transfers, expenditures on purchase and construction of dwellings. The 2001 Meeting of Experts asked that a number of these items be addressed in the draft resolution (*cf. paragraphs 29-32 of the draft resolution*).
- 74.** *Paragraph 30 of the draft resolution* recommends two approaches for the weights for seasonal items:

⁴ Eurostat has suggested developing quality-control procedures for monitoring the weights of the items which are judged to be most critical for reliability and relevance of the overall index and whose changes in the prices have diverged from the movement of the overall index.

⁵ Annex 1.

-
- (a) a fixed-weight approach which uses the same weight for the seasonal item in all months and an imputed price in the out-of-season months, i.e. treating the seasonal item groups as all other “normal” consumption groups in the index;
 - (b) a variable weights approach where a changing (moving) weight is attached to the seasonal item in various months. According to this method, the weights of the seasonal items change monthly according to changes in the quantities consumed during the different months of the base period.

75. The decision on the approach to use 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 is 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 later case, monthly price changes for items that are out of season can be greatly magnified by the use of annual weights.⁶ To satisfy the needs of different users it may be appropriate to construct *two* indices: one for the short-term measurement of price changes (with variable monthly weights) and another longer term index (with fixed annual weights).

76. With regard to the valuation of *consumption from own production* the practice recommended by the United Nations System of National Accounts (SNA) is to use the market prices for similar goods. However, these may not be the most suitable in many developing and transition countries, especially for countries plagued with poverty where the CPI will be used to deflate the consumption of the poor. Consumption from own production may be substantial for many categories of the poor, because they cannot afford to buy many items. Valuation of the consumption from own production at the prevailing market prices may overstate their well-being. A valuation based on the prices of the input, including an appropriate compensation for working time, and prices of the input in production of these goods and services would be more suitable in such situations. The third option is to consider consumption of own production as a consumption of different quality and, therefore, use quality adjusted market prices in its valuation (*cf. paragraph 32 of the draft resolution*).

77. The issue is very similar with regard to the *second-hand goods*. Consumption of second-hand goods is relatively more important in developing countries than in developed countries, and especially in the consumption of poor households. The changes in the prices of second-hand goods have a very different impact on the low-income and high-income households. Therefore, in the countries struggling with poverty, separate CPIs should be compiled for the two groups of households, so that low-income households are properly compensated. *This is implicitly reflected in paragraph 6 of the draft resolution.*

78. Estimation of weights for second-hand goods is controversial. One view, which fits in the established standards for the national accounts is that weights should be based on a net acquisition (acquisitions less sales) basis. According to this approach if all second-hand goods originated from members of the reference population group, then the net expenditures would correspond to dealer margins plus taxes. Another view is that the weights for second-hand goods should be based on acquisitions without netting sales. The argument for the later is that, in order for the CPI to reflect the average price experience of

⁶ 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.

households, the weights have to reflect the importance that the respective product groups have in their consumption. In calculating these “average weights” it does not matter how the households obtain the funds used to pay for the expenditures, thus a “netting out” of second-hand goods will not be appropriate. Netting out the purchases of such goods for the purpose of calculating weights would substantially underestimate the importance of the second-hand purchases for an average household and thus the actual price experience of a significant proportion of households and purchases will be ignored.

79. The two approaches might be regarded as correct for different purposes of the index. For an index intended to be used in macro analysis, the first approach might be considered as appropriate as the acquisitions cancel the sales of second-hand goods. For the index intended to measure changes in the cost of living, a microeconomic perspective and the second approach might be more relevant (*cf. paragraph 31 of the draft resolution*).
80. Regarding *goods and services totally or partially subsidized* by the government and non-profit institutions serving households, some argue that the gross expenditure and the full, unsubsidized, price of such products should be the basis for estimating weights and observing price changes for the index. Others argue that the CPI does not aim to measure total inflation, but just that part affecting the private households, therefore, the expenditures net of reimbursements and the nominal price paid by the household should be used. The second option may be more appropriate for CPI purposes. Its main disadvantage is that it does not capture the change in the prices of goods or services that were previously provided free, because they will have a weight equal to zero. In cases where subsidies that have been provided to households are changed significantly, it may be necessary to recalculate the set of weights that are used in order for the CPI to reflect correctly the prices experienced by households. ***The Conference is invited to consider the need for guidelines on the above.***
81. For *insurance*, there are two conceptually valid approaches for constructing the weights. According to the gross expenditure approach, the weight is estimated from the total household payments for insurance premiums in the base period. According to the net expenditure approach, the weight is determined on the basis of the total household payments to insurance companies in the base period, minus the compensation received by the insured households from the insurance companies. In this case the weight used for the index would reflect the administration costs of the insurance companies (the difference between the premiums paid to the companies and the cost of damages they paid out). The choice is the conceptual issues which also depend on the relative feasibilities of these alternatives in each country. ***The Conference is invited to consider the need for guidelines on the above.***
82. Service charges for *financial transactions* although within the scope of the index, have typically been ignored or badly covered in CPIs. Due to the difficulty of obtaining reliable data, very often it is impossible to separate service charges from the other components charged by the institution providing the service. The method of measuring financial services requires further investigation.

7. Sampling for price collection

- 83.** The universe of products and outlets is huge. Hence, for practical reasons, sampling methods have to be applied to decide the items and the outlet types (such as supermarkets, specialty stores, markets etc.) for pricing.
- 84.** The sample size and sample selection methods should ensure the accuracy required for the objectives of the index. Therefore, the samples of geographic areas, dwelling units, sales outlets, and items and varieties priced, should be as large and representative as possible so that the resulting indices be sufficiently accurate (*cf. paragraph 35 of the draft resolution*).
- 85.** The sample size will depend on the expected regional differences in price change and on the level of detail to which sub-indices of the CPI will be published. Larger samples are called for if regional differences in price change are of interest and the level of detail for published sub-indices is very high. To optimize the cost of the index, the sample size of each group could be set approximately proportional to its respective weight. An even better approximation could be obtained by multiplying the weight with a measure of expected price change dispersion in the group, e.g. determined on the basis of historical experiences. In many countries, unfortunately, the size of the samples depends more on the total budget available and previous decisions about the sample than on the level of accuracy required.
- 86.** The strengths and weaknesses of probability or non-probability sampling methods are discussed below.
- 87.** Three probability sampling designs can be used to select outlets and products: simple random sampling (SRS), probability proportional to size (PPS) sampling, and stratified sampling with SRS or PPS sampling in each stratum. The advantage of SRS, which gives each population element, i.e. outlet or item, the same probability of being included in the sample, is its simplicity. PPS sampling has the advantage that the most important elements have a high probability of being selected, while at the same time allowing a random element in the selection process. Using either SRS or PPS will make it possible to estimate the degree of precision in the resulting price observations.
- 88.** Unequal probability designs, like PPS, can lead to substantial variance reduction by comparison with equal probability designs. It should be noted, however, that most of the potential gain in the precision of PPS sampling can be captured through stratified selection with SRS within well-constructed strata. In stratified sampling, the population is divided into non-overlapping subpopulations called strata. For instance, at the United Kingdom Office for National Statistics, the population of outlets is split by outlet type (multiple, independent or specialist, such as baker and butcher) to form different strata. A sample according to a certain design is then selected in each stratum. This strategy is much easier to implement than PPS.
- 89.** When appropriate sampling frames are lacking, samples have to be chosen by non-probability methods, such as judgemental (or expert choice) sampling, where an expert designates the list of products/outlets according to specific criteria. Quota sampling is a more sophisticated non-probability method where the population is divided into certain strata. For each stratum, the number (“quota”) of elements to be included in the sample is specified. The price collector simply “fills the quotas”, which means, in the case of outlet sampling, that the selection of the outlets is based on the judgement of the price collectors and the specified criteria. When correctly implemented the selected sample should have the same proportions of units as the universe with respect to a number of specified characteristics, such as, product subgroup, type of outlet, location. A third non-probability

method is cut-off sampling, in which there is deliberate exclusion from selection of some members of the target population. The word “cut-off” refers to the borderline value between the included and the excluded units.

90. The main problem with non-probability sampling is that there is no way of knowing whether the average price change for the observed prices accurately reflects the average price change for the entire population. Probability sampling allows the estimation of sampling variance and hence optimization of sample sizes for localities, outlets, items and varieties. Thus, the draft resolution recommends that both outlets and products be selected by random sampling with known probabilities of selection. Where this is difficult to implement, some form of purposive sampling, with a preference for cut-off sampling should be used (*cf. paragraphs 36 and 37 of the draft resolution*).
91. Efficient and reliable sampling, whether random or purposive, requires comprehensive and up-to-date sampling frames. Two types of frames are needed for CPI purposes, one listing the universe of outlets and the other listing the universe of products.
92. Statistical business registers (SBR), where outlets are classified according to major activity and location, could be used as a sampling frame for outlets. SBRs may have extensive over-coverage, however, because they contain out-of-scope outlets (for instance firms that sell their services to businesses rather than to households). In addition, there is usually no detailed information available in a SBR on the commodities sold by an outlet. So, it is possible that a sampled outlet may not sell the commodity in question. A more common problem is, however, that SBRs can have undercoverage, which means that some outlets where commodities are purchased have not been registered, and therefore will not appear in the sampling frame, for example, market stalls.
93. Other potential sampling frames for outlets include business telephone directories, records of local government administrations, organizations of enterprises, etc. An appropriate sampling frame can be created by enumeration of the main outlets within each sampled geographic area, e.g. municipality. Such outlet enumeration yields a list of all outlets in the area, together with the commodity groups that are available in them. A less expensive way to organize an outlet sampling frame is to ask the price collectors to make a list of outlets where purchases are made by households in the area that they will cover; as they can be assumed to know the local situation well.
94. Point-of-purchase surveys, i.e. surveys where households are asked to name or describe where they make their purchases of different items, are a valuable source of information for outlet selection. Based on the information collected it is possible to establish a list of outlets with the total sales for all the different products. A sample of outlets could then be drawn from this list with probability proportional to the sales.
95. Sampling frames for products are not always available in practice. Possible frames are catalogues or other product lists drawn up by major manufacturers, wholesalers or trade associations, or lists of products that are specific to individual outlets such as large supermarkets. These lists could also be drawn up by the price collectors themselves by noting the products exposed in the outlets in their areas, i.e. “on the shelf”. “Shelf space” may then be used as a size measure for selecting the most appropriate products.
96. Electronic databases now used in most major outlets in industrialized countries may allow completely new approaches to sampling. Information collected by bar-code readers at the cashier’s desk can be particularly helpful in the selection of products.
97. The populations of items and outlets are continually changing over time. The composition of most item groups is not constant over time, because some items disappear from the

market and new ones appear. Over time also some outlets close, temporarily or permanently, new outlets emerge and the importance of some outlets will change. Therefore, the samples of items and outlets should be reviewed and updated periodically to maintain their “representativeness” with respect to the current buying habits of the households. *This point is reflected in paragraph 39 of the draft resolution.*

8. Index calculation

98. The compilation of a CPI consists of collecting and processing price and expenditure data according to specified concepts, definitions, methods and practices. There is no fixed set of procedures that can be applied automatically in all circumstances.
99. 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 by using either the APR, RAP or GM formula (see below). In the second stage, elementary indices are combined to obtain higher level indices by using weights assigned to each elementary aggregate. The number of elementary aggregates differs between countries, from 100 to around 1,000.
100. In previous ILO resolutions on the CPI, the appropriateness of the different formulae for computing elementary aggregates, and their application in relation to the main use/purpose of the index, was not discussed. However, better insight has recently been obtained into the relative strengths and weaknesses of the various formulae and methods used to process the basic price data collected for CPI purposes.

Elementary aggregates

101. Elementary aggregates are the smallest relatively homogeneous sets of items for which a reliable expenditure weight can be estimated. The items should be similar in their physical characteristics or functions and may be defined not only in terms of their characteristics but also in terms of the type of location and outlet in which they are sold. The degree of homogeneity achieved in practice will depend on the availability of corresponding expenditure data.
102. Because expenditure weights usually cannot be attached to the prices/price relatives for the sampled items within the elementary aggregate, an elementary index is calculated as an unweighted average of the prices/price relatives. This is the lowest level aggregate and the only one for which an index number is constructed without any explicit expenditure weights, although other kinds of weights might be explicitly or implicitly introduced into the calculation. For example, countries that use probability sampling of outlets and items can use the inverse of the sampling probabilities as weights. Also, for certain elementary aggregates, information about sales of particular items, market shares and regional weights may be used as weights within an elementary aggregate.
103. The three most commonly used formula for calculation of elementary indices are:

(a) the ratio of arithmetic mean prices (RAP)
$$I_{RAP}^{0t} = \frac{\frac{1}{n} \sum p_i^t}{\frac{1}{n} \sum p_i^0}$$

(b) the arithmetic mean of price relatives (APR).
$$I_{APR}^{0t} = \frac{1}{n} \sum \left(\frac{p_i^t}{p_i^0} \right)$$

- (c) the geometric mean of price ratios and the ratio of geometric mean prices (GM) (The ratio of the averages is identical to the average of the ratios.)

$$I_{GM}^{0:t} = \prod \left(\frac{p_i^t}{p_i^0} \right)^{1/n} = \frac{\prod (p_i^t)^{1/n}}{\prod (p_i^0)^{1/n}}$$

- 104.** APR formula traditionally has been used by many compilers. This formula gives more importance to prices that rise more quickly than those that rise slowly. In other words, it overestimates a general price increase and underestimates a general price fall. There is a general consensus that an APR may be unsuitable for a CPI because it is liable to give a significant upward bias, especially when used in its chained form.
- 105.** The RAP formula is also widely used. It requires that the various items whose prices are being averaged to be strictly homogeneous, and this is difficult to achieve in practice. It gives higher weight to higher price levels, so it should not be used when the dispersion of prices within the elementary aggregate is considerable. RAP does not allow for substitution within an elementary aggregate; it assumes that *fixed quantities* of all items are consumed over time irrespective of the price changes. Therefore it could be said that RAP is most appropriate for elementary aggregates where the possibility for substitution is very low or close to zero.
- 106.** The GM formula gives the same results in its direct and chain form, and allows substitutions, i.e. it assumes that the consumers maintain *fixed expenditures* and not fixed quantities. It is regarded as the preferred formula from many perspectives. There is an increasing tendency for national statistical agencies to switch from using APR or RAP to GM.
- 107.** The use of different formulae in calculation of elementary aggregate indices is illustrated in the table below. From the table, it can be seen that the choice of formula can deliver very different results.

Calculation of elementary aggregate indices by using different formulae

	Average 2000	January 01	February 01	March 01
	Price in the period			
Item A	5.0	5.0	4.0	5.0
Item B	4.0	8.0	6.0	4.0
Item C	8.0	4.0	10.0	8.0
<i>Arithmetic mean prices</i>	<i>5.7</i>	<i>5.7</i>	<i>6.7</i>	<i>5.7</i>
<i>Geometric mean prices</i>	<i>5.4</i>	<i>5.4</i>	<i>6.2</i>	<i>5.4</i>
Arithmetic average of price ratios (APR)				
Direct index	100.0	116.7	118.3	100.0
Chained monthly index	100.0	116.7	157.5	142.6
Ratio of arithmetic mean prices (RAP)				
Direct Index	100.0	100.0	117.6	100.0
Chained monthly index	100.0	100.0	117.6	100.0
Ratio of geometric mean prices and geometric average of price ratios (GM)				
Direct index	100.0	100.0	114.5	100.0
Chained monthly index	100.0	100.0	114.5	100.0

-
- 108.** *Paragraph 43 of the draft resolution* concerns the formula to be used for the calculation of elementary aggregate indices. The recommendation is that the GM should normally be used where possible, especially where the elasticity of substitution between items in the same elementary aggregate is close to one. It might not be appropriate for all elementary aggregates, particularly where the price may become zero or where consumers have only limited ability to substitute among products and outlets. The geometric mean would not necessarily work well with elementary aggregates that consist of larger product families for which the substitution elasticities between items might be low. In addition, it might be inappropriate for small samples. In these cases, it is recommended that the elementary aggregate index be constructed using the ratio of the RAP approach. The APR approach should be avoided if at all possible, owing to its known upward bias, especially in its chained form.
- 109.** It is acceptable to use different formulae for different elementary aggregates, depending on the homogeneity within the elementary aggregate, elasticity of demand, variation of prices, etc. It is recommended that the characteristics of the price behaviour within each elementary aggregate should be examined in order to identify the most appropriate formula.
- 110.** The choice of the formulae also depends on the conceptual basis of the index. It has been argued that, for an index whose main purpose is to measure changes in the cost of living, the GM should be used for elementary aggregates where the elasticity of substitution is close to one, and the RAP should be used for elementary aggregates where the elasticity of substitution is close to zero. For an index intended to measure the *changes in average prices*, relevant for an index whose focus is on the inflationary experience of households, there is an argument for using just the RAP. APR may be considered as the most useful for an indicator where a central focus is on the *average price changes* in the economy.
- 111.** The need to assign weights to the items composing an elementary aggregate, if at all possible, is stressed in the last sentence of *paragraph 43 of the draft resolution*. This is important because unweighted samples can be biased. Therefore national statistical agencies are encouraged to make every effort to attempt to assign weights at all levels of aggregation. Improved sources of information, for example retail trade and scanner data may make it possible to attach explicit weights at more detailed levels of aggregation in the foreseeable future.
- 112.** The elementary index may be computed by using either a chained or direct form of the formula chosen. In a direct elementary index, the prices of the current period are compared directly with those of the price reference period. In a chain index, prices in each period are compared with those in the previous period, with the resulting short-term indices being chained together to obtain the long-term index. The table above shows that the chained APR produces biased estimates. Although RAP and GM give identical results whether calculated in a chained or direct form, they offer different ways of dealing with new and disappearing items, missing prices and quality changes.
- 113.** The use of a chained form formula generally makes the estimation of missing prices and the introduction of replacement items easier from a computational point of view. When a replacement item has to be included in a direct index, it will be necessary to estimate the price of the new item in the price reference period, which may be several periods ago. In a chain index, if an item becomes permanently missing, a replacement item can be included in the monthly index as soon as prices for two successive months are obtained, without the need to estimate a price for it for the base period. In addition, a chained form is more suitable because the sets of products available in adjacent periods tend to be much more similar than those in periods that are far apart (*cf. paragraph 44 of the draft resolution*). For the elementary aggregates where the frequency of disappearance of old models (and

appearance of new models) is high, it may be more appropriate to use the formula in its chained form rather than in its direct form.

Upper level indices

- 114.** Once the indices for the elementary aggregates have been estimated, class indices are obtained as their weighted averages. Class indices are then combined, following the hierarchy of the classification, with appropriate weights applied along the way. For example, the price indices for butter in different regions are combined in the price index for butter using appropriate regional weights. The price indices for butter, margarine, oil and animal fats are then combined to form an index for oils and fats with appropriate weights for each of these items. Similarly, the various price indices for clothing materials are combined to obtain a clothing materials' index. These indices are then further combined to produce major division indices, in these cases, "food" and "clothing and footwear". Finally, the major division indices are combined to arrive at the "all-items" index, the CPI.
- 115.** There are many types of formulae that might be used to aggregate the elementary indices and compute the average price change. Most if not all countries are using the Laspeyres-type index formula. The Laspeyres index is characterized by a fixed base and by fixed quantities. It is defined as the percentage change in the total cost of purchasing a fixed basket of goods and services resulting from changes in their prices. The meaning of such an index is easy to grasp and to explain to users. Indices of this kind are sometimes described as "pure" price indices because they change purely in response to price changes, the quantities of the goods and services in the basket remaining fixed. Such indices date back about two hundred years.
- 116.** The Paasche index compares the cost of purchasing the current basket of goods and services with the cost of purchasing the same basket in an earlier period. The prices are weighted by the quantities of the items consumed during the current period. This requires continuous data collection on current expenditure patterns in each period, which may be costly and time consuming. With weights that vary from period to period, it is difficult to know whether the index changes are due to changes in quantities or changes in prices. These make the use of the Paasche index much less extensive than the Laspeyres.
- 117.** From a theoretical point of view, a Fisher or other "superlative" index number formula (e.g. the Tornqvist index or the Walsh index) are regarded as the optimal index number formulae for most purposes. "Superlative" formulae require both base-period weights and current-period weights, as they treat the time periods being compared symmetrically. While the Laspeyres and Paasche indices rely exclusively on the expenditure weights in one or other of the two periods being compared, "superlative" indices make equal use of the expenditure patterns in both periods, but in different ways. The Fisher index is the GM of the Laspeyres and Paasche indices and therefore treats both periods symmetrically. It is, theoretically, one of the best proxies of an ideal index. Theory also shows that a Laspeyres index usually overestimates the Fisher index, while a Paasche index usually underestimates it.
- 118.** A "superlative" index can only be produced with a time lag. Therefore, in practice, regardless of the objective of the index, most if not all countries are using the Laspeyres-type index formula.
- 119.** Used as a COLI, the Laspeyres-type index assumes that no important quantity changes take place in response to changes in relative prices between the base period and the current period. It thus has an upward bias, usually described as "substitution bias". This has had a

profound influence on attitudes towards the Laspeyres-type CPIs in some countries. It should be noted that a Paasche index would be expected to have a downward substitution bias.

- 120.** With respect to “the pure price indices” desirable for many purposes, it should be noted that some of the superlative indices, such as like the Walsh index, are also *pure* price indices. The fact that a Walsh is both a superlative and a pure index throws light on the interrelationships between COLIs and pure price indices. Pure price indices do not have to diverge from COLIs and are not biased as estimators of COLIs. Bias is only likely to arise when the relative quantities used in a pure price index favour one of the periods at the expense of the other, as in a Laspeyres or Paasche index.
- 121.** The table below presents some numerical examples using an artificial data set. The purpose is not to illustrate the methods of calculation as such, but rather to demonstrate how different index number formulae can yield very different numerical results.

Commodity	Base period			Current period		
	P ₀ (\$ per kg)	Q ₀ (kg)	Exp. ₀	P ₁ (\$ per kg)	Q ₁ (kg)	Exp. ₁
Chicken	3	150	450	7	80	560
Beans	4	100	400	2	300	600
Total			850			1 160

The results are as follows:

Laspeyres index	=	147.06
Paasche index:	=	80.56
Fisher index	=	108.84
Walsh index	=	108.98

The Laspeyres index over the period registers an increase of 47 per cent while the Paasche falls by 20 per cent. The two superlative indices, Fisher and Walsh, register increases of 8.84 per cent and 8.98 per cent respectively. These results show that the choice of index formula and method does matter. The Fisher and the Walsh indices tend to yield similar results.

- 122.** Although a Fisher, Walsh or other superlative index cannot be calculated within the short deadlines required for the CPI, some national statistical agencies may wish to calculate a retrospective Fisher, Walsh or other superlative index once the weights for the current year become available. Comparing the difference between this index and the CPI estimated with a Laspeyres formula would give some indication of the combined impact of income change, preference change and substitution effects over the period in question, which may be important information for users. The 2001 Meeting of Experts suggested that calculation of retrospective superlative indices could be more useful for the index compilers, as a means of identifying the procedures that may be expected to produce results that most closely approximate the optimal index. (*This is reflected in paragraph 46 of the draft resolution.*) It should be noted that, in the course of time, enough expenditure data could become available fast enough to make it possible for national statistical offices to calculate a “superlative” index almost as fast as a Laspeyres-based CPI.
- 123.** Recent developments in index number theory permit the calculation of an index that approximates the superlative index, without information on current weights. This is done

by using an assumed elasticity of substitution between the commodities in the index – this is called the “constant elasticity of substitution” (CES) approach. Such a method permits approximating superlative indices without current period weight information, and will avoid the necessity of frequent and costly basket and weight updates. Statistical agencies could produce such an index, currently, and its accuracy could be evaluated historically when the data needed to calculate a Fisher index become available. The advantage of the CES formula is that, given an estimate for the relevant elasticities of substitution, it can be measured in real time. The limitation is the need to obtain reliable and robust estimates for these elasticities, a task that will require substantial development and maintenance work and assumptions about changes in substitution over time.

- 124.** Another option is the weighted GM formula. This formula assumes fixed expenditures and not fixed quantities. It is a special case of the CES formula, with the elasticity of substitution equal to one. This formula is not widely used in practice.¹
- 125.** The 2001 Meeting of Experts considered these different approaches and concluded that they have not yet been sufficiently developed to be included in the CPI guidelines. However, it was generally felt that, since a new resolution would be expected to provide guidelines for many years, these possible methods should not be ignored. *The Conference on CPI may want to discuss whether references to these approaches (proposed under paragraph 45) should be included in the guidelines, and the best way to do so.*
- 126.** The calculation of upper level indices as direct or two-stage indices is covered in *paragraph 47 of the draft resolution*. The Meeting of Experts proposed that guidelines that clarify the distinction between fixed-base and chained indices be included in the resolution. The first strategy is to choose a certain period as the base period and compute fixed-base price indices for later periods by comparing these later periods to the base period (formula 1). In this formula the weights remain fixed from period to period. This is the most commonly used approach where the reference period is kept constant for several years (three to ten years or more). Instead of calculating a time series of Laspeyres indices on a fixed-base period, the index for each successive period can be based on the preceding period, month or year. The indices between each successive pair of periods can then be linked together to form a *chain index* to measure longer term price movements (formula 2). Such indices are often described in the literature as “modified” Laspeyres indices.

$$(1) I^{0t} = \sum w_i^0 \cdot I_i^{0t} = \sum w_i^0 \cdot I_i^{0t-1} \cdot I_i^{t-1t}, \quad \sum w_i^0 = 1$$

- 127.** For the chained index the expenditure weights have to be price updated each linking period to take account of the price changes between the price reference period and the linking period, $t-1$. Price updating is revaluing the quantities of period 0 at the prices of period $t-1$. Price updating is needed to ensure that the base-period quantities are unchanged. It does not change the consumption pattern of the weight-reference period but allows the expenditure shares to vary with the developments in relative prices. *This is reflected in paragraph 47 of the draft resolution*. The advantage of the “modified” Laspeyres index is that it allows the sampled products within the elementary aggregate index from $t-1$ to t to differ from the sampled products in the periods from 0 to $t-1$. The problem with the use of fixed-base Laspeyres indices is that the period 0 fixed basket of commodities that is being

¹ The US Bureau of Labor Statistics has been investigating alternative forms of basic level and aggregate index estimators and as from 10 April 1997, is releasing an experimental Consumer Price Index for All Urban Consumers that uses a GM formula at the lower level of aggregation while keeping the current Laspeyres arithmetic mean formula for higher level aggregation (BLS, 1997).

priced in period t can often be quite different from the basket priced in period t . More and more frequently, countries are using “modified” Laspeyres indices.

$$(2) \quad I^{0:t} = I^{0:t-1} * I^{t-1:t} = I^{0:t-1} \cdot \sum w_i^{0(t-1)} \cdot I_i^{t-1:t}$$

$$\text{where} \quad w_i^{0(t-1)} = \frac{w_i^0 \cdot I_i^{0:t-1}}{\sum w_i^0 \cdot I_i^{0:t-1}}$$

Index and price reference periods

128. Closely related to the use of the fixed and chained indices is the choice of the price and index reference period. The index reference period is the period for which the index base is set to 100. It could be a month, a quarter or a year. The price reference period is the period with which prices in other periods are compared. It could also be a month, a quarter or a year. In countries that are using fixed-base indices, the price reference period and the index reference period are the same. In countries that are using “modified” Laspeyres indices two periods are different.² Most statistical agencies that employ the “modified” Laspeyres formula use a single month as a price reference period whereas for fixed-base indices the practice is mixed. The main argument in favour of one month is the fact that the new index can be introduced much more quickly than if the comparison base were one year, for example. In the latter case, it would not be possible to introduce a new index until after the old index had been in use for a year. During that time, reporting establishments and surveying agencies would have had to work at compiling both the old and the new index. The disadvantage of choosing a single month is that abnormally high or low prices can occur in certain price series during a given month. Choosing a year as the reference obviously eliminates this problem, but the practical advantages of the one-month base may outweigh the disadvantage. *The Conference is invited to consider the need for guidelines on this issue.*

² For example, the price reference period could be the previous December (December 2002), and the index reference period could be maintained as December 2000 = 100. The weight reference period could be the previous year (2002).

9. Price observations

- 129.** To ensure the credibility of the index, prices have to be observed and recorded accurately. Price collection is a complex operation, much of it involving extensive fieldwork by a large number of individual collectors. The whole process requires careful planning and management, to ensure that the data collected conforms to the requirements laid down by the central office with overall responsibility for the CPI.
- 130.** Price collectors should be well trained to ensure that they understand the procedures that they have to follow. A comprehensive manual should be provided to complement the training received (*cf. paragraph 48 of the draft resolution*). It may also be useful to occasionally audit the work of the price collectors, by either accompanying price collectors (to monitor their work) or by repricing in the same outlets.

Collection

- 131.** There are many issues to consider when collecting prices. These include the frequency and timing of price collection, item specification, coverage (geographic and outlet), item collection procedures and techniques, and data quality. These items are addressed in the draft resolution (*cf. paragraphs 49-52 of the draft resolution*) and are not discussed here.
- 132.** Specifications for items to be priced can either be in the form of tightly pre-specified descriptions, or discretion can be given to the price collector. A tightly pre-specified item, for example, could be “Coke, 1 litre”. In these instances, the price collector is expected to price exactly to specification. Prices for near substitutes are unacceptable. Discretion to the price collector can be of two forms: (i) where the price collector is given the basic description of the item to be priced and they determine the exact item based on sales volume; the standard feature of this type of item is that the best-selling brand is to be chosen and the collector is free to ignore what was priced on the previous visit; or (ii) where the price collector virtually selects the entire specification, given one or two essential characteristics of the item, e.g. a men’s business suit, where the price collector selects the brand, style and fabric features. With this type of open specification the price collector must maintain the same specification from one pricing period to the next (*cf. paragraph 53 of the draft resolution*).
- 133.** It is important to ensure that prices to be collected are actual transaction prices, that include indirect taxes and non-conditional discounts. The prices should be those that would be paid, agreed or costed (accepted) by the reference population (*cf. paragraph 54 of the draft resolution*). “Money-off” coupons and loyalty discounts are usually ignored as these may not be used or wanted. Tips for services, for example “service charge” on a restaurant bill should be included where compulsory or normal practice. Where price discrimination occurs, the prices to be observed are those that are available to the vast majority of people or to identifiable subgroups for which appropriate weights may be calculated (e.g. pensioner discounts).
- 134.** *Paragraph 58 of the draft resolution* concerns different methods for price collection that are discussed in this and the following three paragraphs. Over the last few years, national statistical agencies have increasingly looked towards “electronic point of sale” (EPOS) or “scanner data” as a convenient method of obtaining up-to-date and accurate information on goods sold and their prices, that can reduce the necessity of sending price collectors into the field. EPOS data are normally data obtained directly from a retailer’s EPOS, whilst the term “scanner data” usually refers to a commercial database that collates individual EPOS data.

-
- 135.** The use of such sources of price information is still at the experimental stage. There are concerns about the completeness of outlet and product coverage, as well as the accuracy of the average prices recorded in scanner data. Furthermore, it cannot be assumed that the geographical and population coverage or the treatment of goods and transactions match the scope of the index. Scanner data are also unlikely to be of much use in collecting prices of services, which in many countries comprise a large and increasing share of transactions and thus of weights in CPIs.
- 136.** In spite of these concerns and limitations, there are many potential advantages in using scanner and EPOS data. Collection of data in electronic form will reduce the incidence of recording errors, increase the precision of specifications, lower the burden on respondents and speed up the statistical processes. Their availability should obviously be exploited to the fullest possible extent. It should be noted that in many countries the cost of collecting and using scanner data is of a great concern. According to some estimates the cost of using scanner data is at least double that of existing CPI price collection practices.
- 137.** The Internet is becoming a more common source for price collection, either for convenience (where the shop price is offered over the Internet) or through necessity (in order to maintain a representative sample where this type of retail outlet is increasingly used). Other collection methods include using mail catalogues, head office price lists, and inquiries to outlets and producers by telephone, fax, mail and email.
- 138.** *Paragraph 59 of the draft resolution* recommends that collected price information be edited and reviewed for comparability and consistency with previous observations, the presence of replacements, unusual or large price changes and to ensure that price conversions of goods priced in multiple units or varying quantities are properly calculated. This process should enable detection of possible errors and outliers. It should be noted that focus of editing should be on high-risk areas – items with large weights and items for which few prices were collected.
- 139.** The treatment of missing price observations is an important issue (*cf. paragraph 60 of the draft resolution*). Temporary unavailability may occur for seasonal items (particularly for certain types of fruit, vegetables and clothing), because of supply shortages or possibly because of some collection difficulty (e.g. an outlet was closed or a price collector was ill). The treatment of seasonal items raises a number of particular problems that are discussed elsewhere.
- 140.** In the case of temporarily missing observations for non-seasonal items, one of four actions may be taken:
- (a) omit the item for which the price is missing so that a matched sample is maintained (like is compared with like) even though the sample is depleted;
 - (b) carry forward the last observed price;
 - (c) impute the missing price by the average price change of the items in the same elementary aggregate that are available; and
 - (d) impute the missing price by the price (change) of a particular comparable item from another similar outlet.
- 141.** Omitting an observation from the calculation of an elementary index is equivalent to assuming that the price would have moved in the same way as the average of the prices of the items that remain included in the index. Omitting an observation increases the implicit weights attached to the other prices in the elementary aggregate.

-
- 142.** Carrying forward the last observed price should be avoided wherever possible and is acceptable only for a very limited number of periods. Special care needs to be taken in periods of high inflation or when markets are changing rapidly as a result of a high rate of innovation and product turnover. While simple to apply, carrying forward the last observed price biases the resulting index towards zero change. In general, carrying forward is not an acceptable solution to the problem.
- 143.** Imputation of the missing price by the average change of the available prices may be applied for elementary aggregates where the prices can be expected to move in the same direction. The imputation can be made by use of all of the remaining prices in the elementary aggregate. As already noted, this is numerically equivalent to omitting the item for the immediate period, but it is useful to make the imputation so that if the price becomes available again in a later period the sample size is not reduced in that period. In some cases, depending on the homogeneity of the elementary aggregate, it may be preferable to use only a subset of items from the elementary aggregate to estimate the missing price. In some instances, this may even be a single comparable item from a similar type of outlet whose price change can be expected to be similar to the missing one.

Replacements

- 144.** In the case of permanently missing observations (e.g. an item may be considered to be permanently missing when its price cannot be observed for three consecutive months), a replacement product has to be sampled and included in the index. The replacement product should ideally be one that accounts for a significant proportion of sales of similar items, is likely to continue to be sold for some time and is likely to be representative of the sampled price changes of the market that the old product covered. Very often, it is unlikely that one product satisfies these criteria. In such cases, depending on the frequency of resampling and the potential for accurate quality adjustment, the alternatives are: (i) the most popular variety among those that belong to the same elementary aggregate; (ii) the variety most similar to the replaced one; and (iii) the variety most likely to be available in the future (*cf. paragraph 61 of the draft resolution*). It should be noted that the replacement with “the most popular” is expected to pick up new models, while “the most similar” will tend to underrepresent new models. Therefore, it is important to resample frequently, so that these new models are included. Similar criteria should be applied for a selection of a replacement outlet.

10. Quality change

- 145.** As far as possible, the same item should be priced in each period. The CPI should measure price change unaffected by changes in the quality/utility of the goods and services purchased. However, in practice, items that can be observed at different time periods may differ with respect to package sizes, weights, volumes, features and terms of sale as well as other characteristics. Thus it is necessary to monitor the relevant characteristics of the items being priced in order to identify possible changes in quality/utility. The price of the item whose quality/utility has changed should be adjusted so that pure price change¹ can be estimated (*cf. paragraph 64 of the draft resolution*).
- 146.** A particular case of quality change (associated with or without a price change) is when a new style replaces an old one that is no longer available. In these cases, the consumer is obliged to pay the price of the new model or variety. This is the case, for example, with the mandatory installation of safety equipment or of anti-pollution devices in motor vehicles. The change in price may accurately reflect the change in quality, but consumers that would prefer not to have the new equipment will consider themselves worse off. Under the fixed-basket approach, it is appropriate to treat the change as a change in quality and not as a price change. However, for an index designed to measure changes in the cost of living (utility, satisfaction), this may be treated as a price change, because the consumer had no control over the change in the product and may not have wanted the change. *No recommendation has been made in the draft resolution regarding this particular case.*
- 147.** The 2001 Meeting of Experts pointed out that in principle differences in quality should be valued from the viewpoint of the consumers. In practice, however, the quantification of any such change can be extremely difficult, because the personal perceptions of consumers can vary a lot. The assessment of product quality by price collectors dealing with all kinds of products can also be very subjective. Nevertheless, a statistical office could: (i) provide appropriate training to collectors so that they can identify the differences in quality; (ii) instruct collectors to periodically ask the vendors questions concerning the main characteristics of a given product, such as the model, size and other major features; and (iii) amend the price collection form to include more detail regarding the characteristics of the products in the sample.
- 148.** When a quality change (either improvement or degradation) is detected, an adjustment must be made to the price, so that a true price movement can be estimated. If this is not done, the index will either record a price change that has not taken place or fail to record a price change that did happen. The 2001 Meeting of Experts recommended that attention should be paid to both quality reductions and quality improvements.
- 149.** Adjusting for quality change is difficult to do well, and a wide variety of approaches may need to be adopted, depending on the particular goods and services involved. Great care needs to be exercised because the accuracy of the index depends on the quality of this process. Assuming that the whole price change is a result of the change in quality or that items with different qualities are essentially equivalent should be avoided (*cf. paragraph 66 of the draft resolution*).
- 150.** All methods for quality adjustments may be grouped in two main categories, depending on whether the price or quality component is estimated first: i.e. implicit and explicit quality adjustment methods. *Explicit methods* directly estimate the value of the quality difference

¹ Annex 1.

between the old and new item(s) using information about item characteristics. *Implicit methods* first estimate the pure price change component of the price difference between the old and new items (based on the price changes observed for similar items) and then the remaining part of the price change is considered as change due to quality difference (*cf. paragraph 67 of the draft resolution*). The Meeting of Experts generally considered explicit methods as preferable, although they do not always necessarily produce better results than implicit methods. It was pointed out that the relative merits of the different methods would depend on whether the required information on the price relevant characteristics would be available or not. Therefore, the recommendation is to use explicit quality adjustment whenever possible, especially for the items with large weights and characteristics that change in ways that are easily described. For items whose characteristics change in ways that are difficult to describe and/or are not easily observable,² indirect methods might be applied. *This is reflected in paragraph 67 of the draft resolution.*

² There are many aspects of quality change. Some quality dimensions of products are readily observable (e.g. volume or weight) and adjustments for changes in these are relatively straightforward. Other changes are less visible and hence are difficult to measure and make adjustments for.

11. Accuracy

- 151.** The CPI, like all other statistics, may be subject to sampling imprecisions and error arising from a variety of sources. Sampling imprecision arises because the estimated CPI is based on samples, rather than on complete enumeration of populations. Errors in the estimated CPI may occur during any stage of the survey process (i.e. selection, collecting, coding and/or processing the data).
- 152.** The following are some well-known sources of potential error, either in pricing or in index construction, that over time can lead to significant errors in the overall CPI: (i) incorrect selection of items and incorrect observation and recording of their prices; (ii) failure to observe and adjust correctly for quality changes, appearance of new goods and outlets; (iii) failure to adjust for item and outlet substitution (in a COLI index) or loss of representativity (in a “pure” price index); and (iv) the use of inappropriate formulae for computing elementary aggregate and upper level indices. The different types of errors are defined in Annex 3 of the draft resolution. It should be noted that, contrary to the widely held belief that measurement error always causes CPI to overstate the true rate of price change, measurement error for certain items is downward rather than upward.
- 153.** Compilers of CPIs need to be aware of the possible sources of error, and to take steps during the index construction and compilation processes to minimize their impact. In general, regularly updating weights and baskets, employing unbiased elementary aggregate formulae, making appropriate adjustments for quality change, allowing adequately and correctly for new products, and taking proper account of substitution issues (in a COLI index) as well as quality control of the entire production process will minimize the potential for arriving at a CPI that will give a misleading picture of the average development of prices. This means that the collection and subsequent processing of information to produce a CPI should be organized and managed in an effective, consistent manner. Validation and verification checks should be put in place to ensure that the results meet the requirements of the users.

12. Dissemination

154. Most, if not all, countries have rules and procedures regarding the dissemination of their statistics, and in particular the CPI. In addition, the International Monetary Fund has established a Special Data Dissemination Standard (SDDS) and a General Data Dissemination System (GDDS) that cover, amongst other categories, CPI. These standards were developed on the basis of existing international standards on the economic and financial statistics, including the 1987 resolution on CPI (ILO, 1987). Four dimensions of data dissemination are identified in these standards:¹

- the data: coverage, periodicity and timeliness;
- access by the public;
- integrity of the disseminated data; and
- quality of the disseminated data.

Furthermore, guidelines concerning dissemination practices for labour statistics were endorsed by the Sixteenth ICLS (ILO, 1998).

155. The 2001 Meeting of Experts strongly supported the recommendation that a CPI should be computed and publicly released as soon as possible after the reference period, and to a fixed and pre-announced release date. It was also recognized that there were certain circumstances under which certain users might be given pre-release access to the results, and that these should be clearly specified (*cf. paragraph 71 of the draft resolution*).

156. Note that while users of the index attach great importance to having the index published as soon as possible after the period to which it refers, they also do not wish the index to be revised once it has been published. Hence, in a number of statistical agencies, there is a degree of trade-off between timeliness and quality.

157. *Paragraph 72 of the draft resolution* recommends that the index should be produced and released monthly. Of 186 countries and territories that communicated official CPI series to the ILO for the preparation of the 2002 edition of the *ILO Yearbook of Labour Statistics*, only 22 publish the CPI on a quarterly basis and only two with semi-annual periodicity. However, the resolution recognizes that in some countries it may be too costly to produce a monthly CPI, or it is not warranted to produce the CPI so frequently.

158. The main advantage of a monthly CPI is timeliness. By releasing data more frequently, users are more aware of recent price movements and are able to react more quickly to changes. However, a monthly CPI tends to be more volatile than a quarterly index and it usually increases respondent burden. Note that for a monthly index, it is not necessary to carry out monthly price collections for all goods and services.

159. Decisions about the dissemination formats and the degree of detail contained within each format need to be taken. A number of countries publish their CPI in hard-copy form (press release or bulletin) and an increasing number in electronic form (online database, Internet, diskette). Results commonly presented by national statistical agencies usually include: (i) the index level from the index (reference) base period; (ii) the changes in the major

¹ IMF web site: <http://dsbb.inf.org/Applications/web/sddshome/> .

aggregates between the current month and the previous month (useful for users interested in short-run inflationary trends in the economy); (iii) the change between the current month and the same month of the previous year (largely free from seasonal influence); and (iv) the change in the average of the latest 12 months over the average of the previous 12 months (can serve as substitute for seasonally adjusted indices) (*cf. paragraph 73 of the draft resolution*).

- 160.** For analytical purposes, it may be appropriate to design and produce special sub-indices that are of wide interest. For example, for the users interested in inflationary trends in the economy, it might be appropriate to exclude seasonal goods from a short-term month-to-month index, especially from that constructed with fixed annual weights for seasonal items. In addition, a separate index for consumer durables or an index excluding imported goods, government charges and government-controlled prices may be released for special analytical purposes. In some countries, a calculation is made to exclude the effect of changes to indirect taxes such as VAT. Of course, care must be taken so as not to exclude so many items that the remainder becomes only a small and unrepresentative component of the total. *This practice is reflected in paragraph 74 of the draft resolution.*
- 161.** Users of the index are often interested in how much of the change in the overall index is attributable to the change in the price of some particular good or group of products, such as oil or food. Alternatively, there may be interest in what the index would be if housing or energy were left out. Questions of this kind can be answered by decomposing the change in the overall index into its constituent parts (*cf. paragraph 75 of the draft resolution*).

Example: Decomposition of the index for January 2003, base period 2000=100

	2000 weights (w _b)	Index (i)			Change (in %) from Jan. 02 to Jan. 03	Effect * (contribution)	
		2000	Jan. 02	Jan. 03		As % points of total price change	As % of total price change
Food	3 873	100	118.8	129.3	8.8	3.4	37.3
Clothing and footwear	640	100	132.8	145.2	9.3	0.7	7.3
Housing	1 864	100	109.6	120.6	10.0	1.7	18.8
Transport and communication	1 989	100	126.3	131.3	4.0	0.8	9.1
Miscellaneous	1 634	100	123.4	141.3	14.5	2.4	26.8
All items	10 000	100	120.2	131.1	9.1	9.1	100.0

* It is important to note that contribution (as per cent points of total price change) should be calculated by multiplying "change from (in per cent) Jan. 02 to Jan. 03" with the price-updated weights from 2000 to Jan. 2002.

- 162.** *Paragraph 76 of the draft resolution* recommends that the index base period be changed at regular time intervals. In the periods of rapid inflation it may be necessary to change the base period frequently to ensure that the index numbers remain easy to present and understand.
- 163.** To ensure public confidence in the reliability of the index and the competence and integrity of those responsible for its compilation, a full and up-to-date description of the methodology and data sources should be published. The documents should include, among other things, details of the weights, objectives of the index and a discussion on the precision of the index (if available). The precise identities of the samples of outlets, goods and services for which prices are obtained and any other details which, if disclosed, might

affect the behaviour of outlets and/or consumers, as well as the representativeness of the index, should not be revealed (*cf. paragraph 79 of the draft resolution*). In addition, it is recommended to publish a short pamphlet describing the index in terms designed to be understood by the general public.

13. Consultation and integrity

- 164.** *Paragraph 82 of the draft resolution* recognizes the need to consult users of the CPI in designing or revising the concepts, definitions and methodology used in the collection, compilation and publication of the CPI, with a view to taking into account their needs. One way of organizing such consultations is through the establishment of advisory conferences on which users and outside experts might be represented. Many countries have an official CPI advisory group consisting of both experts and users. Its role is not just to advise the statistical office on technical matters but also to promote public confidence in the index.
- 165.** Statistical producers should ensure that the data respond to the needs of users, in both content and format. Consultation with users will ensure that the final product meets those needs. The production of a successful publication requires a level of cooperation with users. Special care must be taken in the data presentation to ensure that they are accurate and that they will not be misinterpreted.
- 166.** Many countries wish to compare their CPI with those of others. It is generally agreed that exclusion of housing and financial services from the all-items index makes the rates of price change more comparable across countries, although it does not eliminate all the difficulties encountered when such comparisons are made. Countries should therefore provide for dissemination at the international level an index that excludes shelter and financial services, in addition to the all-items CPI (*cf. paragraph 83 of the draft resolution*).

Bibliography

- Balk, B. 1999. *On curing the CPI's substitution and new goods bias*, Paper submitted by Statistics Netherlands to the joint ECE/ILO Meeting on Consumer Price Indices, 3-5 November 1999.
- Boon, M. 1999. *Sampling and non-sampling errors in a consumer price index*, Paper submitted by Statistics Netherlands to the joint ECE/ILO Meeting on Consumer Price Indices, 3-5 November 1999.
- Boskin, M.J. et al. 1996. "Toward a more accurate measure of the cost of living", Final report to the Senate Conference from the Advisory Commission to study the consumer price index, in *Getting prices right*, published for the Economic Policy Institute by M.E. Sharpe, 1998.
- Bureau of Labor Statistics. 1997. "The experimental CPI using geometric means (CPI-U-XG)" 10 April, 1997 (Washington: Bureau of Labor Statistics).
- de Haan, J. 1999. *Item sampling in the CPI: The success of cut-off selection methods*, Paper submitted by Statistics Netherlands to the joint ECE/ILO Meeting on Consumer Price Indices, 3-5 November 1999.
- EUROSTAT. 2001. *Compendium of HICP reference documents*, Commission of the European Communities, Brussels, 2001.
- Greenlees, J.S. 1999. *Consumer price indexes: Methods for quality and variety change*, Paper submitted by the Bureau of Labor Statistics to the joint ECE/ILO Meeting on Consumer Price Indices, 3-5 November 1999.
- Hill, P. 1997. *The measurement of inflation and changes in the cost of living*, Paper submitted by the ECE secretariat to the joint ECE/ILO Meeting on Consumer Price Indices, 24-27 November 1997.
- Hill, P. (ed.). *Consumer price indices*, Draft manual under preparation by the Inter-Secretariat Working Group on Prices Statistics, ILO, scheduled to be published for 2003, <http://www.ilo.stat> .
- ILO. 2003. *Bulletin of Labour Statistics* (Geneva, 2003).
- . 2001. Meeting of Experts on Labour Statistics (Geneva, 22-31 October 2001), Report II: Consumer Price Indices (Geneva, doc. MELS/2001/II).
- . 2001. Meeting of Experts on Labour Statistics (Geneva, 22-31 October 2001), Report of the Meeting (Geneva, doc. MELS/2001/R).
- . 2000. *Current international recommendations on labour statistics* (Geneva, 2000).
- . 1998. *Report of the Sixteenth International Conference of Labour Statisticians* (Geneva, 1998).
- . 1992. *Sources and methods (labour statistics), Volume 1: Consumer price indices*, companion to the Yearbook and Bulletin of Labour Statistics (Geneva, 1992).

-
- . 1989. *Consumer price indices: An ILO manual*, R. Turvey et al. (Geneva, 1989). (Draft chapters of the revised (2001) version are available at: <http://mirror/public/english/bureau/stat/guides/qi/index.htm>).
 - . 1987. *Consumer price indices*, in Report II, Fourteenth International Conference of Labour Statisticians (Geneva, 1987).
 - . 1987. *Report of the Fourteenth International Conference of Labour Statisticians* (Geneva, 1987).
 - . 1962. *Computation of consumer price indices (special problems)*, in Report IV, Tenth International Conference of Labour Statisticians (Geneva, 1962).
- Obst, C. 1999. *A review of bias in the CPI*, Paper submitted by the OECD to the joint ECE/ILO Meeting on Consumer Price Indices, 3-5 November 1999.
- Statistics Canada. 1997. *Bias in the CPI: Experiences from five OECD countries*, Ottawa, 1997.
- United Nations. *Classifications of expenditure according to purpose*, Statistical Papers, Series M, No. 84 (New York, 2000).

Appendix 1

Proposals for a draft resolution concerning consumer price indices

Preamble

Recalling the resolution adopted by the Fourteenth International Conference of Labour Statisticians concerning consumer price indices and recognizing the continuing validity of the basic principles recommended therein and, in particular, the fact that the consumer price index (CPI) is designed primarily to measure the changes over time in the general level of prices of goods and services that a reference population acquires, uses or pays for,

Recognizing the need to modify and broaden the existing standards in the light of recent methodological and computational developments to enhance the usefulness of the international standards in the provision of technical guidelines to all countries and particularly those with less advanced statistical infrastructure,

Recognizing the usefulness of such standards in enhancing the international comparability of the statistics,

Recognizing that the CPI is used for a wide variety of purposes, governments should be encouraged to identify the (priority) purposes a CPI is to serve, to provide adequate resources for its compilation, and to guarantee the professional independence of its compilers,

Recognizing that the (priority) objectives and uses of CPI differ among countries and that, therefore, a single standard could not be applied universally,

Recognizing that the CPI needs to be credible to observers and users, both national and international, and that better understanding of the principles and procedures used to compile the index will enhance the users' confidence in the index,

Agrees that the principles and methods used in constructing a CPI should be based on the guidelines and methods that are generally accepted as constituting good statistical practices,

Adopts, this ... day of ..., the following resolution which replaces the previous one adopted in 1987.

The nature and meaning of a consumer price index

1. The CPI is a current economic indicator that is constructed to measure changes over time in the general level of prices of consumer goods and services that households acquire, use or pay for consumption.
2. The objective of the index may be to measure the change over time in the cost of purchasing a fixed basket of consumer goods and services of constant quality and characteristics, with the items in the basket being selected to be representative of households' expenditure during a year or other period. Such an index is called a fixed-basket price index and may be calculated by using the Laspeyres-type index number formula. This is the type of index most commonly produced by national statistical agencies.
3. The objective of the index may also be to measure the effects of price changes on the cost of achieving a standard of living (i.e. utility or welfare) corresponding to that achieved during a year or other specified period. Such an index is called a cost-of-living index (COLI). Operationally, a COLI cannot be directly calculated but may be approximated.

The uses of a consumer price index

4. The CPI is used for a wide variety of purposes, the two most common ones being: (i) to adjust wages and government and social security benefits to compensate, partly or completely, for changes in the cost of living or in consumer prices; and (ii) to provide an average measure of price inflation

for the household sector as a whole. CPI sub-indices are also used to deflate components of household final consumption expenditure in the national accounts and the value of retail sales to obtain estimates of changes in their volume.

5. CPIs are also used for purposes less directly linked to the price experiences of households. These include monitoring the overall rate of price inflation for all sectors of the economy, the adjustment of government fees and charges, and the adjustment of payments in commercial contracts. In these types of cases, the CPI is used as more appropriate measures simply do not exist, or because other characteristics of the CPI (e.g. high profile, wide acceptance, predictable publication schedule, etc.) are seen to outweigh any conceptual or technical deficiencies.
6. Given that the CPI may be used for many purposes, it is unlikely to perform equally satisfactorily in all applications. It may therefore be appropriate to construct a number of alternative price indices for specific purposes, if the requirements of the users justify the extra expense. Each index should be properly named to avoid confusion and a “headline” CPI measure should be explicitly identified.
7. Where only one index is produced, it is the main use that should determine the type of index produced (fixed-basket price index or COLI), the range of goods and services covered, its geographic coverage, the households it relates to, as well as to the concept of price and the formula used. If there are several major users, it is likely that compromises may have to be made with regard to how the CPI is constructed. Users should be informed of the compromises made and of the limitations of such an index.

Scope of the index

8. The scope of the index depends on the main use for which it is intended, and should be defined in terms of the type of households, geographic areas, and the types of consumer goods and services acquired, used or paid for by the reference population.
9. If the primary use of the CPI is for adjusting money incomes, a relevant group of households, such as wage and salary earners, may be the appropriate target population. For this use, all consumption expenditures by these households, at home and abroad, should be covered. If the primary use of the CPI is to measure domestically sourced inflation, it may be appropriate to cover consumption expenditures made within the country, rather than the expenditures of households resident within the country.
10. In general, the reference population for a national index should be defined very widely (to cover consumption expenditure of households resident in the country or consumption expenditure that takes place within the country). If any income groups, types of households or particular geographic areas are excluded, for example, for reasons of practicality or costs, then this should be explicitly stated.
11. The geographic scope refers to the geographic coverage of price collection and of consumption expenditures of the reference population and both should be defined as widely as possible, and preferably consistently. If price collection is restricted to particular areas due to resource constraints, then this should be specified. The geographic coverage of the consumption expenditure may be defined either as covering consumption expenditure of the resident population (resident consumption) or consumption expenditure within the country (domestic consumption).
12. Significant differences in the expenditure patterns and/or price movements between specific identifiable population groups or regions may exist. In such cases, separate indices for these population groups or regions may be computed if there is sufficient demand to justify the additional cost.
13. The CPI should relate to all types of consumer goods and services of significance to the reference households, without any omission of those that may be regarded as non-essential or undesirable. Goods and services not legally available should also be included, if and when possible, and if the expenditures on such items can be expected to be significant. Special aggregates may be constructed to assist those users who may wish to exclude certain categories of goods and services for particular applications or for purposes of analysis.
14. Goods and services purchased for business purposes, expenditures on assets such as works of art, financial investment (as distinct from financial services), and payments of income taxes, social security contributions and fines are not considered to be consumer goods or services and should be excluded from the coverage of the index.

Acquisition, use or payment

15. In determining the scope of the index, the time of recording and valuation of consumption, it is important to consider whether the purposes for which the index is used are best satisfied by defining consumption in terms of “acquisition”, “use”, or “payment”.¹ In general, the “acquisition” approach is regarded as the most appropriate for an index intended to be used as a macroeconomic indicator while the “payment” approach is the most appropriate for a compensation (an income adjustment) index. For the purposes of an index intended to measure changes in the cost of living, the “use”² approach may be suitable. The decision regarding the approach to follow (or a combination of these approaches) for a particular group of items should be based on the purpose of the index, as well as on the costs and the acceptability of the decision to the users who should be informed of the approach followed for different items.
16. The differences between the three approaches are most pronounced in dealing with items such as owner-occupied housing, durable goods, goods and services produced for own-account consumption, items acquired on credit, remuneration in kind and goods and services provided without charge or at prices subsidized by government and non-profit institutions serving households (NPIs).
17. The most complex and important of the items mentioned above is owner-occupied housing. In most countries, a significant proportion of households are owner-occupiers of their housing, with the housing being characterized by a long useful life and a high purchase outlay (price). Under the “acquisition” approach, the value of the new dwellings acquired in the weights reference period is used for deriving the weight (and the full price of the dwelling is included in the CPI at the time of acquisition, regardless of when the consumption is taking place). Under the “payment” approach, the weights reflect the amounts actually paid out for housing (and the prices enter the CPI in the period(s) when the prices are paid), while under the “use” approach it is the value of the flow of housing services consumed during the weights reference period estimated using an implicit or notional cost (and prices or estimated opportunity costs enter the CPI when the consumption is taking place).
18. Own-account consumption, remuneration in kind and/or goods and services provided without charge or subsidized by governments and NPIs may be important in some countries where the purpose of the index is best satisfied by defining consumption in terms of “use” or “acquisition” (under the payment approach these are out of scope). The inclusion of these items will require special valuation and pricing techniques. One option is to impute their prices and expenditures on the basis of the prices of similar goods and services bought and sold on the market. This requires increasing the weight applied to such market prices to include the value of the corresponding non-market transactions. If market prices are not relevant or cannot be reliably observed, or there is no interest in using hypothetically imputed prices, the expenditures and prices paid for the inputs into the production of these goods and services should be used instead. Users should be informed of the methods followed for the different items.

Basket and weights

19. Decisions on the composition of the basket and the weights follow directly from the choice of reference population and geographic coverage, as well as from the choice between the “acquisition”, “use” or “payment” approaches.
20. Once defined, the expenditures that fall within the scope of the index should be grouped into similar categories (group of products that have a common purpose (end-use) or are considered substitutes for each other) in a hierarchical classification system (e.g. divisions/groups /classes) to make the index useful for descriptive and analytical purposes. The classification used for the index

¹ Annex 1.

² Because of the practical difficulties in uniformly defining consumption and estimating the flow of services provided by other durable goods in terms of “use”, it may be necessary to adopt a mixed approach – e.g. “use” for owner-occupied housing and “acquisition” or “payments” basis for other consumer durables.

compilation should be as consistent as possible with that used for household expenditure statistics and should meet the needs of users for special sub-indices. For the purposes of international comparison, the classification should also conform to, or be reconcilable with, the standard international classification of individual consumption according to purpose (COICOP), at least at its division level.³

21. In order to facilitate the analysis and interpretation of the results of the index, it may be desirable to classify goods and services according to various supplementary classifications (i.e. source of origin, durability, seasonality, etc). Calculation of the CPI by using various classifications should generate the same overall results as the original index.
22. The classification should also provide a framework for the allocation of expenditure weights. Expenditures at the lowest level of the classification system (class level), expressed as a proportion of the total expenditure, determine the weights to be used at this level. These weights stay fixed from one period of reweighting to the next. When the weights are to remain fixed for several years, the objective should be to adopt weights that are most likely to be representative of the contemporary household behaviour, rather than to precisely reflect the situation of a particular period that may have been abnormal in some way.
23. The two main sources for deriving the weights are the results from household expenditure surveys (HESs) and national accounts estimates on household consumption expenditure. The results from an HES are more appropriate for an index defined to cover the consumption expenditures of reference population groups resident within the country, while national account estimates are likely to be more suitable for an index defined to cover consumption expenditures within the country. 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.
24. The information from the main source (HESs or national accounts) should be supplemented with all other available information on the expenditure pattern. Sources of such information that can be used for disaggregating the expenditures are surveys of sales in retail outlets, point-of-purchase surveys, surveys of production, export and import data and administrative sources. Based on these data the weights for certain items may be further disaggregated by region and type of outlet. Where the data obtained from different sources relate to different periods, it is important to ensure, before weights are allocated, that expenditures are adjusted so that they have the same reference period.
25. Where the weight reference period differs from the price reference period, the weights should be price updated to take account of price changes between the weights reference period and price reference period. Where it is likely that price updated weights are less representative of the consumption pattern in the price reference period this procedure may be omitted.
26. Weights should be reviewed and if appropriate revised as often as accurate and reliable data are available for this to be done, preferably once every five years. Periodic revisions are important to reduce the impact on the index of item substitutions.⁴ Weights at the lowest level of index classification, for at least some categories, may need to be updated more frequently as they are likely to become out of date more quickly than upper level weights.
27. When a new basket (structure and/or weights) replaces the old, a continuous CPI series should be created by linking⁴ together the index numbers based on the new basket of goods and services to those based on the earlier basket. The particular procedure used to link index number series will depend on the particular index compilation technique used. The objective is to ensure that the technique used to introduce a new basket does not, of itself, alter the level of the index.
28. Completely new types of goods and services (i.e. goods and services that cannot be classified to any of the existing expenditure classes) should normally be considered for inclusion only during one of the periodic review and reweighting exercises. A new model or variety of an existing product that can be fitted within an existing expenditure class should be included at the time it is assessed as

³ Annex 4.

⁴ See Annex 1.

having a significant and sustainable market share. If a quality change is detected an appropriate quality adjustment should be made.⁵

29. Some items such as seasonal items, insurance, second-hand goods, expenditure abroad, interest, own production, expenditures on purchase and construction of dwellings, etc., may need special treatment when constructing their weights. There are many alternatives for dealing with these items and the choice should be determined by national circumstances, the main purpose of the index and whether the acquisition, use and payment approach is used.
30. Seasonal items should be included in the basket. It is possible to use: (i) a fixed-weight approach which uses the same weight for the seasonal item in all months using an imputed price in the out-of-season months; and (ii) a variable weights approach where a changing weight is attached to the item in various months. The decision on the approach should be based on conditions in each country, but also on whether the focus is on short-term (month-to-month) changes or on the long-term index changes.
31. When second-hand goods, including houses, are included in the index, then expenditure weights for these goods should be based on the net trade of such goods of the reference population group with others, e.g. dealers of such goods or households outside the reference population. Where more appropriate, acquisitions without netting sales may be used for estimating weights for second-hand goods.
32. When consumption from own production is within the scope of the index, the weights should include the expenditures on quantities purchased plus the value of quantities consumed from own production. Valuation of consumption from own production should be made on the basis of prices prevailing on the market, unless there is some reason to conclude that market prices are not appropriate. In this case the expenditures and prices of the inputs of agricultural materials could be used instead. The third option is to value it by using quality adjusted market prices.
33. Expenditure classes are normally too broad to be of direct use in selecting representative products for pricing. A finer level of detail needs to be specified and decisions need to be taken concerning the items for which prices should be observed. The factors that need to be taken into account in this process include the relative significance of each item, its expected price behaviour and the practicality of obtaining prices of items at constant quality. In this selection it is important to include items that may be purchased mainly by or for all main groups in the reference population, e.g. as defined by gender, age or geographic location.

Sampling for price collection

34. A CPI is an estimate based on a sample of households to estimate weights, as well as a sample of zones within regions, a sample of outlets, a sample of goods and services, a sample of varieties and a sample of price observations.
35. The sample size and sample selection methods for both outlets and the goods and services for which prices are to be observed should ensure that the prices collected are representative and sufficient to meet the requirements for the accuracy of the index, but also that the collection process is cost-effective. The sample of price observations should reflect the importance of the goods and services available for purchase by consumers in the reference period, the number, types and geographic spread of outlets that are relevant for each good and service, and the dispersion of prices across outlets.
36. Probability sampling is the preferred method as it permits estimation of sampling variation (errors) and enables the sample size to be optimized. However, it is costly to implement and can result in the selection of items that are very difficult to price to constant quality.
37. In cases where appropriate sampling frames are lacking and it is too costly to obtain them, samples of outlets and items have to be obtained by non-probability methods. Statisticians have to use all available information and apply their best judgement to ensure that representative samples are

⁵ See Annex 2.

selected. Particular attention should be given to the possibility of applying a cut-off sampling⁶ strategy, especially where the sample size will be small.

38. Efficient sampling, whether random or purposive, requires comprehensive and up-to-date sampling frames for outlets and products. Statistical business registers, business telephone directories, results from the point-of-purchase surveys or surveys of sales in different types of outlets may be used as sampling frames for selection of outlets. Catalogues or other product lists drawn up by major manufacturers, wholesalers or trade associations, or lists of products that are specific to individual outlets such as large supermarkets might be used as the sampling frame for selection of products. Data scanned by bar-code readers at the cashier's desk (electronic databases) can be particularly helpful in the selection of goods and services.
39. The sample of outlets and of goods and services should be reviewed periodically and updated where necessary to maintain its representativeness.

Index calculation

40. CPIs are calculated in two steps. In the first step, the elementary aggregate indices are calculated. In the second step, higher level indices are calculated by aggregating the elementary aggregate indices.

Elementary aggregates

41. The elementary aggregate is the smallest and relatively homogeneous set of goods or services for which expenditure data are available and established (used) for CPI purposes. It is the only aggregate for which an index number is constructed without any explicit expenditure weights, although other kinds of weights might be explicitly or implicitly introduced into the calculation. The set of goods or services covered by an elementary aggregate should be similar in their end-uses (i.e. close substitutes for each other) and are expected to have similar price movements. They may be defined not only in terms of their characteristics but also in terms of the type of location and outlet in which they are sold. The degree of homogeneity achieved in practice will depend on the availability of corresponding expenditure data.
42. An elementary index is a price index for an elementary aggregate. As expenditure weights usually cannot be attached to the prices/price relatives for the sampled items within the elementary aggregate, an elementary aggregate index is calculated as an unweighted average of the prices/price relatives.
43. There are many different ways in which the prices, or the price relatives, might be averaged. The three most commonly used formulae are the ratio of arithmetic mean prices (RAP), the geometric mean (GM) and the arithmetic mean of price relatives (APR). The choice of formula depends on the need to reflect substitution within the elementary aggregate (especially with respect to COLI), degree of homogeneity, dispersion of prices and price movements, etc. It is possible to use different formulae for different elementary aggregates within the same CPI. It is recommended that the GM formula be used where possible but particularly for those elementary aggregates for which it is reasonable to assume a high degree of substitutability. In cases where consumers have only a limited ability to substitute among products or outlets or where one of the prices may become zero, it is recommended that the elementary aggregate index be constructed by using the RAP formula. For an index intended to measure the "pure" price change, RAP should be used for all elementary aggregates that are homogeneous. The APR formula should be avoided, particularly in its chained form, as it is known to result in biased estimates of the elementary aggregate indices. Wherever possible the elementary aggregate indices should be calculated as weighted averages, where the weights reflect, for example, the sales of particular items, market shares or regional weights.
44. The elementary index may be computed by using either a chained or direct form of the formula chosen. The use of a chained form generally makes the estimation of missing prices and the introduction of replacement items easier.

⁶ See Annex 1.

Upper level indices

45. Price indices at the class/group/division/national levels are constructed as weighted averages of elementary aggregate indices. There are many types of formulae that could be used to average the elementary aggregate indices. In order to produce a timely index, the only practical option is to use a formula that relies only on the weights observed for some past period. One such formula is the Laspeyres-type index, the formula used by most national statistical agencies. (Other alternatives would be the weighted GM index and the constant elasticity of substitution (CES) approach. The latter relies on base period weights and on estimating the coefficient of substitution for all the goods in the basket. The Laspeyres and GM indices are special cases of the CES formula, with zero and unitary substitution elasticities, respectively.)
46. For analytical purposes it may be appropriate to calculate the index retrospectively by using one of the index number formulae that employs both base-period weights and current-period weights, such as the Fisher or Walsh index. Comparing the difference between the index of this type and the Laspeyres index can give some indication of the combined impact of income change, preference change and substitution effects over the period in question, which may be important information for producers and users of the CPI. The magnitude of the difference is expected to decline with an increase in the frequency at which the weights in the Laspeyres index are updated.
47. The upper level indices may be computed as a direct or two-stage indices. The two-stage index is calculated by multiplying the index for the previous period (measuring the change between base period and $t-1$) by the index measuring the change between $t-1$ and t . The latter should be calculated with the price-updated expenditure weights in which the quantities of the base period are valued at the prices of the previous index period ($t-1$).

Price observations

48. The quality of the price information is the crucial determinant of the reliability of the index. Standard methods for collecting and processing price information should be developed and procedures put in place for collecting them systematically and accurately at regular intervals. Price collectors should be well-trained and well-supervised, and should be provided with a comprehensive manual explaining the procedures they have to follow.

Collection

49. An important consideration is whether the index should relate to monthly (or quarterly) average prices or to prices for a specific period of time (e.g. a single day or week in a month). This decision is related to a number of issues, which include the use of an index, the practicalities of carrying out price collection and the pattern of price movements. When the aim is a point-in-time pricing, prices should be collected over a very small number of days each month (or quarter). The interval between price observations should be uniform for each item. Since the length of the month (or quarter) varies, this uniformity needs to be defined carefully. When the aim is monthly (or quarterly) average prices, prices, especially of the items whose prices are subject to significant variation over the month or quarter, should be collected more than once during the period.
50. Attention should also be paid to the time of the day selected for price observation. In the case of perishable goods, price observations should not be made just before closing time, as stocks may be low, or dumped to minimize wastage. In these particular cases, prices observed may not be representative.
51. Price collection should in principle be undertaken in all regions within the scope of the index, especially where there are significant differences in price movements between areas. Even when it is assessed that prices are unlikely to move differently in different areas, it may still be necessary to collect prices in all areas to maintain confidence in the index, and to monitor whether prices move in parallel. The number of price observations from each area depends on their relative significance to the CPI.
52. Prices should be collected in all types of outlets that are important, including open-air markets and informal markets, and in free markets as well as price-controlled markets. Where more than one type of outlet is important for a particular type of item, an appropriately weighted average should be used in the calculation of the index.

-
53. Specifications should be provided detailing the variety and size of the items for which price information is to be collected. These should be precise enough to identify all the characteristics that are necessary to ensure that, as far as possible, identical goods and services are priced in successive periods in the same outlet. The specifications should include, for example, make, model, size, terms of payment, conditions of delivery, type of guarantees and type of outlet.
 54. Prices to be collected are actual transaction prices, including indirect taxes and non-conditional discounts, that would be paid, agreed or costed (accepted) by the reference population. Where prices are not displayed or have to be negotiated, where quantity units are poorly defined or where actual purchase prices may deviate from listed or fixed prices, it may be necessary for the price collectors to purchase items in order to determine the transaction prices. A budget needs to be provided for any such purchases. When this is not possible, consideration should be given to interviewing customers about the prices actually paid. Tips for services, where compulsory, should be treated as part of the price paid.
 55. Exceptional prices charged for stale, shop-soiled, damaged or otherwise imperfect goods sold at clearance prices should be excluded, unless the sale of such products is a permanent and widespread phenomenon. Sale prices, discounts, cut prices and special offers should be included when applicable to all customers on the date of the price observation without there being significant limits to the quantities that can be purchased by each customer.
 56. In periods of price control or rationing, where limited supplies are available at prices which are held at a low level by measures such as subsidies to the sellers, government procurement, price control, etc., such prices as well as those charged on any significant unrestricted markets should be collected. The different price observations should be combined in a way that uses the best information available with respect to the actual prices paid and the relative importance of the different types of sales.
 57. Where centrally regulated or centrally fixed prices are collected from the regulatory authorities, checks should be made to ascertain whether the goods and services in question are actually sold and whether these prices are in fact paid. For goods and services where the prices paid are determined by combinations of subscription fees and piece rates (e.g. for newspapers, journals, public transport, electricity and telecommunications) care must be taken to ensure that a representative range of price offers are observed. Care must also be taken to ensure that price differences between different types of consumers are observed, e.g. those linked to the age of the purchaser or to memberships of particular associations.
 58. For each type of item, different alternatives for collecting prices should be carefully investigated, to ensure that the price observations could be made reliably and effectively. Means of collection could include visits to outlets with paper forms or hand-held devices, interviews with customers, computer-assisted telephone interviews, mail-out questionnaires, brochures, price lists provided by large or monopoly suppliers of services (including scanner data) and prices posted on the Internet. For each alternative, the possible cost advantages need to be balanced against an assessment of the reliability and timeliness of each of the alternatives.
 59. The collected price information should be reviewed for comparability and consistency with previous observations, the presence of replacements, unusual or large price changes and to ensure that price conversions of goods priced in multiple units or varying quantities are properly calculated. Extremely large or unusual price changes should be examined to determine whether they are genuine price changes or are due to changes in quality. Procedures should be put in place for checking the reliability of all price observations. This could include a programme of direct pricing and/or selective re-pricing of some items shortly after the initial observation was made.
 60. Consistent procedures should be established for dealing with missing price observations because of, e.g. inability to contact the seller, non-response, observation rejected as unreliable or items temporarily unavailable. Prices of the items that are temporarily unavailable should be estimated until they reappear or are replaced, by using appropriate estimation procedures, e.g. imputation on the basis of price changes of similar non-missing items. Carrying forward the last observed price should be avoided, especially in periods of high inflation. Treatment of the items that have permanently disappeared is discussed in paragraphs 61-63.

Replacements

61. Replacement of an item will be necessary when it disappears permanently from the outlet(s), where its price is observed, and may be necessary also when it is no longer available or sold in significant quantities or under normal sale conditions. Replacement should be made within the first three months (quarters) of the item becoming unavailable. Clear and precise rules should be developed for selecting the replacement item. Depending on the frequency of sampling and the potential for accurate quality adjustment, the alternatives are to select: (i) the most popular variety among those that belong to the same elementary aggregate; (ii) the most similar to the replaced variety; and (iii) the variety most likely to be available in the future. Precise procedures should be laid down for price adjustments with respect to the difference in characteristics when replacements are necessary, so that the impact of changes in quality is excluded from the observed price. Responsibility for making such price adjustments should be clearly stated.
62. Replacement of an outlet may be necessary if prices cannot be obtained e.g. because it has closed permanently or temporarily, because of a decline in representativeness or because the outlet no longer cooperates. Clear rules should be established on when to discontinue price observations from a selected outlet, on the criteria for selecting a replacement, as well on the adjustments that may be required to price observations and/or weights. Such rules should be consistent with the objectives of the index and with the way in which the price collection sample has been determined.
63. Deletion of an entire elementary aggregate will be necessary if all items in that elementary aggregate disappear from most or all outlets and it is not possible to locate a sufficient number of price observations to continue to produce a reliable index for this elementary aggregate. In such situations, it is necessary to redistribute the weight assigned to the elementary aggregate among the other elementary aggregates included in the next level of aggregation.

Quality changes

64. As far as possible, the same item should be priced in each period. However, in practice, items that can be observed at different time periods may differ with respect to package sizes, weights, volumes, features and terms of sale, as well as other characteristics. Thus it is necessary to monitor the relevant characteristics of the items being priced to ensure that the impact of any changes in quality/utility can be excluded from the observed prices and pure price change⁷ can be estimated.
65. Identifying possible changes in quality/utility is relatively more difficult for complex durable goods and services. It is necessary, therefore, to collect a considerable amount of information on the relevant characteristics of the items for which prices are collected. Some of this information can be obtained in the course of collecting prices, but often the most important sources of information on changing characteristics will be producers, importers or wholesalers of the goods included and the study of articles and advertisements in trade publications.
66. When a quality change is detected, an adjustment must be made to the price, so that the index reflects only pure price change. If this is not done, the index will either record a price change that has not taken place or fail to record a price change that did happen. The choice of method for such adjustments will depend on the particular goods and services involved. Great care needs to be exercised because the accuracy of the resulting index depends on the quality of this process. To assume that all price change is a reflection of the change in quality or, on the other hand, to assume that items with different qualities are essentially equivalent, should be avoided as it could cause bias.
67. The methods for estimating quality-adjusted price may be:
 - (a) *Explicit (or direct) quality adjustment methods* that directly estimate the value of the quality difference between the old and new item and adjust one of the prices accordingly. Pure price change is then implicitly estimated as the difference in the adjusted prices.
 - (b) *Implicit (or indirect) quality adjustment methods* which estimate the pure price change component of the price difference between the old and new items based on the price changes

⁷ Annex 1.

observed for similar items. The difference between the estimate of pure price change and the observed price change is considered as change due to quality difference.

Whenever possible, it is preferable to use one of the explicit quality adjustment methods as the implicit ones are generally considered to be less reliable and may result in biased estimates. As the explicit methods are more complex, difficult and costly to apply, their application should be directed to items with large weights and characteristics that change in ways that are easily described. For items whose characteristics change in ways that are difficult to describe and/or are not observable, indirect methods might be applied. Publishing estimates of the aggregate effects of any quality adjustments made would enhance the transparency of the compilation process.

Accuracy

68. CPI estimates may be subject to both sampling imprecisions and sampling and non-sampling errors⁸ arising from a variety of sources. Compilers of CPIs need to be aware of the possible sources of error, and to take steps during the index construction and compilation processes to minimize their impact.
69. The following are some well-known sources of potential error, either in pricing or in index construction, that over time can lead to significant errors in the overall CPI: incorrect selection of items and incorrect observation and recording of their prices; failure to observe and adjust correctly for quality changes, appearance of new goods and outlets; failure to adjust for item and outlet substitution (in a COLI index) or loss of representativity (in a “pure” price index); the use of inappropriate formulae for computing elementary aggregate and upper level indices.
70. In general, regularly updating weights and baskets, employing unbiased elementary aggregate formulae, making appropriate adjustments for quality change, allowing adequately and correctly for new products, and taking proper account of substitution issues (in a COLI index) as well as quality control of the entire production process will minimize the index’s potential for giving a misleading picture.

Dissemination

71. The CPI estimate should be computed and publicly released as quickly as possible after the end of the period to which it refers, and according to a pre-announced timetable. It should be made available to all users at the same time, in a convenient form, and should be accompanied by a short methodological explanation. Rules relating to its release should be made publicly available and strictly observed. In particular, they should include details of who has pre-release access to the results, why, under what conditions, and how long before the official release time.
72. The index should be produced and released monthly. Where countries do not have the necessary resources and/or there is no strong user demand for a monthly series, the CPI should be prepared and released with quarterly or semi-annual periodicity.
73. The press release presenting CPI results should show the index level from the index reference period. It is also useful to present derived indices, such as the one that shows changes in the major aggregates between: (i) the current month and the previous month; (ii) the current month and the same month of the previous year; and (iii) the average of the latest 12 months and the average of the previous 12 months. The indices should be presented in both seasonally adjusted and unadjusted terms, if seasonally adjusted data are available.
74. Sub-indices should also be produced and released. Consideration should be given to producing sub-indices for the divisions and groups of the *UN Classification of individual consumption according to purpose (COICOP)*.⁹ Sub-indices for different regions or socio-economic groups, and alternative indices designed for analytical purposes, may be produced and publicly released if they are judged to be reliable and their preparation is cost effective.

⁸ Annex 3.

⁹ Annex 4.

-
75. Comments and interpretation of the index should accompany its publication to assist users. An analysis of the contributions of various items or group of items to the overall change and an explanation of any unusual factors affecting the price changes of the major contributors to the overall change should be included.
 76. The index reference period should be changed as frequently as necessary to ensure that the index numbers remain easy to present and understand. The index reference period may be chosen to coincide with the latest weights reference period or it could be established to coincide with the base period of other statistical series.
 77. Average prices and price ranges for important and reasonably homogeneous items may be estimated and published in order to support the research and analytical needs of users.
 78. Retrospective corrections (for example, as a result of an error in the price observations or in the calculations) of the publicly released indices should only be made when the index estimate previously presented was sufficiently distorted to be of concern to users. Corrections should be made as soon as possible after detection and a press release prepared and released to explain the differences.
 79. In order to ensure public confidence in the index, a full description of the data collection procedures and the index methodology should be published and made widely available. The documentation should include an explanation of the main objectives of the index, details of the weights, the index number formulae used, and a discussion of the precision of the index estimates, even if this is based only on subjective assessments. The precise identities of the outlets and goods and services used for price collection should not be revealed, as this could influence the representativeness of the index.
 80. Users should be warned in advance of any changes that are going to be made to the scope, weights or methodology used to estimate the CPI.

Consultations and integrity

81. The compiling agency should have the professional independence, competence and resources necessary to produce a high quality CPI. The United Nations “Fundamental Principles of Official Statistics”¹⁰ and the ILO “Guidelines concerning dissemination practices for labour statistics”¹¹ should be respected.
82. The agency responsible for the index should consult representatives of users on issues of importance for the CPI, particularly during preparations for any changes to the methodology used in compiling the CPI. One way of organizing such consultations is through the establishment of advisory committee(s) on which social partners, as well as other users and independent experts, might be represented.
83. Comparing CPI movements across countries is difficult because of the different measurement approaches used by countries of certain items, particularly housing and financial services. The exclusion of housing (actual rents and either imputed rents or acquisition of new houses, and maintenance and repair of dwelling) and financial services from the all-items index will make the resulting estimates of price change for the remaining items more comparable across countries. Therefore, in addition to the all-items index, countries should, if possible, produce and provide for dissemination to the international community an index that excludes housing and financial services. It should be emphasized, though, that even for the remaining items in scope, there are still be difficulties when making international comparisons of changes in consumer prices.
84. Countries should report national CPI results and methodological information to the International Labour Office in the format and at the frequency requested, and as soon as possible after the national release of the corresponding results.

¹⁰ UN Economic and Social Council, 1994.

¹¹ Sixteenth International Conference of Labour Statisticians, 1998.

Annex 1 to the draft resolution

Terminology and definitions

- (a) “Consumer goods” are goods or services that are used by households for the direct satisfaction of individual needs or wants.
- (b) “Consumption expenditures” are expenditure on consumer goods and services and can be defined in terms of “acquisition”, “use”, or “payment”:
 - “acquisition” indicates that it is the total value of the goods and services acquired during a given period that should be taken into account, whether through purchase, own-account production or as a social transfer in kind received from government or non-profit institutions, irrespective of whether they were wholly paid for or used during the period. The prices enter the CPI in the period when consumers accept or agree prices, as distinct from the time payment is made;
 - “use” indicates that it is the total value of all goods and services actually consumed during a given period that should be taken into account; for durable goods this approach requires valuing the services provided by these goods during the period. The prices (opportunity costs) enter the CPI in the period of consumption;
 - “payment” indicates that it is the total payment made for goods and services during a given period that should be taken into account, without regard to whether they were delivered or used during the period. The prices enter the CPI in the period or periods when the payment is made.
- (c) “Scope of the index” refers to the population groups, geographic areas, items and outlets for which the index is constructed.
- (d) “Coverage” of the index is the set of goods and services whose prices are observed for inclusion in the index. For practical reasons, coverage may have to be less than what corresponds to the defined scope of the index.
- (e) “Reference population” refers to that specific population group for which the index has been constructed.
- (f) “Weights” are the aggregate consumption expenditures on any set of goods and services expressed as a proportion of the total consumption expenditures on all goods and services within the scope of the index in the weight reference period. They are a set of numbers summing-up to unity.
- (g) “Price updating of weights” is a procedure that is used to bring the expenditure weights in line with the index or price reference period. The price updated weights are calculated by multiplying the weights from the weight reference period by elementary indices measuring the price changes between weight reference and price reference period and rescaling to sum to unity.
- (h) “Index reference period” is the period for which the value of the index is set at 100.0. This may be a year, a quarter or an individual month.
- (i) “Price reference period” is the period whose prices are compared with the prices in the current period. The period whose prices appear in the denominators of the price relatives.
- (j) The “weight reference period” is the period, usually a year, whose estimates of the volume of consumption and its components are used to calculate the weights.
- (k) Probability sampling is the selection of a sample of units, such as outlets or products, in such a way that each unit in the universe has a known non-zero probability of selection.
- (l) Cut-off sampling is a sampling procedure in which a predetermined threshold is established with all units in the relevant population at or above the threshold being eligible for inclusion in the sample and all units below the threshold being excluded. The threshold is usually specified in terms of the size of some relevant variable (such as some percentage of total sales), the largest sampling units being included and the rest excluded.

-
- (m) Imputed expenditures are the expenditures assigned to an item that has not been purchased, such as an item that has been produced by the household for its own consumption (including housing services produced by owner-occupiers), an item received as payment in kind or as a free transfer from government or non-profit institutions.
 - (n) Imputed price refers to the estimated price of an item whose price during a particular period has not been observed and is therefore missing. It is also the price assigned to an item for which the expenditures have been imputed, see (m).
 - (o) “Outlet” indicates a shop, market stall, service establishment, internet seller or other place where goods and/or services are sold or provided to consumers for non-business use.
 - (p) “Linking” means joining together two consecutive sequences of price observations, or price indices, that overlap in one or more periods, by rescaling one of them so that the value in the overlap period is the same in both sequences, thus combining them into a single continuous series.
 - (q) “Price” is defined as the value of one unit of a product, for which the quantities are perfectly homogeneous not only in a physical sense but also in respect of a number of other characteristics.
 - (r) “Pure price change” is that change in the price of a good or service which is not due to any change in its quality. When the quality does change, the pure price change is the price change remaining after eliminating the estimated contribution of the change in quality to the observed price change.
 - (s) “Quality adjustment” refers to the process of adjusting the observed prices of an item to remove the effect of any changes in the quality of that item over time so that pure price change may be identified.
 - (t) “Consumer substitution” occurs when, faced with changes in relative price, consumers buy more of the good that has become relatively cheaper and less of the good that has become relatively more expensive. It may occur between varieties of the same item or between different expenditure categories.

Annex 2 to the draft resolution

Quality adjustment methods

Implicit quality adjustment methods

1. The “overlap” method assumes that the entire price difference at a common point in time between the disappearing item and its replacement is due to a difference in quality.
2. The “overall mean imputation” method first calculates the average price change for the elementary aggregate without the disappearing item and its replacement, and then uses that rate of price change to impute a price change for the disappearing item. It assumes that the pure price difference between the disappearing item and its replacement is equal to the average price changes for continuing (non-missing) items.
3. The “class mean imputation” method is a variant of the overall mean imputation method. The only difference is in the source of the imputed rate of price change to period $t+1$ for the disappearing item. Rather than using the average index change for all the non-missing items in the elementary aggregate, the imputed rate of price change is estimated using only those price changes of the items that were judged essentially equivalent or were directly quality-adjusted.

Explicit quality adjustment methods

4. The “expert’s adjustment” method relies on the judgement of one or more industry experts, commodity specialists, price statisticians or price collectors on the value of any quality difference between the old and replacement product. None, some, or all of the price difference may be attributed to the improved quality.
5. The “differences in production costs” approach relies on the information provided by the manufacturers on the production costs of new features of the replacements (new models), to which retail mark-ups and associated indirect taxes are then added. This approach is most practicable in markets with a relatively small number of producers, with infrequent and predictable model updates. However, it should be used with caution as it is possible for new production techniques to reduce costs while simultaneously improving quality.
6. The “quantity adjustment” method is applicable to items for which the replacement item is of a different size to the previously available one. It should only be used if the differences in quantities do not have an impact on the quality of the good.
7. The “option cost” method adjusts the price of the replacements for the value of the new observable characteristics. An example of this is the addition of a feature that earlier has been a priced option as standard to a new automobile model.
8. A “hedonic” regression method estimates the price of an item as a function of the characteristics it possesses. The relationship between the prices and all relevant and observable price-determining characteristics is first estimated and then results are used to estimate the effects of changes in these characteristics on prices.

Annex 3 of the draft resolution

Types of errors

- “Quality change error” is the error that can occur as a result of the index’s failure to make proper allowance for changes in the quality of goods and services.
- “New goods error” is the failure to reflect either price changes in new products not yet sampled, or given a COLI objective, the welfare gain to consumers when those products appear.
- “Outlet substitution error” can occur when consumers shift their purchases among outlets for the same item without proper reflection of this shift in the data collection for the index. Most relevant when trying to estimate a COLI.
- “New outlets error” is conceptually identical to new goods error. It arises because of the failure to reflect either price changes in new outlets not yet sampled, or the welfare gain to consumers when the new outlets appear.
- “Upper level substitution error” arises when the index does not reflect consumer substitution among the basic categories of consumption owing to the use of an inappropriate method for aggregating elementary aggregates in the construction of the overall index value. Only relevant to a COLI, although an equivalent (representativity error) may be defined from the perspective of the pure price index.
- “Elementary index error” arises from the use of an inappropriate method for aggregating price quotations at the very lowest level of aggregation. The elementary index error can take two forms: formula error and lower level substitution error. The index suffers from formula error if, as a result of the properties of the formula, the result produced is biased relative to what would have been the result if a pure price change could have been estimated. The index suffers from lower level substitution error if it does not reflect consumer substitution among the items contained in the elementary aggregate. Lower level substitution error is only relevant to a COLI.
- “Sampling imprecision “ is not an error, but a consequence of the CPI being based on samples and not on a complete enumeration of the population.
- “Selection error” arises when the sample of price observations is not fully representative of the intended population of outlets and/or items. The first four types of errors listed above can be seen as special cases of this type of error.

Annex 4 of the draft resolution

Classification of individual consumption according to purpose (COICOP)¹

01-12	Individual consumption expenditure of households
01.0	Food and non-alcoholic beverages
01.1.0	Food
01.2.0	Non-alcoholic beverages
02.0	Alcoholic beverages and tobacco
02.1.0	Alcoholic beverages
02.2.0	Tobacco
02.3.0	Narcotics
03.0	Clothing and footwear
03.1.0	Clothing
03.2.0	Footwear
04.0	Housing, water, electricity, gas and other fuels
04.1.0	Actual rentals for housing
04.2.0	Imputed rentals for housing
04.3.0	Maintenance and repair of the dwelling
04.4.0	Water supply and miscellaneous services related to the dwelling
04.5.0	Electricity, gas and other fuels
05.0	Furniture, household equipment and routine household maintenance
05.1.0	Furniture and furnishing, carpets and other floor coverings
05.2.0	Household textiles
05.3.0	Household appliances
05.4.0	Glassware, tableware and household utensils
05.5.0	Tools and equipment for house and garden
05.6.0	Goods and services for routine household maintenance
06.0	Health
06.1.0	Medical products, appliances and equipment
06.2.0	Outpatient services
06.3.0	Hospital services
07.0	Transport
07.1.0	Purchase of vehicles
07.2.0	Operation of personal transport equipment
07.3.0	Transport services

¹ Explanatory notes are available on <http://esa.un.org/unsd/cr/registry/regcst.asp?C1=5&Lg=1>

08.0	Communication
08.1.0	Postal services
08.2.0	Telephone and telefax equipment
08.3.0	Telephone and telefax services
09.0	Recreation and culture
09.1.0	Recreational equipment and accessories
09.2.0	Recreational and cultural services
09.3.0	Newspapers, books and stationery
09.4.0	Package holidays
10.0	Education
10.1.0	Educational services
11.0	Hotel, cafes and restaurants
11.1.0	Catering services
11.2.0	Accommodation services
12.0	Miscellaneous goods and services
12.1.0	Personal care
12.2.0	Prostitution
12.3.0	Personal effects n.e.c.
12.4.0	Social protection
12.5.0	Insurance
12.6.0	Financial services n.e.c
12.7.0	Other services n.e.c.

Appendix 2

Resolution concerning consumer price indices adopted by the Fourteenth International Conference of Labour Statisticians, 1987

Preamble

The Fourteenth International Conference of Labour Statisticians,

Having been convened at Geneva by the Governing Body of the ILO and having met from 28 October to 6 November 1987,

Recalling the existing international standards concerning cost-of-living index numbers contained in the resolutions adopted by the Second and Sixth Conferences in 1925 and 1947 respectively, and those concerning special problems in the computation of consumer price index numbers contained in the resolution adopted by the Tenth International Conference of Labour Statisticians in 1962,

Recognising the need to revise and broaden the existing standards in order to enhance their usefulness in the provision of technical guidelines to all countries and particularly those with less developed statistics,

Recognising the usefulness of such standards in enhancing the international comparability of the statistics,

Recognising that consumer price indices are essential to assessments of social conditions and of economic performance and potential, and

Recognising, therefore, that such indices need to be credible to observers and users, both national and international,

Agrees that the principles and methods used in constructing a consumer price index should be selected, with consideration of the chosen objectives, from among the guidelines and standards which are generally accepted as constituting good statistical practice; and

Adopts, this fifth day of November 1987, the following resolution which replaces those adopted in 1925, 1947 and 1962.

Terminology

1. For the purposes of this resolution, the following terms are defined:
 - (a) "Outlet" indicates a shop, market, service establishment, or other place, where goods and/or services are sold or provided to consumers for non-business use.
 - (b) "Consumption" indicates all goods and services (or "items") that are acquired, used or paid for, but not for business purposes and not for the accumulation of wealth.
 - (c) "Region" indicates any geographically defined area and/or type of area within a country.
 - (d) "Scope of the index" indicates the population groups, regions, items and outlets for which the index is established.
 - (e) "Reference population" indicates the population that falls within the scope of the index.
 - (f) "Elementary aggregate" indicates the most detailed level for which expenditure or quantity weights are held constant for a certain period of time.
 - (g) Consumption expenditure can be measured in terms of "acquisition", "use" or "payment":
 - (i) "acquisition" indicates that the total value of all goods and services delivered during a given period, irrespective of whether they were wholly paid for or not during the period, should be taken into account;

-
- (ii) “use” indicates that the total value of all goods and services actually consumed during a given period should be taken into account; and
 - (iii) “payment” indicates that the total payments made for goods and services during a given period, without regard to whether they were delivered or not, should be taken into account.

The nature of a consumer price index

2. The purpose of a consumer price index is to measure changes over time in the general level of prices of goods and services that a reference population acquire, use or pay for for consumption. A consumer price index is estimated as a series of summary measures of the period-to-period proportional change in the prices of a fixed set of consumer goods and services of constant quantity and characteristics, acquired, used or paid for by the reference population. Each summary measure is constructed as a weighted average of a large number of elementary aggregate indices. Each of the elementary aggregate indices is estimated using a sample of prices for a defined set of goods and services obtained in, or by residents of, a specific region from a given set of outlets or other sources of consumption goods and services.

The uses of a consumer price index

3. The uses of a consumer price index and their relative importance vary from country to country. They include:
 - (a) general economic and social analysis and policy determination;
 - (b) negotiation or indexation, or both, by government (notably of taxes, social security benefits, civil service remuneration and pensions, licence fees, fines and public debt interest or principal) and in private contracts (e.g. wages, salaries, insurance premia and service charges) and in judicial decisions (e.g. alimony payments);
 - (c) establishing “real” changes, or the relationship between money and the goods or services for which it can be exchanged (e.g. for the deflation of current value aggregates in the national accounts and of retail sales); and
 - (d) price movement comparisons done for business purposes, including inflation accounting.

Sub-indices rather than the all-items index may be suitable for some of the above uses.

Scope of the index

4. The reference population should normally be defined very widely, specifying those income groups and household or family types that are excluded.
5. The regional scope should normally be defined as widely as possible, noting any exclusions. It should also be specified whether any regional limitation or breakdown of consumption expenditure and of price collection relates to sales in a region, or to purchases by residents of a region.
6. Separate indices may be computed for different population groups or for different regions.
7. The extent to which expenditure abroad is included should be clearly indicated.
8. Ideally, the consumer price index should relate to all goods and services (including imports) acquired, used or paid for by the reference population for non-business purposes, without any omission of tobacco or other things which may be regarded as non-essential or undesirable. The range of goods and services included may, but need not, coincide with consumption expenditure as defined in a national accounts framework. Income taxes, savings, life insurance and pension fund contributions, and financial investments (as distinct from financial services) should not be included in the consumer price index.
9. If second-hand purchases are represented in the index, then the weights for second-hand goods should be calculated net of the corresponding sales including trade-ins.
10. In some cases, such as insurance, health care, second-hand goods, etc., it may not be possible to use the same methodology as in the general index. Groups of goods or services which fall within the scope of the index but which cannot be dealt with according to the general methodology, either

because this methodology cannot be applied correctly for these items or because the necessary information is insufficient or lacking, may be included in or excluded from the calculations:

- (a) in the case of their inclusion, special methods will need to be used;
- (b) in the case of their exclusion:
 - the group may be explicitly represented by another group to which the weights of the excluded items are allocated;
 - the group may be purely and simply excluded from the index (price collection and weights) which assumes that its price movement is represented by the movement of the overall index.

In all the above cases, users should be informed as to the method followed.

11. The goods and services or household expenditures should follow a classification which is dependent upon the objectives of the index, previous practices, the methods of data collection, as well as upon the nature and quality of data available for the computation of weights. Nevertheless, it is desirable that this classification permit aggregation according to the eight major groups of the United Nations System of National Accounts (SNA): “Food, beverages and tobacco”, “Clothing and footwear”, “Gross rent, fuel and power”, “Furniture, furnishings, and household equipment and operation”, “Medical care and health expenses”, “Transport and communication”, “Recreation, entertainment, education and cultural services” and “Miscellaneous goods and services”. If need be, a ninth group might be created, covering items which are not included in the household final consumption expenditure of the SNA.

Acquisition, use or payment

12. Having decided the scope of the index in terms of the reference population and the goods and services to be included, it should be explicitly considered whether the objectives of the index are best satisfied by adopting the concepts of acquisition, use or payment. These issues should be examined, taking into account the theoretical index concept, acceptability to users, availability of data, and resource requirements. These issues particularly arise in dealing with own-account consumption, owner-occupied housing, consumer credit, durable goods, remuneration in kind and goods and services which are provided without charge or are subsidised by government.
13. The concepts of acquisition or payment may be chosen if the index is defined in terms of money flows. Adherence to the conventions of national accounting may be desired if the deflation of consumer expenditure as defined in the national accounts is one of the major uses to which the index is put. When the design of the index is founded upon the consistent application of consumer demand theory, the concept of use may be appropriate. This concept implies estimating the rental value of owner-occupied housing if the data permit such estimates to be made reliably. Alternatively, it would imply the explicit inclusion of all owner-occupied housing costs.

Defining elementary aggregates

14. In defining elementary aggregates (in terms of kinds of goods or services, types of outlets and regions), the following principles should be observed:
 - (a) related goods or services which are thought to display similar price movements should be grouped together in an elementary aggregate;
 - (b) goods or services whose prices might reasonably be expected to move markedly differently should not be grouped together in the same elementary aggregate;
 - (c) elementary aggregates should be distinguished whenever weights (including regional or outlet weights) are available or can be estimated;
 - (d) such regional or outlet weights should be used in calculating the index even when separate regional or outlet-type sub-indices are not required;
 - (e) elementary aggregates should be described so that any good or service can be unambiguously assigned to the appropriate elementary aggregate.

-
15. In the calculation of elementary aggregate indices, consideration should be given to the possible use of geometric means.

Weighting

16. Weights are the relative expenditure or consumption shares of the elementary aggregates estimated from available data.
17. In deriving the weights of the elementary aggregates, a household expenditure survey is usually the main source of data. As far as resources permit, such surveys should be representative of household size, income level, regional location, socio-economic group and any other factors which may have a bearing on household expenditure patterns. The period of the survey should be a normal one (or temporary abnormalities should be adjusted in determining the weighting pattern) and should preferably cover a whole year if seasonal variations in expenditure patterns are important. When inflation during the period has been rapid and/or has differed significantly between expenditure groups, either expenditure for the different sub-periods should be valued at the prices of a common time sub-period or the expenditure proportions of the different sub-periods should be averaged over the period, in the absence of any superior method.
18. Surveys of sales in retail outlets and household surveys on point-of-purchase can provide valuable information concerning the breakdown of consumption by outlet-type and by region. In the absence of such surveys, it is sometimes preferable for statisticians to use their personal knowledge of the markets and their nature rather than to apply equal weights to the different outlets or types of outlets and/or to different regions.
19. In countries which have reliable information concerning components of the household final consumption expenditure of the national accounts, such information can sometimes be used to derive an initial aggregate weighting pattern. In centrally planned economies in particular, retail sales data may be a major source of weights. More detailed data from household expenditure surveys can be used to break down the aggregates or to adjust the figures to relate more closely to the reference population.
20. In countries where data from household expenditure surveys are not available and where the data on the components of the household final consumption expenditure of the national accounts are inadequate, data from various surveys such as of production, export and import and retail trade, and from administrative sources may have to be used to obtain an estimated consumption pattern.
21. Before any of the survey results are used to provide weights for the index, it is necessary to examine them carefully, e.g. in the light of the sampling and non-sampling errors, in order to judge whether the survey has provided reliable and representative information. Adjustments should be made, if necessary, using other available statistics.
22. Analysis of the data to show the expenditure patterns for different regions and categories of the population is useful, both to assist in revealing those categories for which the computation of separate consumer price indices may be warranted and for establishing the elementary aggregates and their weights.
23. The weights should be examined periodically, and particularly if economic circumstances have changed significantly, to ascertain whether they still reflect current expenditure or consumption patterns. The weights should be revised or adjusted if the review shows that this is not the case. In any case, they should be revised at least once every ten years.
24. Whenever the composition and/or weighting pattern of the index is changed, the new index should be linked to the old index to provide a continuous series of index numbers.

Sampling for price collection

25. Sampling of goods and services and of outlets is necessary to decide what prices should be collected and where they should be collected for each elementary aggregate (except in cases of centrally determined and uniform prices). Sample selection methods and sizes should be adequate to provide the accuracy required for the objectives of the index.
26. Efforts should be made to ensure that samples of cities, urban areas or regions, of dwelling units, of sales outlets, and of items and varieties priced are as representative as possible. Probability

sampling, although involving difficult practical problems, will normally enhance the accuracy of the index and, moreover, will make possible an estimate of the sampling error.

27. Probability sampling gives every price within the scope of the index an opportunity for selection. Each price need not have an equal probability of selection. Indeed, efficient designs use probabilities that are proportional to variables that affect the precision of the estimates.
28. Implementation of probability sampling may be a gradual process. Where one begins will vary depending on the nature of the economic structure and the availability of data. Probability sampling might begin with geographic areas, or with detailed items within larger groups, or with outlets. Each stage of probability sampling makes some contribution to the quality of the indices.
29. If sufficient information or resources do not exist for constructing a probability sample which will give a good measure of price change, then the statistician should apply the best judgement and available data to select a representative sample of geographical areas, outlets, items and varieties. If, for example, resources are inadequate to establish a representative sample for the country as a whole, it might be appropriate to decide, in principle and *a priori* (that is, outside any random sampling), that certain regions, towns or urban areas where the collection of prices is less expensive represent larger groups of regions, towns or urban areas.
30. The samples of outlets and of goods and services and the specifications used for pricing should be reviewed periodically, and they should be updated if this is necessary to maintain their representativeness.
31. Particular attention should be paid to the way in which pricing is distributed in time. Price observations of the same item at the same outlet should, especially in the case of wide price variations, be made at regular intervals, of, for example, about one month or three months, depending upon the frequency of the index compilation. Account should be taken of the fact that, when the index collection period is organised on the basis of weeks, there may be time discrepancies since a month or quarter is not composed of an exact number of weeks.
32. In the case of perishable goods, attention should also be paid to the time of day which is selected for price collection.
33. Rents should be obtained from a specially designed survey relating to a sample of dwellings which is periodically updated to ensure continuing representativeness and, particularly, that newly constructed units are brought into the sample.

The price data

34. The quality of the price data is the crucial determinant of the reliability of the index. Hence, great care should be taken to ensure that the prices obtained are actual transaction prices and are collected systematically at regular intervals. Standard methods for collecting and processing price data should be developed. Where centrally regulated or centrally fixed prices are collected centrally, checks should be made to ascertain whether the goods and services in question are indeed sold and whether these prices are in fact observed. Where prices are not displayed, where quantity units are poorly defined or where actual purchase prices may deviate from list or fixed prices, check purchases by the price collectors are advisable and a budget should be provided for these purchases. Where prices are subject to significant fluctuations over the month or quarter, it is desirable to collect them more than once during the month or quarter.
35. Consistent procedures should be established for dealing with missing price observations whatever the cause, including: seasonally unavailable, unable to contact, non-response, rejected observation, temporarily out of stock. Price collectors should be well trained and well supervised, and should be provided with a good manual explaining all the procedures they have to follow. The price data sent in by the price collectors should be reviewed and edited for comparability, substitutions, unusual or simply large price changes and for price conversions of goods priced in multiple units or varying quantities, where the units or quantities do not form part of the specification. There should be procedures, such as repricing in the same outlets, for checking the reliability of the price data.
36. The specifications used for pricing, including the final selection of the particular variety and size by the price collector, where relevant, serve the purpose of securing comparability between successive periods and assisting selection and evaluation of substitutes. The specifications should be precise enough to identify all the characteristics that are necessary to ensure that identical goods and services are priced in successive periods in the same outlet. It should be noted that the relevant

characteristics of the goods and services should include, for example, terms of payment, conditions of delivery, guarantees and type of outlet.

37. Substitutions will be necessary when priced items disappear permanently from the outlet(s) in which they are priced. An item which is no longer available in sufficient quantities or under normal sale conditions may also be considered to be unavailable. Clear and precise rules should be developed for identifying the substitute item. Precise procedures should be laid down for price adjustment with respect to the difference in characteristics when substitutions are necessary. Responsibility for such evaluation should be clearly established. Evaluations of the difference in characteristics and decisions on how to use substitute prices in the index should, to the extent possible, be based on solid, empirical evidence of the market valuation of the difference in characteristics between the original and the substitute items. A number of techniques and data sources may be used to approximate this market valuation. In the absence of a satisfactory estimate of the specific adjustment for the difference in characteristics, a choice must be made between an assumption of no change and an assumption that the price difference is simply and wholly a reflection of the difference in characteristics. Under the former assumption, the price for the substitute should be compared directly with that of the item for which it is substituted; this assumption can be made only when the items are fairly similar. Where the whole price difference is taken as a reflection of the difference in characteristics, the index should be constructed by linking the series for the substitute to that of the item for which it is substituted.
38. Substitutions made because of a decline in representativeness or disappearance of an item from an outlet might possibly require that another outlet be chosen. This might also be necessary when an outlet disappears. In these cases, rules should be established to ensure that the price collector makes a correct choice with respect to a new outlet, and that the adjustments are made, if need be, to take account of the change in outlet or the change in the nature of the outlet. The rules should be consistent with the objectives of the index and with the way in which the price collection sample has been determined.
39. Substitutions will also be necessary if all items in an elementary aggregate disappear from most or all outlets. In such cases, if a substitute item representing the elementary aggregate cannot be found and appropriate adjustments for the difference in characteristics made, it may be necessary to redistribute the weight assigned to the elementary aggregate among other elementary aggregates within the next highest level of aggregation possible.
40. The prices to be collected are the regular actual transaction prices, including indirect taxes, paid by the reference population. Prices charged for stale, shop-soiled, damaged, or otherwise imperfect goods sold at clearance prices should be excluded unless they are a permanent and widespread feature of market conditions. However, sale prices, discounts, cut prices and special offers should be included when applicable to all customers and when the goods and services are offered in their normal availability.
41. Prices should be collected in all types of markets which are important. These may include open-markets and black-markets as well as state-controlled markets. Where more than one type of market is important, an appropriately weighted average should be used in the calculation of the index.
42. In periods of price control or rationing, where limited supplies are available at prices which are held low by subsidies to the sellers, by government procurement, by price control, etc., these prices as well as those charged on unrestricted markets should be collected. They should be combined in a way which uses the best information available with respect to the actual prices paid and the relative importance of the different types of sales.
43. Countries may wish to calculate, from the data collected for their consumer price index, average prices for selected reasonably homogeneous goods or services. However, their dissemination should be accompanied by an indication of the limitations of these calculations. Countries may also wish to establish efforts to collect separate data to support average price calculations, given considerable user interest in these data.

Dissemination

44. A consumer price index should be computed and publicly released as quickly as possible according to the resources available and to the user needs, preferably at least once every three months. Rules relating to the release of the data should be established, publicly known and strictly observed.

-
45. In general, retrospective corrections (e.g. as a result of an error in the data or in calculation) of the publicly released indices should only be done when absolutely necessary because of the difficulties such corrections cause for indexed contracts or payments. Instead, necessary corrections might be made to the index for the subsequent period. An explanation should be provided in order to avoid misinterpretation of the short-term price movement.
 46. Sub-indices should also be released, at least for such major expenditure groups as food, clothing and footwear, housing, etc. Sub-indices for different regions or socio-economic groups or for special analytical purposes (e.g. travellers' expenses, imported items) might be publicly released if they were judged to be useful and the cost warranted it. Average prices or price ranges for important and reasonably homogeneous items may be released.
 47. The exclusion of shelter from the all-items index makes the rates of price change more comparable across countries, although it does not eliminate all the difficulties encountered when making such comparisons. Countries should, therefore, provide for dissemination at the international level of an index which excludes shelter, in addition to the all-items index.
 48. In order to ensure public confidence in the index, a full description of the methodology and data sources should be published. The document(s) should include, among other things, details of the weights, objectives of the index, and a discussion of the precision of the index. However, the precise identities of the outlets and goods and services for which prices are obtained and any other details which, if disclosed, would adversely affect the representativeness of the index should, in general, not be revealed.
 49. The agency responsible for the index should consult with representatives of users on major issues. One way of organising such consultation is through the establishment of advisory committee(s) on which users and outside experts might be represented.