Contents

1. Introduction

1. The consumer price index (CPI) is possibly the most important statistical number produced by national statistical agencies. Its development plays 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 regulated as a function of CPI development. Given the importance of the CPI, it is not surprising that measurement issues regarding CPI have attracted considerable attention over the years.

2. Many contemporary comments have been made about the possible sources of bias in the CPI. Questions have been raised concerning the treatment of quality changes, new goods, choice of index formula, age of the weights used, etc. The fact that the CPI may overestimate true price movements, and the consequent considerable financial consequences for government budgets over the long term, has forced many statistical agencies to reconsider and make significant changes in their CPI methodology.

3. 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 of the CPI:

- the formula used;
- the frequency of weight updates;
- the procedures for quality adjustment, introduction of new goods and new outlets;
- the sampling methods used, etc.

4. Other issues that have arisen include the need for constructing and publishing more than one index to meet specific requirements, because no single index can serve all purposes equally well. It may also be relevant to compute separate CPIs for different population groups, given the possibility that these groups may experience significantly faster or slower growth in their cost of living than the growth recorded by changes in the general CPI. This could come from differences not only in expenditure patterns but also in changes to the prices paid. Another point that needs to be addressed concerns the subsequent correction of an index that has already been published.

5. A need to review, update and further develop international standards on CPIs was expressed at the Sixteenth International Conference of Labour Statisticians (ICLS) in 1998. On the basis of these considerations, the Governing Body of the International Labour Office decided, at its 277th Session in March 2000, to convene a Meeting of Experts on Labour Statistics in Geneva from 22 to 31 October 2001, the second part of which (from 26 to 31 October) will be devoted to consumer price indices.

6. In preparation for the Meeting, the Office has prepared the present report.

7. The Meeting's conclusion on the need to revise the current (1987) ICLS resolution concerning consumer price indices and the abovementioned issues will be taken into account when the Bureau of Statistics prepares a new draft resolution for consideration by the Seventeenth International Conference of Labour Statisticians, to be held in Geneva in 2003.

Structure of the report

8. This report has been prepared to facilitate discussion at the Meeting, and is organized as follows. Chapter 2 provides general background information, touching upon a few points of historical interest and giving some examples of recent developments on the national and international plan, particularly in respect of the possible sources of bias in the CPI. Chapter 3 outlines 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 4 covers the scope and coverage of CPIs and the implications of using the acquisition, use or payment approach in the treatment of owner-occupied housing. Chapter 5 concerns the compilation of a CPI, and covers sampling and weighting procedures and calculation of elementary and upper level indices. Price collection and treatment of quality changes are covered in Chapter 6. Chapter 7 reviews several categories of error, either in price observations or in index construction, that can potentially lead to bias in the overall CPI, along with some methods to reduce or eliminate such errors. Chapter 8 covers dissemination of the index. Finally, proposals for a new draft resolution concerning consumer price indices are presented in Chapter 9. The 1987 resolution adopted by the Fourteenth ICLS is reproduced as Appendix I, and the COICOP classification is attached as Appendix II.

9. Where relevant, reference to a proposed point for inclusion in a draft resolution on CPIs is provided in the text. In a few places, specific issues not covered in the draft resolution are raised with the aim of obtaining the view of the Meeting.

2. Historical background and recent developments

Historical background

10. 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 dates back to 1925 in the Second International Conference of Labour Statisticians (ICLS), and subsequent revised resolutions were adopted by the Sixth (1947), Tenth (1962) and Fourteenth (1987) ICLS.

11. 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.

12. 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. It was followed by a manual on methods published in 1989 which provided guidance to countries on the practical application of the standards.

Recent developments

13. Over the last few years, a considerable amount of work on the methodology of price indices has been undertaken at international level as a result of the formation of the *International Working Group on Price Indices*. This group, 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 scanner data.

14. The final report of the United States Advisory Commission to Study the CPI, the "Boskin Commission", which was established by the Senate Finance Committee in 1995, generated a lot of discussion on measurement bias in the CPI. It discussed

possible sources of bias in the CPI such as 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 persons not deeply involved with these issues in their professional capacity.

15. The Boskin Commission report also highlighted the fact that, owing to the widespread use of the United States CPI for index-linking of social benefits such as pensions and other government payments, the cumulative effects of even small potential biases can have considerable financial consequences for the government budget over the long term.

16. The fact that the CPI may overstate the rate of inflation has drawn considerable attention from a variety of users in the academic and business community, as well as from politicians. Among countries in which major research projects have recently been undertaken to investigate the presence and size of a possible upward bias in the CPI are Canada, the United Kingdom, France and Australia.

17. Another 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, in the last three decades of the twentieth century. The slowing down of inflation in many parts of the world in the 1990s, as compared with the 1970s and 1980s, did not lead to a loss of interest in its measurement; 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 so 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.

18. Within the European Union, EUROSTAT in conjunction with the Member States has recently developed procedures and standards for a Harmonized Index of Consumer Prices (HICP). HICP is the inflation indicator used in setting the monetary union interest rate. These standards are also being followed by the pre-accession countries of Eastern Europe.

19. These discussions and research have generated a wealth of material for a better understanding of both the meaning and the limitations of a CPI, as well as requests for a revision of the current international CPI standards.

20. An Intersecretariat Working Group on Price Statistics (IWGPS) was established in 1998 with a mandate to revise the international standards, in particular the ILO manual on CPI, and to coordinate the efforts and expertise of the major organizations concerned with CPI. The role of the IWGPS is to develop and document guidelines on concepts and methods of price statistics and indicators in line with the established methodological consensus and best national practices.

3. The nature and uses of consumer price indices (CPIs)

21. The CPI is treated as one of the key indicators of economic performance in most countries. Its purpose is 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. Such movements affect the real purchasing power of money incomes and the real wealth and welfare of consumers. As the prices of different goods and services do not all change at the same rate, a price index can only 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 2 of the draft resolution, Chapter 9).*

22. A CPI may be designed to measure the average change in the prices of a fixed set of goods and services purchased by households for their own consumption or, alternatively, the change in the cost of maintaining 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 *(cf. paragraphs 3-4 of the draft resolution, Chapter 9).*

23. The following discussion examines the differences between a CPI defined to measure the price change of a fixed set of goods and services, and one defined to measure changes in the cost of maintaining a given standard of living.

24. 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.

25. Maintaining a constant standard of living does not imply continuing to consume a fixed basket of goods and services when the prices of different goods and services are changing relative to one another. A cost-of-living index 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.

26. It should be noted that the calculation of a complete COLI would have to take into account not only price-induced changes over time in the amount that consumers need to spend to reach a certain "utility level" or "standard of living", but also changes in other factors that affect consumers' well-being, such as government policies and other environmental factors. It is very difficult to determine the proper treatment of public goods, such as education, health, water quality and law enforcement, that would comprise a complete COLI.

27. The 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 reflect 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.

Uses of the CPI

28. The consumer price index is used for a wide variety of purposes, as in practice it remains the most accurate measure of inflation experienced by households. It is the barometer of economic performance and a key indicator for evaluating the results of a country's monetary and fiscal policy. A popular function is the use of CPI for adjusting wages and social security benefits (such as pensions) to compensate for changes in the cost of living. Developments in the CPI will also be important for the formulation of social policy measures and for the adjustment of social security and welfare allowances. In addition, CPI sub-indices are used for deflating sub-components of total household consumption in national accounts at current prices.

29. The main uses of the CPI have been changing over time, and may differ from one country to the next. In most countries, CPIs were originally compiled to enable automatic adjustment of wages to compensate wage earners for changes in the prices of goods and services purchased and, as such, have played an important role in the income adjustment process.

30. More 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. One example of this is the development of the European Harmonized Index of Consumer Prices (HICP).

31. In practice, most CPIs are often used for both compensation and inflation purposes at the same time *(cf. paragraph 5 of the draft resolution, Chapter 9).*

32. With such widespread use of the CPI, it is easy to lose sight of the index itself, the specific purposes for which it was developed, and thus of the assumptions behind its construction, and its limitations in its relevance for other purposes for which it is now being used. It is unlikely that a single CPI can perform satisfactorily for all of

its many purposes. It may therefore be appropriate to construct a number of alternative price indices for specific purposes *(cf. paragraph 7 of the draft resolution, Chapter 9).*

33. Separate CPIs might be computed for different population groups, given the likelihood that these groups will experience faster or slower growth in their cost of living than is recorded by changes in the general CPI. Older people, for instance, are likely to spend more on medical care, while young people may tend to spend more on new products, such as mobile phones or computers, than the "average consumer". Another difference may come as a result of differences in the prices paid (for example, some groups may have subsidized transport, rent and so on, and may therefore experience dramatically different price developments than others if the subsidy rates change). Also, the varieties and qualities of the specific items consumed by the elderly (e.g. clothing) might be quite different from those consumed by an average consumer.

34. However, it must also be recognized that the publication of more than one CPI can be confusing, and the coexistence of different measures could undermine the credibility of them all for many users. That is why *paragraph 7 of the draft resolution (Chapter 9)* requires that only one index be referred to as the CPI.

35. The main use of the CPI has implications for the type of index to be produced, in terms of the range of goods and services covered, the extent of geographic coverage, the consumers it relates to, how the item domain is defined, the concept of price followed, and the formula used *(cf. paragraph 6 of the draft resolution, Chapter 9)*. These issues are discussed in Chapters 4 and 5.

CPI as an inflation index

36. The CPI is often used as a general indicator of inflation (or deflation). This use is justified by the fact that the CPI measures price changes at the retail level, which is the final stage of transactions in the economy. It should be noted, however, that the CPI is not a comprehensive measure of inflation because it measures only changes in the prices of consumer goods and services purchased by households; it does not cover capital goods, such as houses, or the goods and services consumed by enterprises or governments. Any attempt to analyse inflationary pressures in the economy must also take account of other price movements as well, such as changes in the prices of imports and exports, the prices of industrial inputs and outputs, and asset prices. The CPI is only a part of the more general measures of inflation for the economy as a whole.

37. The inflation index that covers all transactions carried out in the economy is so broad and would be so costly to construct that it does not currently exist in any country (only a few countries are computing 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).

38. In most countries CPI is used as the best available measure of inflation, since there are currently no other measures which would be acceptable and which at the same time would give a more accurate picture of the evolution of prices for society as a whole.

4. The scope of CPIs

39. The scope of a CPI depends on the use for which it is intended. Decisions about the kinds of goods and services and types of households to be covered by the index can be made only on the basis of its main intended uses. The group of households and range of goods and services covered by a CPI have to be decided by compilers in the light of users' needs. A CPI intended to measure inflation should exclude consumption purchases made abroad and include the consumption purchases of overseas visitors *(cf. paragraph 8 of the draft resolution, Chapter 9)*.

40. In general, a national index should be as broadly defined as possible to cover all households in the country. Depending on the main uses of the index, but sometimes also for reasons of practicality or costs, consumption by certain types of households, such as relatively very rich or poor households, or particular geographical areas, may be excluded from the weights. If any households, population groups or geographical areas are excluded, this should be explicitly stated *(cf. paragraph 9 of the draft resolution, Chapter 9)*.

41. While there may be interest in a CPI which is as broadly defined as possible to cover all the goods and services consumed by all households, in principle many alternative CPIs covering particular population groups or areas could be defined which might be more useful for particular analytical or policy purposes *(cf. paragraph 10 of the draft resolution, Chapter 9)*.

42. A CPI measures changes in the prices of goods and services acquired, used or paid for by households for purposes of their own consumption, and nothing should be omitted on the basis of moral or social judgement. The following are examples of categories of expenditures that should be excluded: 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. Property taxes are a special case. Although they are not directly connected with specific quantities and qualities of goods and services obtained by homeowners, they 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. 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 may be interpreted as a financial transaction *(cf. paragraph 11 of the draft resolution, Chapter 9)*.

43. There are goods and services whose inclusion in the CPI poses particularly difficult problems. For example, health and education services received by the population through the health insurance and educational systems may be subsidized or completely financed by the government. The amount of these services is generally

unknown or very difficult to estimate. Sometimes, no price can be associated with these services, since they are not bought and paid for as such. Consequently, a special approach may be needed, and the users should be informed of the items involved and the methods used *(cf. paragraph 12 of the draft resolution, Chapter 9)*.

Acquisition, use and payment as a basis for weights

44. The distinction between these approaches is not relevant for non-durable goods or for durable goods bought for cash. But the distinction is important for own-account consumption, owner-occupied housing, consumer credit, durable goods bought on credit, remuneration in kind and goods and services provided without charge or subsidized by governments. The most controversial of these issues is the treatment of owner-occupied housing. It requires special treatment because it is characterized by a long useful life and by a high purchase price, usually with long-term credit attached *(cf. paragraph 13 of the draft resolution, Chapter 9)*.

45. National practices regarding the treatment of owner-occupied housing in the CPI vary widely between countries. Some countries regard expenditures on owner-occupied housing entirely as capital investment and exclude them from the CPI. For others, owner-occupied housing consists of both a capital and a consumption element and the main difficulty is how to separate them. The problem is that for owner-occupied housing there may be a substantial difference between the time of acquisition, the time of payment and the time of consumption.

46. In general, there are two different approaches in construction of an index for owner-occupied housing *(cf. paragraph 14 of the draft resolution, Chapter 9)*.

(a) The "expenditure" approach measures price movements associated with expenditure on the purchase of the house, together with related ongoing expenses such as repairs and maintenance. This approach comprises two main variants:

– the "net acquisition" approach attempts to measure the change in the price of acquiring a dwelling. 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, regardless of when consumption takes place;

– the "payment" approach attempts to measure the change in households' current actual outlays on owner-occupied housing. In the payment approach, actual outlays are included regardless of the time when the

goods or services are acquired or consumed. 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.

(b) In the "consumption" approach, the purchase of a dwelling is regarded as an investment and expenditures on the purchase or improvements will therefore be excluded from the index's weights. Other capital costs related to the dwelling, such as major repairs, conversions and extensions, insurance and transaction costs, are also excluded. The consumption approach regards the purchase of a house as a capital investment which provides services to the user, and so measures changes in the cost of consuming these services. This can be done through the "rental equivalent" approach or the "user cost" approach:

– under the "rental equivalent" approach (the most common current practice), the rent for the 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 is impracticable if the rental market is very small compared with the owner-occupied market, or if rented dwellings are of a different type 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; a significantly different weight might be produced where state-controlled rents are considerably lower. A second problem in many countries is that there is no reliable information on actual market rents. Very often, there are two contracts between a landlord and tenant, and information is obtainable only on the one which reflects current regulations;

– the "user cost" approach attempts to measure the change in the price of consuming the service of owner-occupied housing. In this approach the actual consumption of the service of the dwelling is included in the CPI and priced by the estimated cost of using an owner-occupied dwelling.

5. The compilation of a CPI

Classification

47. The items selected for the basket should be grouped into similar categories in a hierarchical classification system, e.g. divisions (groups/classes) to make the index useful for analytical purposes. For the purposes of international comparison, it is desirable that the classification scheme of goods and services be consistent with the standard international *Classification of Individual Consumption according to Purpose* (COICOP). The most recent version of this classification, under which individual consumption expenditures for households are classified in 12 major groups, was adopted by the United Nations Statistical Commission at its thirtieth session in March 1999 (see Appendix II). To facilitate estimation and application of weights, the classification used should also be consistent with the classifications used for household expenditure surveys (HESs) and other statistics *(cf. paragraph 17 of the draft resolution, Chapter 9)*.

Weights

48. The quality of the weights used is very important for the relevance, accuracy and reliability of the CPI estimates. For this reason the choice of sources from which the weights are constructed is crucial. Measures of expenditure in the expenditure classes can be obtained from a number of sources. Two of the main sources are the results obtained from household expenditure surveys (HESs) and estimates of the components of households' final consumption made for national accounts (NA). HES results provide more detailed information than do the NA estimates, which are normally based on a combination of HES results and statistics from other sources. The NA estimates may be important when estimating weights for consumption categories which tend to be highly 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.

49. 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. The decision as to what sources to use and how to use them depends on an analysis of their respective advantages and disadvantages and on the main purpose of the index *(cf. paragraph 18 of the draft resolution, Chapter 9)*.

50. 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 future behaviour of

household consumers, rather than precisely reflecting the activity of a particular period of observation that may have been abnormal in some way (for example, consumption affected by different factors such as economic blockades, extremely favourable or unfavourable weather conditions, etc.). Necessary adjustments would need to be made to the survey data to take into account the circumstances that have affected consumption in the weights reference period. Another case would be when expenditure on some items is not available from the result of the HES. This could happen when a new item such as mobile telephones has been introduced in the market after the survey was completed. Necessary adjustments would then need to be made to the survey data to take into account the changes that have occurred. The expenditure for these new items should be imputed on the basis of information available from other sources (for example, import and retail statistics), taking into account the need to adjust for expenditures by enterprises and for business purposes. However, these adjustments will be less necessary if the weights are updated more frequently (for example, annually) *(cf. paragraph 18 of the draft resolution, Chapter 9).*

51. The current resolution on CPI requires that the weights be revised at least once every ten years, to guarantee the objectivity and reliability of the index. However, in most economies today, many new products are brought onto the market all the time, while others disappear. There are also major and frequent quality changes in existing products, and changes in the relative prices of goods and services in response to changes in consumer demand. That is why *paragraph 19 of the draft resolution (Chapter 9)* suggests that weights should be reviewed at least once every five years.

52. To have the best measure of the current rate of consumer inflation, it is necessary for weights to reflect as closely as possible the current pattern of consumer expenditures. This would require the expenditure weights to be updated more frequently (e.g. annually). The advantage of annual updating is that the differences between results obtained from the use of different formulae tend to be reduced *(cf. paragraph 19 of the draft resolution, Chapter 9).*

Sampling

53. A CPI is an estimate based on a sample of households to estimate weights, as well as price observations from a sample of zones within regions, a sample of outlets, a sample of items and a sample of price observations.

54. The selection of items for the observation of prices may be based (partly) on the results of the HES. The HES data reflect a much greater variety of goods and services than can possibly be observed when collecting the prices to be used in the calculations of the CPI. For this reason, each expenditure class has to be represented by selected goods and services that are considered either important or typical of their class. The price changes of these particular goods and services are

then monitored and their weighted average is subsequently used as a measure of price changes for that class.

55. Household income and expenditure surveys may in principle provide information on consumption expenditure broken down by regional location, types of outlets or other factors having a bearing on expenditure patterns, if they request that such information be recorded. Surveys of retail outlets or point-of-purchase surveys can also provide valuable information concerning the breakdown of consumption by outlet type and by region. In the absence of such information, personal knowledge of the markets and of their nature can be useful *(cf. paragraph 23 of the draft resolution, Chapter 9).*

56. The distribution of pricing in time (by quarter, month, day of the month, time of day) is an important factor to be taken into consideration for certain types of items.

57. The sample selection methods and sample sizes should be such as to ensure the accuracy required for the objectives of the index. Therefore, the samples of cities, urban areas or regions, dwelling units, sales outlets, and items and varieties priced, should be as representative as possible.

58. Statistical theory suggests that probability sampling is desirable as a means of avoiding bias. However, this is not easily achieved and most countries follow some form of purposive sampling, rather than probability sampling, and the size of the samples depends more on the costs involved and arbitrary historical decision processes than on the level of accuracy required. The decision as to which prices to collect will often have to be determined by the degree of cooperation of retailers and by other operational considerations *(cf. paragraphs 24 and 25 of the draft resolution, Chapter 9).*

59. The following three probability sampling designs are used extensively in survey practice: 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 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 sampled, while at the same time allowing a random element in the selection process.

60. Unequal probability designs can lead to substantial variance reduction by comparison with equal probability designs. In stratified sampling, the population is divided into non-overlapping subpopulations called strata. For instance, at the United Kingdom Office for National Statistics (ONS), 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 selected in each stratum. One of the reasons why stratified sampling is so popular is that most of the potential gain in precision of PPS sampling can be captured through stratified selection with simple random sampling within well-constructed strata.

61. When appropriate sampling frames are lacking, samples are chosen by non-probability methods. Judgemental (or expert choice) sampling is one form of non-random selection. In this case, an expert designates a list of products/outlets where data are to be collected with a view to formulating conclusions about the whole population. A more sophisticated non-probability method is quota sampling. In quota sampling the population is divided into certain strata. For each stratum, the number ("quota") of elements to be included in the sample is fixed. The interviewer in the field 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. The selected sample should have the same proportions of units as the universe with respect to a number of known characteristics, such as, product subgroup, type of outlet, location, and so on. Another non-probability method is cut-off sampling in which there is deliberate exclusion of part of the target population from sample selection. The word "cut-off" refers to the borderline value between the included and the excluded units.

62. The main problem with non-probability sampling is that there is no way of knowing whether the variance in the sample data accurately reflects the variance in the entire population. Probability sampling allows the estimation of sampling variance and hence optimization of sample sizes for localities, outlets, items and varieties. It is necessary to determine what combination of the number of elementary aggregates and the number of prices required within each elementary aggregate will produce a CPI of sufficient reliability.

63. Provided that the respective sampling designs for the HES and price collection survey are given, the sampling variance of an estimated (all-commodities) CPI can in general be lowered by: increasing the sample of households needed for estimating the expenditure shares; constructing homogeneous commodity groups having similar price changes, or enlarging the outlet sample per commodity; constructing commodity groups made up of commodities having similar price changes, or enlarging the commodity sample.

64. The sample of outlets and items should be reviewed periodically and updated where necessary in order to maintain its representativeness *(cf. paragraph 26 of the draft resolution, Chapter 9)*.

CPI calculation

65. The compilation of a CPI consists of collecting and processing price and expenditure data according to specified concepts, definitions, methods and practices. There may be no fixed set of procedures that can be applied automatically in all circumstances. The index number compilers have to make their choices depending on the circumstances and the purpose of the index. For an informed, rational choice to be made, it is necessary to have a clear perception of what the index is supposed to measure in principle. The calculation of a CPI cannot be reduced to the routine mechanical application of a standard set of rules or

procedures. The most appropriate and cost-effective procedures may depend on the exact definition of the index and its purpose, as well as the resources available.

Elementary aggregates

66. The calculation of the "all-items" index starts with the measurement of the price change for each elementary aggregate which is the smallest set of products for which a reliable expenditure weight can be estimated. These products are usually similar in their physical characteristics or functions and may be purchased in particular types of outlets, possibly located in particular areas. The elementary aggregate is the only aggregate for which an index number is constructed by aggregating price data only. It covers all prices collected for one item in one stratum. The stratification may be by region, shop type, both or neither. For some items, the elementary aggregate may cover all prices collected in the country *(cf. paragraph 22 of the draft resolution, Chapter 9)*.

67. Elementary aggregate indices are thus constructed at the lowest level of aggregation within the index number compilation system. 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. At this very low level of aggregation, there are no expenditure data that can be used to weight the price changes, so the index is computed as an unweighted average. *Paragraph 27 of the draft resolution (Chapter 9)* concerns the formula to be used for the calculation of elementary aggregate indices.

68. There are two types of averages currently used in the calculation of elementary aggregate indices: an arithmetic average and a geometric average. Both are used in two forms: as a ratio between the average price of the items in a particular stratum, or as an average of the price ratios of those items. If a geometric average is used, the ratio of the averages is identical to the average of the ratios. For the arithmetic average, the two are not the same.

69. The arithmetic average of the ratios formula, traditionally used by many compilers, does not behave well in a chained index when prices are volatile. The ratio of the arithmetic averages is also widely used but requires that the various items whose prices are being averaged be strictly homogeneous, which they rarely are in practice.

70. In general, the geometric average should normally be used where possible, especially where the elasticity of substitution is close to one. It might not be appropriate for all elementary aggregates, particularly where the price may be zero or where consumers have only limited ability to substitute among products and outlets. The geometric mean would not necessarily work well with larger product families (less homogeneous groups), for which the substitution elasticities 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

arithmetic mean price approach. The arithmetic mean of price ratios approach should be avoided if at all possible owing to its known upward bias, especially when prices are volatile.

71. It is possible to use different formulae for different elementary aggregates, depending on the homogeneity within the elementary aggregate, elasticity of demand, variation of prices, etc. It has been argued that for an index whose main purpose is to measure changes in the cost of living, the geometric mean should be used for elementary aggregates where the elasticity of substitution is close to one, and the ratio of arithmetic averages should be used for elementary aggregates where the elasticity of substitution is close to zero. For an index intended to measure the "pure" price change, there is an argument for using just the ratio of arithmetic averages.

72. Computerization of the retail trade and use of scanned data may make it possible to attach explicit weights at this level of detail in the foreseeable future.

Upper level indices

73. Once the price indices for the elementary aggregates are estimated, the class indices are obtained as weighted combinations of the indices for elementary aggregates. These indices are then combined following the hierarchy of the classification, with appropriate weights applied along the way. For instance, the price indices for butter in different regions are combined in the price index for butter using appropriate region 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.

74. As explained above, the CPI is an average of price changes weighted by values of quantities consumed. There are many types of formulae that might be used to aggregate the elementary indices and compute the average price change. From a theoretical point of view, a Fisher or other superlative index number formula (the Tornqvist index and the Walsh index) are regarded as the optimal index number formula for most purposes. Superlative formulae require both base-period weights and current period weights. A common feature of superlative indices is that they treat both the time periods being compared symmetrically. In contrast to Laspeyres and Paasche indices, which 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 geometric mean 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.

75. In practice, a Fisher or other superlative index is impossible to calculate within the short deadlines required for an index such as the CPI. The reason is that a Fisher index cannot be established without current-period weights which are available only many months after the end of the year, and for many purposes, it is important to have a more timely measure. That is why all countries calculate CPI as a Laspeyres index that uses weights based on some past period of time. The age of the base year used to estimate the weights varies from one country to another.

76. Although it is not possible to calculate a timely Fisher or other superlative index, it is desirable that such an index be calculated retrospectively once the weights for the current year become available. Comparing the difference between this index and the consumer price index as calculated 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 policy users. It should also help index compilers to identify the procedures that may be expected to produce results that approximate as closely as possible to the optimal *(cf. paragraph 30 of the draft resolution, Chapter 9)*.

77. Recent developments in index number theory permit the calculation of an index that approximates the superlative index, without information on current weights, by using an assumed elasticity of substitution between the commodities in the index – the "constant elasticity of substitution" (CES) approach. Such a method permits production of superlative indices without the necessity of using unavailable 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 *(cf. paragraph 29 of the draft resolution, Chapter 9)*.

$$L_{G_{t/0}} = \prod_{i=1}^{n} \left(\frac{p_t^i}{p_0^i} \right)^{w_0^i}$$

$$\text{where} \quad w_0^i = \frac{p_0^i * q_0^i}{\sum_{i=1}^{n} p_0^i * q_0^i}$$

78. Another option is the weighted geometric mean index defined as:

Wherein: p_0 is the price of an item in period 0; q_0 is the quantity consumed in period 0; and $w_0=p_0*q_0$ is the expenditure on an item in period 0.

This formula, assumes fixed expenditures, not fixed quantities. It is a special case of the CES formula, with the demand elasticity of substitution equal to 1. This formula is not widely used in practice.

6. Price collection and quality changes

79. The quality of the price data is the crucial determinant of the reliability of the index. The collection of the price data is a complex operation, much of it involving extensive field work by a large number of individual collectors. The whole process requires careful planning and management, to ensure that the data collected conform to the requirements laid down by the central office with overall responsibility for the CPI.

80. Price collectors should be well trained to ensure that they understand the importance of selecting the right items for pricing. Price collectors need to be provided with appropriate training and documentation on how to proceed. Clear instructions are also needed to ensure that price collectors collect the right actual prices at regular intervals. Special instructions should be provided about how to deal with sales, special offers or other exceptional circumstances *(cf. paragraphs 31-38 of the draft resolution, Chapter 9)*.

81. Consistent procedures should be established for dealing with missing price observations and replacement of priced items or outlets. The price data sent in by the price collectors should be reviewed and edited for comparability, replacements, unusual or merely 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. Care must be taken to examine unexplained price changes to determine whether they are genuine price changes or are erroneous or reflect changes in quality. Many checks can be carried out by computer using standard statistical control methods. It may also be useful to send out auditors occasionally to accompany price collectors and monitor their work. There should, in addition, be procedures, such as occasional re-pricing in the same outlets, for checking the reliability of the price data *(cf. paragraphs 39-43 of the draft resolution, Chapter 9)*.

82. Over the last few years, national statistical institutes 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 prices, without the necessity of sending price collectors into the field. "Electronic point of sale" data are normally data obtained directly from a retailer's electronic point of sale, whilst the term "scanner data" usually refers to a commercial database that collates individual EPOS data.

83. These methods are still at the experimental stage. Concerns have yet to be addressed about the completeness of their outlet and product coverage, and also whether the average prices given in scanner data accurately reflect actual transaction prices in outlets themselves. 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 an increasing share of transactions and thus of weights in consumer price indices.

84. In spite of these limitations, there are many potential advantages in using scanner and "electronic point of sale" data, and their availability should obviously be exploited to the fullest possible extent *(cf. paragraphs 44-45 of the draft resolution, Chapter 9)*.

Quality changes

85. The CPI is supposed to measure "pure price change" unaffected by changes in the quality of the goods and services which people buy. Prices therefore need to be adjusted for any changes in the quality of the goods and services to which they relate *(cf. paragraph 47 of the draft resolution, Chapter 9)*.

86. When a quality change is detected, a value must be placed on it, so that a true price movement can be estimated. This 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 validity of this process *(cf. paragraph 48 of the draft resolution, Chapter 9)*.

87. Quality adjustment is widely acknowledged among experts as being one of the most complex, if not the most complex, of all problems in CPI construction. Many different methods have been applied in the attempt to solve the problem of quality changes. One and the same change in the physical characteristics of an item is treated in quite different ways from one country to another. Depending on the method applied, the results may be significantly different.

88. All methods may be grouped in two main categories, depending on whether the price or quality component is estimated first: implicit and explicit quality adjustment methods. Explicit methods involve directly estimating the value of the quality change using information about product characteristics or cost. Indirect methods are generally considered to be less desirable than direct methods. On the other hand, direct methods are more complex, difficult and costly to apply. Their application should be directed to areas where the number of replacements, missing items and the weight of that product is relatively high. For product areas where the proportion of missing prices is low, indirect methods might be appropriate *(cf. paragraph 49 of the draft resolution, Chapter 9)*.

Implicit (indirect) quality adjustment methods

89. All implicit quality adjustment methods except overlap are commonly applied when an item priced in period t is unavailable in period t-1 and must be replaced by a new item, when the two items cannot be judged comparable in quality, and when no direct quality adjustment method can be applied.

Overall mean imputation or "link" method

90. This method first calculates the average price change for the elementary aggregate excluding the old and new items, and then uses that rate of price change to impute a price change for the missing item. It assumes that the price difference between the disappearing model and the replacement model is equal to the average price changes for continuing items.

Class mean imputation

91. The class mean imputation is a variant of the overall mean imputation method. It differs from the overall mean imputation method only in the source of the imputed rate of price change for the old item in period t+1. Rather than using the category "average index change", obtained using all the non-missing items in the category, the imputed rate of price change is estimated using only those price changes of the items that were judged comparable or were directly quality-adjusted.

Overlap method

92. In the overlap method, all price differences at a common point in time between the disappearing model and the replacement model are taken to be quality changes (the price difference between the two products in period t is exactly equal to the quality difference). It is assumed that any difference in price levels at a common point in time represents differences in qualities, and therefore no price change is reflected in the CPI. This method requires prices of the old and replacement varieties to be available in the same period. It is employed when samples are rotated. That is, the old sample of items is used to measure the price change between the previous and current month, and the new sample is used between the current and following month. The method cannot be widely used because a price collector in February is likely to be unaware that the priced variety is going to be unavailable in March, and therefore does not collect the price information in February for a new variety. However, it is possible to devise mechanisms to help in such circumstances. There may also be a problem with the assumption that underlies the method, namely, that the quality difference in any period equates to the price difference *at the time of the splice*. In this situation, if the price series for the old and new qualities are linked in a single period, the choice of period can have a substantial effect on the overall change in the linked series.

Link to show no change

93. With this method, when an item becomes unavailable, say in period t, the price change calculation uses the old t-1 price, which is simply carried forward as if there were no change. This method assumes that no price change has occurred, the whole of the observed difference between p_{t-1} and p_t being attributed to a difference in quality. This method should not be used. Where the prices are not observed they must be estimated by an appropriate procedure, not by automatically carrying forward the last observed prices.

Explicit (direct) quality adjustment methods

94. Explicit (direct) quality adjustment methods assume that the quality of a product changes in proportion to the size of some physical characteristic. An alternative procedure may be to try to measure the change in quality by the estimated change in the costs of producing the two qualities.

Essentially equivalent substitution

95. This is where the price collectors make a judgement that the replacement is of a similar quality to the old variety and any price changes are untainted by quality changes. The method relies on the efficiency of the price collectors and, in turn, on the guidelines given to them. National statistical offices are rightly wary of sample sizes being worn down by dropping varieties using imputation, and also wary of the resource-intensive direct estimates outlined below. Using comparable replacements has much to favour it. The selection of inappropriate "comparable" items must, however, be guarded against.

Subjective method

96. This method relies on the judgement of the commodity specialist. When a new product is more expensive than the item it replaces, a flexible adjustment factor can be employed, attributing none, some, or all of the price difference to improved quality. In particular, when no precise information is available on which to make a quality determination, it is permissible for an adjustment to be made of up to 50 per cent of the price difference. Problems can arise if an increase in quality is accompanied by a decrease in price (or vice versa). The use of experts' views may be appropriate for highly complex items for which alternative direct methods are not feasible.

Differences in production costs

97. Replacement varieties often have quite distinguishable additional features. A natural approach is to adjust the price of the old variety by an amount equal to the value of the additional features. One source of data is the manufacturers. They are asked to provide data on production costs, 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. (The adjustment is made to the period t-1 price to provide a one-off adjustment for subsequent periods.)

Quantity adjustment

98. This is one of the most straightforward adjustments to undertake and is applicable to items for which the replacement variety is of a different size to the available one. In some situations, there is a readily available quantity metric that can be used to compare the items. Examples might be the number of units in a package (e.g. paper plates or vitamin pills), or the size or weight of a container (e.g. litres of soda in a bottle or milligrams in a candy bar). Quality adjustment can be accomplished by scaling the price of the old or new item by the ratio of quantities. This method is not without problems. For example, consumers will spend money on a small pack, even if savings can be made with larger ones.

Option cost method

99. This method is similar to quantity adjustment, except that instead of size, any other individual feature of the replacement is adjusted. Situations other than quantity differences may arise in which the old and new items differ in respect of observable characteristics that can be valued in monetary terms by reference to market prices. An example of this is the addition of a feature to an automobile model. A problem with the option cost method is that it treats quality as a single dimension; the unavailable and replacement varieties differ by only one characteristic, and this may or may not actually be the case.

The hedonic approach

100. With this method, the market prices of a set of different qualities or models are regressed on what are considered to be the most important physical or economic characteristics of the different models. When the characteristics are attributes that cannot be quantified, they are represented by dummy variables. The hedonic approach is an extension of the two preceding approaches, in that first, the quality adjustment – the change in price arising from a unit change in quality – is now estimated from a data set comprising prices and characteristic values of a larger number of varieties. Second, the quality characteristic set is extended to cover, in principle, all major characteristics which might influence price. For each item, the

regression equation can be used to predict prices by inserting the characteristics of the items into the explanatory variables. The differences between the actual and predicted results are the residual errors. The main limitation of the hedonic method is that it requires access to detailed, reliable and timely information on product characteristics to support regression estimation.

101. ***The Meeting of Experts may wish to consider the usefulness of including in the draft resolution short descriptions of the specific methods that may be applied to estimate quality adjusted prices.***

7. Accuracy: Errors and bias

102. The CPI is not a perfect measure and is subject to potential error (sampling and non-sampling errors and bias). Sampling errors are due to the fact that an estimated CPI is based on samples, rather than on a complete enumeration of populations. Non-sampling errors may occur even if the whole population is investigated. They may occur during the process of collecting, coding and processing the data.

103. Bias is a systematic error in the index which can occur as a result of the failure to deal adequately with consumer substitution, product quality improvements, and the introduction of new items and services. The most important categories of bias identified in the literature are: upper level substitution bias, elementary aggregate bias, quality change bias, new goods bias, and new outlet bias. These categories can also be broken down into two subgroups according to whether they refer to errors in individual price measurements or errors in computing index series. It should be noted that upper level substitution bias and lower level substitution bias are only an issue if the CPI takes the cost-of-living index as its measurement objective *(cf. paragraphs 50 and 51 of the draft resolution, Chapter 9)*.

Quality change bias

104. Quality change bias is the bias which can occur as a result of the index's failure to make proper allowance for changes in the quality of goods and services. Discussion of potential CPI biases arising from inadequate quality adjustment has a long history. Unlike substitution bias, which can be estimated by comparison of alternative formulae, quality change bias must be analysed on a product-by-product basis. Products and their associated index components will experience widely varying rates of quality change over time. Moreover, the methods used for quality adjustment will also vary.

New products bias

105. New product bias can be divided conceptually into two components. The first concerns the failure to bring new products into the CPI sample with sufficient speed. The second component is, given a cost-of-living objective, the welfare gain that consumers experience when a new product appears. Waiting for a new product to be "established" or waiting for the rebasing of an index before incorporating new products may lead to errors in the measurement of price changes if unusual price movements at critical stages in product life cycles are ignored.

106. In recent decades, we have witnessed the emergence of many new products and services (personal computers, video games, cellular phones). For most of these products, the price level at the time of their introduction on the market was relatively high. Standardization and optimization of the production process subsequently brought production costs, and therefore prices, down; this in turn led to increased sales and accelerated the rate of price decline.

107. If these products are introduced into the CPI with delays and sometimes not until their prices stop falling, a bias may be introduced into the calculation of the CPI. However, since the share of these products in the basket of goods and services purchased by consumers is usually initially very small, the impact of late introduction on the total CPI is probably also small.

108. CPIs are frequently criticized for failing to include new products such as mobile phones and personal computers. The requirement in the proposed draft resolution is that, in order to maintain the relevance of the CPI, new products be included when they become a significant part of consumption. In general, new products should be included in the CPI as soon as they achieve or are expected to achieve a sales volume of over 1 part per thousand of total consumers' expenditure.

New outlet bias

109. Conceptually, new outlet bias is identical to new product bias. 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 bias

110. Upper level or commodity substitution bias is perhaps the best-known source of CPI bias and the kind with which economists are most familiar from textbook expositions of price index theory and practice. It arises when CPIs employ the Laspeyres formula, which is well known to provide an upper limit on a cost-of-living index subject to certain assumptions about consumer behaviour. It may be estimated with some precision by comparing Laspeyres price indices to Fisher's Ideal, Tornqvist or other superlative indices, assuming relative price changes to have been the only cause of changed expenditure patterns.

111. The differences between Laspeyres and superlative indices derive from all shifts in quantities consumed, including substitutions toward those product categories that have fallen in relative price.

112. The level of this bias depends on the elasticity of substitution between the product categories, the price variation and the degree of commodity disaggregation. Substitution effects are more likely to be important within lower level aggregates than between their aggregates, for example, within the food lower level aggregate "meat" than between "meat" and other food lower level aggregates. Substitution between higher level aggregates, for example "food" and "clothing", are even less likely. With lower level aggregates the substitution effect is, in general, much more important.

113. The size of the bias of the Laspeyres index depends on the frequency and speed of introduction of revised weights in the basket. Any bias associated with substitution between products in different weighting groups will be greatly reduced if expenditure weights are updated frequently. However, frequent updating of expenditure weights will not affect any substitution bias between products within the same weighting group.

114. Correcting for commodity substitution would require a continuous change of the basket of goods and weights reflecting the representative consumer's basket. Current practice in most countries is to update the basket every five or ten years.

Elementary aggregate bias

115. This bias depends both on the choice of formula used to average the raw price data and on consumer reaction to price change (in particular the elasticity of demand for different items within a group). Various formulae can be used to combine individual price quotations within the elementary aggregate.

116. The use of a geometric mean is regarded by some as a way to compensate for substitution bias due to shifts in buying patterns between different varieties of the same commodity. If one price rises faster than the others, consumers tend to switch away from the brand, variety or outlet represented by that price, which should be "down-weighted" to avoid upward bias. The use of a geometric mean is equivalent to assuming that expenditure shares remain constant, so that if one price doubles while the others stay the same, the quantities purchased of the brand, variety or outlet will halve. In reality, the sensitivity of consumers to price change will vary from item to item. Thus for each elementary aggregate, one would ideally estimate how much variety and outlet substitution is likely to occur and, in the light of this, decide which formula would be most appropriate.

117. The ratios of arithmetic mean prices may overemphasize the influence of more expensive items. While geometric mean takes into consideration substitution between products, arithmetic mean assumes fixed quantities. The geometric mean gives less importance to high-priced items than the arithmetic mean.

118. The arithmetic ratio-of-averages and geometric mean formulae eliminate formula bias. The geometric mean formula is exact for a cost-of-living index if elasticity of substitution is close to 1, whereas the arithmetic ratio-of-averages formula corresponds to zero-substitution behaviour. Thus, if the goal is to approximate a cost-of-living index, the geometric mean formula is likely to be preferred.

119. The importance of elementary aggregate bias will vary by country and by product group, depending on the particular index formulaes used, the degree of heterogeneity within index strata, the possibility of substitution and the sampling methods employed. Also, as with upper level substitution bias, elementary aggregate bias will vary with the overall level of inflation in the economy if absolute and relative price changes are correlated.

120. Only upper level and elementary aggregate formula bias may be estimated; the biases resulting from the improper or late treatment of the appearance of new goods, the inadequate treatment of quality changes in observed products and the improper or late treatment of the appearance of new outlets, although important, cannot be estimated without a degree of subjectivity and controversy.

121. In general, an index which regularly updates weights and baskets, employs unbiased elementary aggregate formulae, considers quality change issues, allows adequately and correctly for new products, and takes proper account of substitution issues, will be more relevant and have a reduced potential for bias than an index where the procedures used fail to implement the procedures needed to deal with such problems *(cf. paragraph 52 of the draft resolution, Chapter 9)*.

8. Dissemination

122. Users of the index attach great importance to having the index published as soon as possible after the end of each month or quarter, and preferably within two or three weeks. The consumer price index (CPI) is an extremely important statistic whose movements can influence a central bank's monetary policy, affect stock markets, influence wage rates and social security payments, and so on *(cf. paragraph 53 of the draft resolution, Chapter 9)*.

123. The results should be made available to all users in both the public and the private sectors at the same time and according to a publication schedule announced in advance. There should be no discrimination among users in the timing of the release of the results. The results must also not be subject to governmental scrutiny as a condition for their release, and the results must be seen to be free from political or other pressures.

124. Decisions about the degree of detail in the published data and alternative ways in which the results may be presented will have to be taken.

125. The proposal in *paragraph 54 of the draft resolution (Chapter 9)* is that the index should be produced at least once every three months. ***The Meeting of Experts may wish to consider this point and recommend a monthly periodicity of the index***. Of 186 countries and territories that communicated official CPI series to the ILO for the preparation of the 2000 edition of the ILO *Yearbook of Labour Statistics*, only 22 publish a CPI on a quarterly basis and two with semi-annual periodicity. This suggests that the CPI should be compiled monthly. However, if this is recommended, the resolution should not rule out the possibility of exceptional situations where a national statistical office may justify the compilation of a quarterly or less than quarterly CPI.

126. A consumer price index should be computed and publicly released as quickly as possible after the period to which it refers. On the other hand, most users do not wish the index to be revised once it has been published, and there can be some trade off between timeliness and quality. Retrospective corrections of publicly released data should be done only when absolutely necessary because of the difficulties such corrections can cause for indexed contracts or payments. Instead, necessary corrections might be made to the index for the subsequent period, with any necessary explanations *(cf. paragraph 57 of the draft resolution, Chapter 9)*.

127. To ensure public confidence in the reliability of the index and the competence and integrity of those responsible for its compilation, a full 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. However, the precise identities of the 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. The users should also be informed of the limitations of the index *(cf. paragraph 58 of the draft resolution, Chapter 9)*.

Other matters

128. *Paragraph 59 of the draft resolution (Chapter 9)* 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 committees 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.

129. Many countries wish to compare their CPI with those of others. The exclusion of shelter 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 of an index that excludes shelter and financial services, in addition to the all-items index *(cf. paragraphs 60 and 61 of the draft resolution, Chapter 9)*.

9. 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 designated primarily to measure the changes over time in the general level of prices of goods and services that a reference population acquire, use or pay for consumption,

Acknowledging that the consumer price index is used for a wide variety of purposes, that the objectives and uses differ among countries and that therefore, a single standard could not be applied universally,

Recognizing the need to modify and broaden the existing standards in the light of recent methodological and computational developments, in particular, problems involved in the methodology for computation of consumer price indices,

Recognizing the need to enhance the usefulness of the international standards in the provision of technical guidelines to all countries and particularly those with less advanced statistical organizations, and recognizing the usefulness of such standards in enhancing the international comparability of the statistics;

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

Terminology and definitions

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" is defined as all goods and services that are acquired, used or paid for by households, but not for business purposes and not for the acquisition of wealth.

(c) "Scope of the index" indicates the population groups, geographic areas, items and outlets for which the index is established.

(d) "Reference population" indicates the population that falls within the scope of the index.

(e) Consumption expenditure can be measured in terms of "acquisition", "use", or "payment":

- "acquisition" indicates that the total value of all goods and services delivered during a given period should be taken into account, irrespective of whether they were wholly paid for/used or not during the period;

- "use" indicates that the total value of all goods and services actually consumed during a given period should be taken into account;

- "payment" indicates that the total payment made for goods and services during a given period should be taken into account, without regard to whether they were delivered/used or not during the period.

(f) "Quality adjustment" refers to the process of adjusting observed prices in some way to remove that proportion of the price change resulting from changes in the characteristics of items over time.

(g) "Bias" occurs when the consumer price index produces results which are systematically higher or lower than the true price changes; this may happen at the overall or at detailed levels.

The nature of a consumer price index (CPI)

2. The CPI is a current economic indicator that is constructed to measure changes over time in the general level of prices of consumption goods and services that a reference population pay for, acquire or use.

3. A CPI may be defined as a measure of the price change of a fixed set of consumption goods and services of constant quality and characteristics, according

to their relative importance in households' expenditure for a year or other period in the past. This is the approach commonly used by national statistical agencies.

4. Alternatively, the index may be defined to estimate the effects of price changes on the cost of achieving a standard of living corresponding to that achieved during a year or other period in the past. Such an index is called a cost-of-living index (COLI). A COLI is designed to measure the change in the cost of maintaining a given standard of living (or utility or welfare), as distinct from measuring the change in the cost of purchasing a fixed set of goods and services.

The uses of a consumer price index

5. The consumer price index is used for a wide variety of purposes, the main ones being to adjust wages and government and social security benefits to compensate for changes in the cost of living, and to measure the inflation experienced by households. Another use is to deflate components of total household consumption expenditures in national accounts. CPIs are also used for many purposes for which the relationship to the price experiences of households is less clear. These include measuring the overall rate of price inflation for the whole economy, the adjustment of government fees and charges, and the adjustment of payments in commercial contracts. In most of these cases, the CPI is used because technically more appropriate measures simply do not exist, or because other characteristics of the CPI are seen to outweigh any technical deficiencies (e.g. high profile, wide acceptance, predictable publication schedule, etc.).

6. In practice, it is the main use, or uses, which determine what type of index is produced in terms of the range of goods and services covered, the geographic coverage, the consumers it relates to, how the item domain is defined, the concept of price followed, and the formula used. If there are several major uses, it is likely that compromises may have to be made with regard to how the CPI is designed.

7. Given that the CPI is used for many purposes, it is unlikely to perform satisfactorily for all of its many uses. It may therefore be appropriate to construct a number of alternative price indices for specific purposes (although only one should be referred to as the CPI), if the requirements of the users justify the extra expense.

Scope of the index

8. The scope of the index depends on the specific purpose for which it is intended.

9. In general, a national index should be defined to cover all resident households in the country. If any households, groups of people or geographic areas are excluded,

for example, for reasons of practicality or costs, then this should be explicitly stated.

10. In some cases the general rule stated in the previous paragraph may not be followed. In the case of an income compensation index, a particular group of households, such as wage and salary earners, may be targeted. In the case of a domestic inflation index, it may be appropriate to target sales within a region, rather than the experiences of households resident within a region. If the primary use of the CPI is for deflation of total household consumption expenditures in the national accounts, its population coverage should be specified in a corresponding manner, or any difference precisely identified.

11. The CPI should relate to all types of consumer goods and services of relevance to the reference households, without any omission of things that may be regarded as non-essential or undesirable, e.g. tobacco. To assist those users who may wish to exclude particular categories of goods and services for particular applications, special series may be constructed.

12. In some cases, such as insurance, subsidized medical care and education, and second-hand goods, it may not be possible to use the same methodology as employed elsewhere in the CPI. In those cases, a special approach may be needed, which will differ by country depending on the institutional arrangements and the purpose of the index, or the category may simply be excluded from the index. Users should be informed of the items involved and methods followed.

Acquisition, use or payment

13. Once the reference population has been defined, consideration must be given to whether the objectives of the index are best satisfied by defining consumption in terms of acquisition, use, or payment, taking into account the theoretical index concept (that is, whether the index is to be an inflation or a compensation measure, and whether or not a COLI approach is to be followed), acceptability to users, the availability of data, and resource requirements. These issues arise particularly in dealing with own-account consumption, owner-occupied housing, consumer credit, durable goods bought on credit, and goods and services provided without charge or subsidized by government.

14. The most controversial and important of these issues is the treatment of owner-occupied housing since, in most countries, a significant proportion of households are owner-occupied. Two approaches predominate: one is aimed at measuring the prices actually paid for housing, with many possibilities for what is priced, while the other is aimed at measuring the flow of housing services consumed. The decision regarding the approach to follow should be based on the purpose of the index, its costs and the acceptability of the decision to the users.

The compilation of a CPI

15. A long-term CPI series is normally made up of a number of short-term indices that are chain-linked together. These short-term indices usually cover the period from one re-weighting to the next. This approach allows for changes in the expenditure patterns of households to be incorporated in the CPI.

Basket

16. For practical reasons, each short-term index is normally a measure in the change over time in the price of a fixed basket of goods and services. The items selected for the basket should adequately represent all consumer goods and services, while taking into account the feasibility and costs of collecting the required price information. Decisions on the composition of the basket flow directly from the choice between acquisition, use or payment, and should, if possible, be based on the results of a household expenditure survey and/or using all other available information on expenditure patterns.

17. The items selected for the basket should be grouped into similar categories in a hierarchical classification system (e.g. divisions/groups/classes) to make the index useful for analytical purposes. The classification used should be consistent with that used for household expenditure surveys and should meet the needs of users. For the purposes of international comparison, the classification should also be consistent with the standard international *Classification of Individual Consumption according to Purpose* (COICOP), at least at its division level.

18. The proportion of the expenditure relating to the items at the lowest level of the classification system defines the weights to be used at this level. Care needs to be taken to ensure that the weighting is derived from a reliable source, such as a household expenditure survey or the final household consumption expenditure estimates of the national accounts. These data may be supplemented with data from various surveys, such as surveys of sales in retail outlets and household surveys on point-of-purchase, as well as other statistics on production, exports/imports and the retail trade. When the weights are to remain fixed for some time (e.g. several years), the objective should be to adopt weights that are most likely to be representative of the behaviour of household consumers over a longer period of time, rather than precisely reflect the activity of a particular period that may have been abnormal in some way. However, this will not be necessary if the weights are updated frequently (e.g. annually).

19. The weights should be reviewed as often as accurate and reliable data are available for this to be done, but at least once every five years. In times of significant economic change, it might be necessary to review the weights more frequently. This approach is important, as it minimizes the potential adverse impact of changes in consumer preferences and item substitutions on the index. Reduction of the re-

weighting interval may also reduce the upper level substitution bias in the Laspeyres CPI.

20. Descriptions of the items selected for the basket are normally too broad to be of direct use in selecting price samples. These items need to be subdivided into a finer level of commodity detail, for example, from bread to types of bread, and decisions need to be taken on which commodity price samples should be constructed, such as wholemeal bread. The factors that need to be taken into account include the relative significance of each commodity, its likely price behaviour and the practicality of measuring prices to constant quality. During the life of each short-term index, the commodities finally selected may change and the weights used below the class level may change as well. These aspects need to be under continual review.

21. The sample of goods and services in the basket should also be reviewed regularly because new products and services come onto the market and begin to account for significant household expenditure. Completely new goods and services (i.e. goods and services that cannot be classified anywhere in the existing CPI classification) can normally only be considered for inclusion during one of the periodic review and re-weighting exercises, as their inclusion will require modification of the classification. However, a new product that can be fitted within an existing expenditure classification may be included at any time, provided that it is assessed as having a significant and sustainable market share, and that the price structure for the item is not unduly influenced by factors such as prestige, novelty value or relative scarcity of the product.

Elementary aggregates and sampling

22. An “elementary aggregate” is the smallest set of products for which a reliable expenditure weight can be estimated. These products are usually similar in their physical characteristics or their functions, purchased possibly in particular types of outlets located possibly in particular areas. The elementary aggregate is the only aggregate for which an index number is constructed by direct reference to a sample of prices. An elementary aggregate index is thus 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.

23. The selection of the specific observations (items and outlets from which to price) to be included in each elementary aggregate has a significant bearing on the overall quality of the CPI. For this purpose, 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 region. In the absence of such information, statisticians should rely on their judgement to determine how the sample of prices is distributed across outlets.

24. An appropriate sampling approach needs to be followed to select both the outlets and the items so as to ensure that the prices collected are representative and sufficient to meet the requirements of the index, but also that the collection process is cost-effective. Probability sampling is the preferred method, as it permits estimation of sampling errors.

25. In cases where appropriate sampling frames are lacking and it is too costly to obtain them, samples might be obtained by non-probability methods such as judgmental sampling, quota sampling or cut-off sampling. In such cases, statisticians should apply the best judgement and available information to ensure that a representative sample is selected. Notwithstanding the selection process, the sample which is selected should reflect the importance of the items in the basket, the number and types of outlets for the items, including the existence of chains of retailers, the dispersion of prices across outlets, and the geographic spread of the outlets.

26. The sample of outlets and items should be reviewed periodically, and should be updated if necessary to maintain its representativeness.

27. In calculating price indices for elementary aggregates, it is possible to use different formulae for different elementary aggregates, depending on the homogeneity within the elementary aggregate, elasticity of demand, variation of prices, etc. The geometric average should normally be used where the elasticity of substitution is close to one. In cases where consumers have only a limited ability to substitute among products and outlets or where one of the prices may be zero, it is recommended that the elementary aggregate index be constructed using the ratio of arithmetic mean price approach. The arithmetic mean of price relatives approach is to be avoided as far as possible, at least in chain indices, owing to its known upward bias.

Index calculation

28. A CPI is constructed as a weighted average of elementary aggregate indices. Once estimated, the elementary aggregate indices are averaged using their assigned weights to obtain price indices at the class/group/division/national levels. There are many types of formulae that might be used to average the elementary aggregate indices. In order to produce a timely product, the only practical option is to use a formula that does not rely on the weights for the current period. One such formula is the Laspeyres index, the formula mostly used by national statistical agencies.

29. Other less common alternatives are the geometric mean 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 geometric mean indices are special cases of the CES formula, with zero and unitary substitution elasticities, respectively.

30. From a theoretical point of view, a superlative index number formula, which employs both base-period weights and current period weights, is preferred. Since in practice a superlative index is impossible to calculate, at least during the year and within the short deadlines required for an index such as the CPI, it is advisable to calculate the index retrospectively once the weights for the current period become available, using, for example, the Fisher approach. Comparing the difference between this index and the consumer price index as calculated 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 policy users. If the weights of the CPI are updated at short intervals, it is expected that this difference could be of less significance.

Price collection

31. The quality of the price data is the crucial determinant of the reliability of the index. Hence, standard methods for collecting and processing price data 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 good manual explaining all the procedures they have to follow.

32. The specifications used for pricing, including the procedures for the final selection of the particular variety and size by the price collector (where relevant), serve the purpose of securing comparability between the successive periods and assisting selection and evaluation of replacements. The specifications 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. It should be noted that the relevant characteristics of the goods or services should include, for example, terms of payment, conditions of delivery, guarantees and type of outlet.

33. The prices to be collected are the regular actual transaction prices, including indirect taxes, paid by the reference population. 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. When this is not possible, consideration should be given to interviewing customers about the prices actually paid. 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.

34. 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.

35. Particular attention should be paid to the way in which pricing is distributed in time. In the case of perishable goods, attention should also be paid to the time of day that is selected for price collection.

36. Prices should be collected in all types of markets that 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 for a particular type of item, an appropriately weighted average should be used in the calculation of the index.

37. Where centrally regulated or centrally fixed prices are collected, checks should be made to ascertain whether the goods and services in question are indeed sold and whether these prices are in fact observed.

38. 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 that uses the best information available with respect to the actual prices paid and the relative importance of the different types of sales.

39. Consistent procedures should be established for dealing with missing price observations whatever the cause, including seasonal unavailability, inability to contact, non-response, rejected observation, or goods temporarily out of stock. Seasonal goods are a particular problem which can be handled in many different ways, including seasonally adjusting the prices, using very complex systems of changing weights, and even excluding such items from the basket, although this latter option is not encouraged.

40. Replacement of a priced item will be necessary when it disappears permanently from the outlet(s) in which it is priced, and may be necessary when it is no longer available in sufficient quantities or under normal sale conditions. Clear and precise rules should be developed for identifying the replacement item. Precise procedures should be laid down for price adjustment with respect to the difference in characteristics when replacements are necessary. Responsibility for such evaluation should be clearly established.

41. Replacement of an elementary aggregate will be necessary if all items in an elementary aggregate disappear from most or all outlets. In such cases, if a replacement item representing the elementary aggregate cannot be found and appropriate adjustments for the difference in characteristics cannot be 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.

42. Replacement of an outlet may be necessary if an outlet permanently or temporarily closes, or because of a decline in representativeness or the disappearance of an item

from an outlet, or because the price could not be obtained. Rules should be established to ensure that a correct choice with respect to a new outlet is made, and that 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.

43. The price data sent in by the price collectors should be reviewed and edited for comparability, replacements, unusual or merely 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. Care must be taken to examine unexplained price changes to determine whether they are genuine price changes or changes in quality. Also, there should be procedures, such as re-pricing in the same outlets, for checking the reliability of the price data.

44. The feasibility of using scanner data to collect prices for some items in the basket should be investigated carefully. If this can be done in a timely and cost-effective manner, large data sets may be available. Even if it is impractical to use scanner data for the direct construction of price indices, the information gained from analysing such data should provide valuable insights into changing consumer behaviour, as well as information relevant for sample selection purposes, hedonic quality adjustments and evaluation of sampling methods.

45. The possibility of using data from "electronic point of sale" (Internet) sources should not be overlooked. Like the use of scanner data, it is a convenient method of obtaining up-to-date and accurate information on goods sold and prices without the necessity of sending price collectors into the field.

Quality changes

46. Pricing to constant quality means taking account of changes in the quantity, quality and the terms of sale of the goods and services in the basket, and it is vitally important that this be done well so that pure price changes can be measured.

47. For basic consumer goods, the application of this principle is relatively straightforward; for more complex durable goods the concept becomes more difficult to apply, and for service items it is generally even more difficult to do so. It is necessary, therefore, to collect a considerable amount of information on the characteristics of the items for which prices are collected in order to identify possible changes in the quality of the goods and services in the basket. Some of this information is obtained in the course of collecting prices, but often the most important source of information on quality change is interviews with manufacturers, importers or wholesalers of goods included in the CPI and the study of articles and advertisements in trade publications, etc. Changes in quality may also be detected in the course of checking the prices data.

48. When a quality change is detected, a value must be placed on that change, so that a "true" price movement may be estimated. This 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 resulting index depends on the validity of this process.

49. The methods for estimating quality-adjusted price may be either direct or indirect:

(a) *Implicit (or indirect) quality adjustment methods* first estimate the pure price change component of the price difference between the old and new items. The quality difference is then indirectly defined by the residual price difference.

(b) *Direct (or explicit) quality adjustment methods* directly estimate the quality difference between the item priced in periods t and t-1. Pure price change is then implicitly estimated as the remaining difference in price.

Indirect methods are generally considered to be less desirable than the direct methods. On the other hand, direct methods are more complex, difficult and costly to apply. Their application should be directed to areas where their coverage in terms of the number of missing items and the weight of that product is relatively high. For product areas where the proportion of missing prices is low, indirect methods might be appropriate.

Accuracy

50. The CPI is not a perfect measure and is subject to variance (errors from sampling), as well as potential bias (errors from inadequate treatment of quality changes, substitution and new goods and services). Compilers of CPIs need to be aware of the possible sources of bias, and to take steps in the practical choices made during the index construction and compilation processes to minimize them. As far as possible, estimates of sampling errors should be produced from time to time.

51. The following are some well-known categories of bias, either in pricing or in index construction, that can lead to error in the overall CPI:

– "Quality change bias" is the bias which can occur as a result of the index's failure to make proper allowance for changes in the quality of goods and services.

– "New good bias" is the failure to reflect either price changes in new products not yet sampled, or (given a cost-of-living index objective) the welfare gain to consumers when those products appear.

– "Outlet substitution bias" can occur when consumers shift their purchases among outlets for the same commodity without proper reflection of this shift in the index.

– "New outlet bias" is conceptually identical to new product bias. 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 bias" 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. This bias arises only when the CPI takes the cost-of-living approach as its measurement objective.

– "Elementary index bias" arises from the use of an inappropriate method for aggregating price quotations at the very lowest level of aggregation. Depending on the measurement objective, the elementary index bias can take two forms: formula bias and lower level substitution bias. The index suffers from formula bias if, as a result of the properties of the formula, the result produced is biased relative to pure price change. The index suffers from lower level substitution bias if it does not reflect consumer substitution among the items contained in the elementary aggregate. Lower level substitution bias is an issue only if the CPI takes the cost-of-living index as its measurement objective.

52. In general, an index which regularly updates weights and baskets, employs unbiased elementary aggregate formulae, considers quality change issues well, allows adequately and correctly for new products, and takes proper account of substitution issues will be more relevant and have a reduced potential for bias than others that do not.

Dissemination

53. A consumer price index should be computed and publicly released as quickly as possible after the period to which it refers. Rules relating to its release should be established, made publicly known and strictly observed.

54. The index should be produced and released at least once every three months, on a timely basis. Where useful, the CPI should be released monthly.

55. Sub-indices should also be produced, and consideration should be given to releasing them in accordance with the COICOP *(Classification of Individual Consumption according to Purpose)* division/group classification or other similar groupings. Sub-indices for different regions or socio-economic groups, or for

special analytical purposes (e.g. travellers' expenses, imported items), may be produced and publicly released if they are judged to be useful and reliable and if this is warranted by the cost of doing so.

56. Average prices or price ranges for important and reasonably homogeneous items should be estimated and published in order to support the research and analytical needs of CPI data users.

57. In general, retrospective corrections (for example, as a result of an error in the data or in calculation) of the publicly released indices should be made only when judged absolutely necessary, because of the difficulties such corrections cause for indexed contracts or payments. As an alternative, necessary adjustments might be made to the index in the current period, in which case a full explanation should be provided in order to avoid misinterpretation of the resulting short-term price movement.

58. In order to ensure public confidence in the index, a full description of the methodology and data sources should be published and made widely available to data users. 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 used for price collection and any other details, which if disclosed would adversely affect the representativeness or confidentiality of the index, should not be revealed.

Other matters

59. The agency responsible for the index should consult representatives of users on major issues. One way of organizing such consultations is through the establishment of advisory committee(s) on which users and outside experts might be represented.

60. The exclusion of shelter 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 making such comparisons. The countries should, therefore, provide for dissemination at the international level of an index that excludes shelter and financial services, in addition to the all-items index.

61. The 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 practicably possible after the national release of corresponding results.

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 Committee 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.

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. 1999. *Compendium of HICP reference documents*, Commission of the European Communities, Brussels, 1999.

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.

ILO. 2001. *Bulletin of Labour Statistics* (Geneva, 2001).

–. 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 *Year Book* 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. *Draft Classifications of Expenditure according to Purpose*, Statistical Papers, Series M, No. 84 (New York, 2000).

Appendix I

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.

Appendix II

Classification of Individual Consumption according to Purpose (COICOP) – Major divisions

01-12 – *Individual consumption expenditure of households*

01 – Food and non-alcoholic beverages

02 – Alcoholic beverages, tobacco and narcotics

03 – Clothing and footwear

04 – Housing, water, electricity, gas and other fuels

05 – Furnishings, household equipment and routine household maintenance

06 – Health

07 – Transport

08 – Communication

09 – Recreation and culture

10 – Education

11 – Restaurants and hotels

12 – Miscellaneous goods and services

13 – *Individual consumption expenditure of non-profit institutions serving households*

14 – *Individual consumption expenditure of general government*