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QUALITY ASSURANCE IN A CONSUMER PRICE INDEX: A CONCEPTUAL FRAMEWORK

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Summary

The consumer price index (CPI) is an important indicator of inflation in a market economy. It is necessary to regularly monitor and improve the quality of the CPI. Before one can develop a quality assurance system, one has to formulate a conceptual framework for evaluating the quality of consumer price statistics. In this paper various quality aspects of the CPI are presented. These aspects are further illustrated with help of experiences from Statistics Netherlands.

Keywords: quality control; consumer price index

I. Introduction

1. Accurately measuring price inflation is very important in a market economy. In many countries the consumer price index (CPI) is used as an indicator of inflation. The CPI has also other applications. For instance, it is used for indexation of wages, revision of the income tax brackets, and

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adjustment of social security benefits. Measurement errors in the CPI can have enormous implications for the whole population. It is useful to develop a quality assurance system for the monthly calculation of the CPI. Then, one is capable to continuously measure, monitor, evaluate with respect to customer needs, and improve the quality of the CPI. The improvement process should encompass not only the ultimate quality of the CPI as a product but also the underlying production process. Before one can develop a quality assurance system, one has to define the quality concept for official statistics. In this paper I want to pay in particular attention to specific methodological aspects of CPI construction. With the help of such a conceptual framework one can evaluate the quality of consumer price statistics.

2. Following the literature on quality management, the quality of a product is defined as all aspects of a product that bear on its ability to satisfy users' needs. To measure the quality of statistical products several aspects can be distinguished (see for instance Elvers and Rosén, 1997). Here, the following quality aspects of consumer price statistics are considered: relevance, accuracy, comparability and coherence, accessibility and clarity, timeliness and punctuality. Cost is a measure of performance reflecting the efficiency of the process. Following Eurostat (1998), I see cost not as a quality aspect, but as an additional factor that is associated with quality. There is an obvious trade-off between cost and quality: CPIs cost money and their quality can be improved if more resources are devoted to them. Thus, quality and cost together determine the total performance of a statistical product. In section 2 I discuss the above-mentioned five quality components and the costs of the CPI. These quality aspects are further clarified with help of experiences from the Dutch CPI as calculated by Statistics Netherlands. Section 3 contains a description of the consecutive steps that have to be taken to bring a quality assurance system for the CPI into operation.

II. Quality components

Relevance

3. Relevance is the extent to which survey results correspond to the needs of the users. To be relevant, statistical information must describe matters that are of interest for the users in terms that are recognisable and interpretable. Relevance depends strongly on a careful transformation of users' needs in product specifications. The larger the discrepancy between realised output and users' needs, the less relevant a statistical product will be.

4. Before setting the objectives of a survey, one has to identify all user categories that are or might be interested in the CPI. In general the following user groups can be distinguished:

- media: bringing the CPI to the attention of the general public;
- employers associations and trade unions: wage negotiations;
- research institutions: economic analysis;
- government: indexation of social security benefits and taxes, and economic and monetary policy;
- Statistical Office of the European Communities (Eurostat): combining the national (harmonised) CPIs within the European Union;
- National Accounts, retail sales statistics, purchasing-power statistics and household expenditure statistics: deflation of economic variables to obtain constant-price estimates;
- general public: indexation of sums of money, such as rents, in contract clauses.

5. There are various choices to be made in calculating a CPI. These choices depend upon the purposes to be served by the index. First, one has to decide which target index is used as our object of estimation. Second, the population group of households to which the index relates has to be defined. Third, one has to specify the basket of goods and services upon which indices are calculated. Fourth, a classification has to be chosen according to which the goods and services will be subdivided.

Target index

6. Following Dalén (1992) I distinguish several steps in defining the final intended product of consumer price statistics. In the first step, the ideal goal of the users, which reflects a general economic concept, has to be formulated. In the Netherlands most users, in a certain sense represented by the Advisory Committee for Price Statistics, are of the opinion that a CPI ought to tell us something about the development of the purchasing power of the household income or the cost-of-living. So, a cost-of-living index can be chosen as the conceptual basis of the CPI. This concept, also called a constant utility price index, measures for a representative consumer the change in the minimum expenditure necessary to retain a certain standard of living or utility level. There are three types of reference periods used in the construction of constant utility price indices: the period from which the utility is derived (utility reference period); the period the base prices refer to (price reference period); and the period for which the index base is set to 100 (index reference period). One can distinguish two strategies for dealing with consecutive time periods in CPI calculation. The first strategy is to choose a certain period as the base period and compute fixed-base price indices for later periods by comparing these later periods to the base

period. With the march of time it becomes less sensible to compare the prices of the current period with those of the base period. For this reason most statistical offices change the base period at regular time intervals. The second strategy is to update the base period every month or year and to multiply the resulting price indices, which now compare adjacent periods. The final indices are called chained indices. At present for the Dutch CPI, all the above-mentioned reference periods are the same, namely 1995, i.e. fixed-base indices are calculated. Up till now the reference period is revised every five year. Statistics Netherlands has the intention to change over to a yearly revision of the reference period.

7. However, the cost-of-living index is a theoretical concept based on unobservable variables such as utility. It is not a single or straightforward index formula readily amenable to practical use. So, in the second step the ideal goal is translated into a measurable definition. This definition should be an index formula based on prices and quantities of all transactions taking place in the market. There exist index formulas, known as 'superlative' indices, which provide reasonably close approximations to a cost-of-living index. The major superlative indices are the Fisher and the Törnqvist formulas. The Fisher index is the geometric mean of the Laspeyres and the Paasche indices, that is the square root of their product. The Törnqvist index is a weighted geometric mean of price relatives, the weights being the averages of the expenditure shares in the base and current periods. Using superlative index formulas, one can better account for commodity substitution by consumers as relative prices change.

8. The superlative indices do, however, require quantity or expenditure data for the current period. Because it takes time to collect and process expenditure data, a superlative index can be produced only with a time lag. That's why most statistical offices adopt a fixed-weight (or Laspeyres-type) price index in the third step as the operational goal or object of estimation. Fixed-weight indices have also the advantage of being easily explainable to the public. The fixed-weight index can be seen as a weighted average of sub-indices with weights being the base period expenditure shares. In the CPI various levels of commodity aggregation are distinguished. At the lowest level, price indices for each commodity (i.e. a specific good and service) are calculated from the price observations from individual outlets. In some countries, like the Netherlands, the weights are fixed at all levels of aggregation. In other countries a mixture of fixed weights and variable weights is used. For instance at upper levels weights are fixed, while at lower levels weights are regularly updated.

9. The difference between a cost-of-living index (i.e. the ideal goal) and a fixed-weight index (i.e. the operational goal) is known as substitution

¹. Substitution bias in a fixed-weight index may show up at all aggregation levels. Elementary substitution bias arises in the process of aggregating outlet-specific price observations into elementary indices for

commodities. Commodity substitution bias occurs when the elementary indices for each commodity are aggregated into the overall CPI.

Reference population of households

10. The CPI is determined by purchasing habits, which can differ substantially between households. This means that there is a case for constructing separate CPIs for different reference groups of households with more or less similar expenditure patterns. For instance, Statistics Netherlands publishes not only a CPI for all private households, but also (monthly) CPIs for low income and high income employees' families and (yearly) CPIs for a number of even smaller household groups. Excluded in the Dutch definition of households are people living in institutional households and private non-profit institutions. Employees' families are private households consisting of a married couple without children or with non-earning children of which the reference person (i.e. the head of the household) is a full-time employee. According to this definition, employees' families form a subset of all employees' households; for instance, single-living employees and non-married couples are excluded. The population of employees' families is split into two parts of equal size by the median of their income distribution. Income is measured as total gross household income, including income transfers.

Coverage of goods and services

11. The aim of the Dutch CPI is to cover all goods and services that are acquired by the average household at market prices in the base period. These acquisitions are made out of disposable household income, which is gross household income minus obligatory transfers (such as income tax and social premiums). Taxes closely tied to the acquisition of certain goods or services, such as motor vehicle tax and property tax, and services provided by the government, such as the supply of a passport, are also included in the Dutch index. Excluded from the scope of the Dutch CPI are medical expenses that are covered by an insurance. As far as owner-occupied housing is concerned, the scope of the Dutch index does not contain the acquisition of a dwelling, but the service that the household acquires from itself as the owner of the dwelling. See Balk (1994) for more details about the consumption definition used in the current Dutch CPI.

12. Indirect taxes such as value added tax and excise duties are normally passed on to consumers through the prices of commodities acquired. As already mentioned, so-called consumption-related taxes are included in the Dutch CPI. This means that the CPI can be called a gross price index, because it incorporates the effect of changes in the rates of indirect taxes and consumption-related taxes. For purposes of wage indexation, Statistics Netherlands calculates a so-called net price index that excludes the effect of tariff changes of the above-mentioned taxes. See De Haan (1998) for more details on the method used to calculate the net index.

Classification of goods and services

13. In most European countries goods and services are classified according to the Classification Of Individual Consumption by Purpose (COICOP) which is recommended by Eurostat. This product classification permits aggregation to the following twelve major groups:

- Food and non-alcoholic beverages,
- Alcoholic beverages and tobacco,
- Clothing and footwear,
- Housing, water, electricity and gas,
- Furnishings and household equipment,
- Health,
- Transport,
- Communication,
- Recreation and cultural services,
- Education,
- Hotels, cafes and restaurants,
- Miscellaneous goods and services.

14. Contrary to the COICOP, Statistics Netherlands does not classify consumption-related taxes and government services by user purpose, but has instead created an additional group covering these expenditure categories.

Accuracy

15. In this paper I assume a fixed-weight CPI as object of estimation (see section 2.1.1). The estimation procedures most statistical offices apply to the CPI involve different kinds of samples. The most important are

- for each commodity group a sample of commodities to calculate the partial price index of a commodity group;
- for each commodity a sample of outlets to calculate the elementary price index of a commodity from individual price observations;
- a sample of households needed for the estimation of the average expenditure shares of the commodity groups².

See Boon (1998) for an overview of the sampling methods that are applied in the compilation of CPIs by European statistical institutes.

16. For a sample survey it is evident that the estimated value of the CPI deviates from the (unknown) population value. Many different error sources affect the accuracy of a statistical outcome. Two broad categories can be

distinguished: sampling errors and non-sampling errors. Sampling errors are due to the fact that the estimated CPI is based on samples and not on a complete enumeration of the populations. Sampling errors vanish if one would observe the complete population. All other errors in the estimated CPI, arising in any stage of the survey process, are called non-sampling errors. Non-sampling errors can be subdivided in frame errors, measurement errors, processing errors, non-response errors, and quality adjustment errors. The last category is characteristic for calculating CPIs. Balk and Kersten (1986) have given an overview of the various sources of stochastics and errors experienced in calculating CPIs.

17. Frame errors in an estimator result from the omission of a part of the target population (undercoverage) or from the inclusion of units from outside of the target population (overcoverage). For outlets, statistical offices have usually inadequate sampling frames. At Statistics Netherlands, for instance, the statistical business register (SBR) is used as sampling frame for outlets. In this register outlets are classified according to major activity. A business register usually has extensive overcoverage, because it contains out-of-scope outlets (for instance firms that sell their services to businesses rather than to households). In addition, there is usually no detailed information on the commodities sold by an outlet. So, it is possible that a sampled outlet may turn out not to sell the commodity in question. The sampling frame of outlets can also have undercoverage, which means that some outlets where commodities are purchased do not appear in the sampling frame. Most statistical offices exclude mail order firms and non-food market stalls from outlet sample selection. The factor time plays also a disturbing role: outlets can shut down; new outlets can have started; the importance of some types of outlets can diminish or increase.

18. For most commodity groups one does not have at ones disposal lists of all commodities constituting such a group. For this reason, most statistical offices do not use probability samples of commodities but judgmental samples. Due to rapidly increasing automation of the retail industry, registers of consumer goods become more and more available. Data scanned by bar-code readers at the cashier's desk can be particularly helpful. It should be noted that the composition of most commodity groups is not constant over time, owing to commodities disappearing from or entering the market.

19. The expenditure weights of the partial price indices of the commodity groups are mostly estimated from a household expenditure survey. In most cases there does not exist a complete list of all members of a population of households. In the Dutch household expenditure survey a substantial part of the sampled households is obtained by random sampling from an approximate sampling frame of addresses. The remaining part of the households is selected by several non-probability techniques. For instance, households of which the reference person is self-employed are obtained from the business register.

20. Measurement errors in a household expenditure survey and/or price survey occur when the respondent does not understand the question, or does not want to give the right answer, or when the interviewer and/or price collector makes an error in recording the answer. In household expenditure surveys, households appear to systematically underreport expenditures on commodity groups such as tobacco and alcoholic beverages. In the Netherlands these measurement errors are adjusted by using other available statistics such as National Accounts consumption data (see Linder, 1996). Price data are usually collected by field collection, mail questionnaires, telephone and/or electronic data capture (by means of CD-ROM, diskette or via the Internet). Until now, in most countries the main collection method is field collection by price collectors that regularly visit outlets. Price collectors can make mistakes in the outlets by collecting prices of wrong commodities. In the Netherlands the price collectors do not use hand-held computers in the outlets. This means that checking of observed prices can not adequately be done at the point of price collection (i.e. in the outlet) by automatically comparing the currently observed prices with the previously observed prices.

21. The collected price data are processed in different stages such as data coding, entry, transfer and editing (i.e. control and correction). At each step mistakes, so-called processing errors, may occur. In the Netherlands, price collectors write down prices on paper forms at the outlets. After they have returned home from collecting prices, they use a laptop computer as input and transmission medium for the price information on the collection forms. This way of processing prices is susceptible to errors.

22. Non-response errors may arise from the failure to obtain the required information timely from all the units selected in the sample. One can distinguish total and partial (or item) non-response. Total non-response occurs when selected outlets cannot be contacted or refuse to participate in the price survey. It is also possible that mail questionnaires and collection forms are returned by respectively the respondent and the collector of the price survey after the deadline for processing. Mail questionnaires and collection forms that are only partially filled in by respectively the respondent and the collector of the price survey can be considered as partial non-response. If the price changes of the non-responding outlets differ from those of the responding outlets, the results of the price survey will be biased. In the Netherlands, prices that are temporarily not observable in certain outlets are imputed by extrapolating the previous price with the change of the other observed prices for the same commodity.

23. In a household expenditure survey one also encounters total and partial non-response. Households drawn in the sample can refuse co-operation. To reduce bias in the expenditure patterns caused by selective non-response, in the Dutch household expenditure survey the sample of households is post-stratified by a number of household characteristics such income, composition and size. Partial non-response occurs if certain types of households refuse

to give information about their expenditure on certain commodity groups. In the Dutch household expenditure survey missing data are imputed with the help of information on the same household from a previous observation period or other households from the same observation period.

24. In calculating the CPI, statistical offices regularly face the problem that some of the commodities to be observed disappear permanently from the market. Then the commodity in question has to be replaced by another commodity. Except for these forced replacements, samples of commodities may be revised either routinely at regular intervals, or when the importance in the market of new commodities becomes apparent. Whenever forced or optional replacements take place, the current price of the replacement commodity has to be adjusted to make it comparable with the previous price of the replaced commodity. An adjustment for quality change should ideally be based on the (average) consumer's valuation of the differences in price-determining characteristics of the old and the new commodity. Since this value is unknown, it must be estimated. At Statistics Netherlands the value of the quality difference is estimated by using: the difference in quantifiable characteristics, (a part of) the price difference between the old and the new commodity in an overlap period; specialist judgements and/or prices for optional equipment which are present in the new commodity and absent in the old commodity. A so-called quality adjustment error in the CPI results when the consumer's valuation of the quality change of a commodity is under- or overestimated.

Comparability and coherence

25. CPIs have the greatest usefulness when they enable reliable comparisons of index numbers across time and space. To follow the development of consumer prices in the course of time, one needs a time series of index numbers that is free from discontinuities. Comparability over space concerns the relationship between statistics for different domains with similar target characteristics, such as CPIs for different groups of households or for different countries. Often users wish to compare or relate data from different survey sources. Therefore, statistics originating from different statistical surveys should be constructed in a coherent way. This means that they have to be based on common definitions (regarding populations, variables etc.) and classifications.

Comparability over time

26. In the Netherlands the fixed-base CPI is mainly used as a short-term indicator. It is not so much the CPI itself that matters for most ends, but rather its relative change over time. For inflation measurement the CPI change with respect to the preceding month or the same month of the preceding year is of particular interest. The change of the CPI from October till April or from April till October is often used as reference indicator in wage negotiations between Dutch employers and unions.

27. There are various conceptual choices to be made in designing a consumer price index that primarily depend on the purposes to be served by the index. In 1994 Statistics Netherlands adjusted the scope of the price index. The household consumption according to the (old) System of National Accounts (SNA) definition was replaced by the acquisitions out of disposable household income. This change was motivated by the opinion of the users that a CPI should give an indication of the development of the cost-of-living. To make comparisons over time easier for users, one has to be consistent over time and stick to the choices made. In other words, one has to refrain as far as possible from modifications of the underlying concepts for the CPI. On the other hand, changes in the measurement process that result into a quality improvement of the CPI should always be implemented as soon as possible. It is important that in such cases the methodological changes are extensively documented and the impact of these changes is assessed.

28. A further aspect of comparability over time is that certain users want to separate the trend in the CPI from effects due to regular seasonal variations in the quantities purchased. Seasonal movements are caused by weather conditions, traditions and institutional arrangements. Such users need seasonally adjusted CPIs. At present Statistics Netherlands does not publish seasonally adjusted CPIs.

29. Fixed-base CPIs compare prices in the current month to prices in the base period. For macro-economic research, long time-series of year-to-year CPI changes are required. To analyse long-run changes in the price level, successive CPIs on different base periods have to be linked to form a time series for more than five years.

Comparability over space

30. As already mentioned, a number of statistical offices construct separate CPIs for different groups of households. To analyse adequately the variability of inflation rates across household groups, one has to use the same conceptual definitions for the calculation of the CPI for each domain. Usually the calculated CPIs for household groups only differ in their expenditure patterns on a certain aggregation level of commodity groups. Below this level the partial price indices for each household group are identical to those used for the CPI for all households. In other words, it is assumed that on this aggregation level each household experiences the same price change. The reason behind this assumption is merely a matter of resources. There is in general no accurate data available on prices paid for commodities by specific household types, the outlets in which different household groups are most likely to shop, and differences in the commodities purchased across household groups. See for instance De Haan (1995) on the calculation of Dutch CPIs for specific household groups. Problems regarding comparability of CPIs for different domains are usually reduced to questions about the precision of these CPIs.

31. Statistical products such as CPIs can differ between countries because of methodological differences. Dalén (1998) presented an overview of various potential sources of non-comparability between national CPIs. In order to get comparable CPIs for different countries within the European Union (EU), Eurostat is in the process of harmonising the methodologies for compiling CPIs in the member states. At the end of 1991 the process towards harmonisation was given an impetus by the Maastricht Treaty on convergence criteria necessary for Economic and Monetary Union. In this agreement it was stated that comparison of inflation should be made with so-called harmonised CPIs on a comparable basis. It was stated in the Council Regulation on the harmonisation of CPIs, adopted in 1995, that CPIs shall be considered comparable if they reflect only differences in price changes or consumption patterns between countries. CPIs that differ on account of differences in the concepts, methods or practices used in their definition and compilation shall not be considered comparable. By seeking agreement on preferred practices or minimum standards, Eurostat tries to establish a harmonised methodology for compiling CPIs in EU countries. See Astin and Sellwood (1997) for more details. The harmonised CPIs are not expressly intended to replace national CPIs. In the Netherlands the harmonised CPI is calculated as a separate statistical product for the purpose of international comparisons, in addition to the national CPI. The major difference between these two indices concerns the underlying consumption definition. Owner-occupied housing, consumption-related taxes, government services and expenditure abroad by residents are included in the scope of the national CPI but excluded from the harmonised CPI.

Coherence with other statistics

32. Users' interests will generally not be confined to data resulting from one particular statistic. Often users wish to compare or relate data from different statistics. It is therefore important for the users that definitions of populations and variables are consistently and uniformly defined in accordance with an integration framework such as the SNA. There exist differences in consumption definition and in reference population of households between the National Accounts (NA) and the Dutch CPI. The most important differences are that the NA household sector includes people living in institutional households and private non-profit institutions and that NA consumption includes insured medical care and excludes consumption-related taxes and government services. The differences in definitions and populations lead to a comparability problem when using NA expenditure data to improve estimates for CPI weights (Linder, 1996).

33. It is also important for the users that the outcomes of economic statistics are comparable with each other. A powerful instrument to attain comparability is the application of standard classifications. This can be illustrated by the following example. Users may want to connect price survey data with household expenditure survey data to deflate the

household-expenditure data for commodity groups by the corresponding partial CPIs. To arrive at this result, the price survey and the household expenditure survey must use the same classification of goods and services. At present the Dutch household expenditure survey applies a classification that differs from the COICOP. In the near future the household expenditure survey will also use the COICOP classification.

Accessibility and clarity

34. Dissemination is a vital step in the information chain. It is not sufficient to have 'good statistics' stored somewhere inside the statistical office. They have to be made available to all potential users, in an appropriate form. Firstly, users should be in a position to know easily which kind of statistics are available. Physical access to the statistics should be convenient. Secondly, the data have to be presented clearly and unambiguous in publications. Thirdly, the statistics should be accompanied by the necessary information on concepts and methods (so-called meta-data). Different levels of explanation should sometimes be envisaged, in order to differentiate between those who are subject specialists and those who are not. Fourthly, further assistance in using and interpreting the statistics and provision of supplementary tables should also be forthcoming from the data providers. Finally, revisions of published data should only be done in exceptional situations.

Forms of dissemination

35. Statistics Netherlands publishes first results on the CPI in a press release. Highlights of the CPI data appear in a weekly statistical bulletin of Statistics Netherlands. Detailed CPI information, including sub-indices of the last twelve months for approximately 200 commodity groups classified according to the COICOP, is published on paper in the Monthly bulletin of price statistics. In addition, the index numbers are available on the Internet (<http://www.cbs.nl>) via the electronic database 'Statline', which contains now the most important statistical products of Statistics Netherlands. Commonly requested information on price index numbers can also be retrieved telephonically via a so-called voice response system.

Presentation

36. Contents of publications heavily depend on the user groups. Expert users are more interested in detailed tables, guided by relevant explanatory notes. For the general public easy readability and accessibility are important. A first condition for each table is that the message to communicate can be easily understood. The intended data should be presented unambiguous and the title should describe essentially the contents of the table. Tables must be accompanied by graphs to enhance accessibility.

37. In the CPI publication the overall index number should be compared with that for the previous month and for the same month of the previous year. The major components of the change in the overall index should be identified and their proximate causes described. Some breakdown should also be provided in the form of sub-indices according to the COICOP classification. In addition, any special sub-indices that are of wide interest should also be released. For example, a separate index for consumer durables has been introduced in the Netherlands that is used by insurance companies for indexation of the insured value of the contents of houses.

Documentation

38. In order to ensure public confidence in the CPI, a detailed and up-to-date description of the methods and data sources should be published. The document should include, among other things, objectives and scope of the index, details of the weights, and a discussion of the accuracy of the index. A description of the sources and magnitude of the errors in the CPI provides users with valuable data on the limitations that might apply to their uses. The samples (for instance the commodities selected) should be confidential. If these were known, it might be possible for the index to be artificially lowered by controlling the prices of the particular commodities whose prices are measured. In addition, it is recommendable to publish a much shorter and more popular pamphlet describing the index in simple terms.

Information services

39. To emphasise the service dimension of their products, statistical offices should provide advice and guidance on how the published statistics might be used. Further, they should calculate supplementary tables upon request of the users. At Statistics Netherlands an information service group responds to all inquiries for CPI data, both verbal and written, from all kinds of users. For instance, they assist people with the use of price index numbers for adjustment of rents in contracts.

Revisions

40. Retrospective corrections of the publicly released indices (e.g. as a result of errors in the data or in the calculation) should obviously only be carried out when absolutely necessary, because of the difficulties such corrections cause for index contracts or payments. In the Netherlands it is common practice that the index number of the most recent month is declared as provisional in CPI publications. In other words, the latest figures can be revised in the next publication.

Timeliness and punctuality

41. Most users want up-to-date index numbers that are published monthly and on time at pre-established dates.

Production time

42. To be of interest for users CPI data must be available as soon as possible. A vital aspect here is timeliness that refers to the period between the reporting month the CPIs refer to and the moment the figures become available to the users. This time lag depends on the production time of the CPI. In the Netherlands CPI data generally refer to the middle of the reporting month (that is, the Thursday in the week in which the 15th of the month falls). On the 1st or the 2nd Friday of the month following the reporting month, Statistics Netherlands releases the first results on the CPI.

43. Keeping production times to a minimum implies using efficient production techniques. The whole process of data collection, entry, editing, imputation, estimation, aggregation, validation and dissemination has to be kept under control in order to minimise the processing period. This means that the monthly process of producing a CPI needs to be carefully planned. One has to follow in time the (actual) production time between reporting month and moment of publication, broken down into the phases of the production process. By reviewing the gap between actual and planned production time necessary improvements in the production process can be identified.

44. In the near future improvements in the timeliness of the CPI can come from using electronic data interchange (EDI) as a tool for data collection. At present Statistics Netherlands is undertaking research into the use of electronically scanned data for commodities sold at supermarkets. The scanner data, which are provided directly by supermarket chains, contain weekly sales for unique products identified by a European Article Number (EAN). One of the problems lies into the linking of the EANs to the COICOP classification of goods and services.

Punctuality

45. Punctuality refers to the agreement between promised and factual date of dissemination. It is common practice for statistical offices to publish planned release dates in advance. In addition, statistical offices usually operate with an embargo policy stating that no consumer price statistics are to be released prior to the predefined date and time.

Costs

46. Although not a component of quality, the resources available for the production of the CPIs act as a constraint of quality. Cost is a measure of performance reflecting the efficiency of the process. Two cost components can be considered: the personal and material costs made by the statistical office and the costs made by the respondents of the price survey by filling in mail questionnaires and/or serving the price collectors (response burden).

47. At Statistics Netherlands a large share of retail sales for a number of commodity groups such as groceries is in the hand of a few sizeable retail chains. Usually the prices are set at headquarters. Such an arrangement provides the possibility of reducing the response burden by collecting prices centrally from the head offices of the retail chains. It is obvious that EDI is not only a promising instrument to improve timeliness but also to reduce the response burden.

III. Follow-up

48. In this paper I have discussed a number of components of the quality concept for consumer price statistics. The following steps must be taken to bring a quality assurance system for the CPI into operation. First, to evaluate the consumer price statistics with respect to the above-mentioned quality aspects, one has to define appropriate quantitative measures of the quality. Second, users of the CPI have to be consulted about their quality requirements. Finally, one has to develop a quality assurance system that encompasses the organisational structure, responsibilities, procedures and infrastructure for the implementation of quality care.

Quality measures

49. In order to measure and monitor quality effectively, it is necessary to define the quality aspects more precisely. In practice this means that quality measures like estimators for the bias with respect to a cost-of-living index, sampling variance estimators, number of price quotations, number of missing prices, number of explicit adjustments for quality change in commodities, number of checks of price observations in the field, production time and punctuality have to be developed. The problem is that some quality aspects can not be quantified. If the quantification of the quality aspects gives too many problems, the use of qualitative measures is the only alternative.

50. For instance, one could start with the development of a methodology for assessing the sampling error of the (fixed-base) CPI change. In this framework one could consider simultaneously the variance due to the sampling of households, outlets and commodities. Both the total sampling error and the relative importance of the various sources of sampling error have to be assessed. Users are primarily interested in the total error of the CPI change. Such information improves the usefulness of the data for the users and enhances their confidence in the published CPI change figures. Information on the relative contribution of each kind of sampling error is exceptionally relevant for index makers. These error components provide an important contribution to the realisation of an optimal sample allocation. An optimal sampling allocation is an allocation of budgeted resources which results into the most precise overall CPI change. For instance, the variance of the overall CPI change can be lowered by devoting more resources (that is

applying higher outlet sample sizes) to commodities with large expenditure weights and large dispersions in price relatives. Another example is that the increase of the number of sampled commodities within highly variable commodity groups in combination with a decrease in the number of sampled outlets can lead to a smaller overall variance.

Quality assessment

51. In section 1 I have stated that the quality of the CPI is determined by the users' opinions of the CPI and its fitness for their purposes. The index producer can list the relevant aspects of the quality concept and the ways how to measure these aspects. The producer should not take a standpoint on whether the published CPI is of good or bad quality. Quality assessment can be left to the users, who can decide whether the quality is good or bad. The index producer has to gather information about users' preferences on the quality aspects, since they constitute the basis for work aiming at quality improvements. For instance, the knowledge about quality requirements for the CPI can be gathered by regularly obtaining the opinions of the members of the Advisory Commission for Price Statistics.

Quality assurance

52. The introduction of quality management systems by statistical departments is stimulated by Statistics Netherlands through the provision of guidelines for quality systems and the adoption of a system of 'statistical auditing'. The guidelines are primarily meant to increase quality awareness in statistical departments. The auditing system was set up to check how quality management in statistical departments is functioning, and how the quality of statistical products and procedures may be improved (see De Vries and Van Brakel, 1998).

53. Following Haworth et al. (1997) the working definition of quality assurance adopted for the CPI is "a process of continuous improvement, systematically evaluated with respect to customer requirements". To bring a quality assurance system in operation at the Department of Consumer Prices of Statistics Netherlands the following procedures should be implemented:

- a regular review of the gap between users' needs and quality standards actually attained;
- the identification of necessary changes in the production process of the CPI and the implementation of action plans.

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Appendix 1. Overview of the quality aspects of the CPI

- relevance
 - target index
 - ◊ elementary substitution 'bias'
 - ◊ commodity substitution 'bias'
 - reference population of households
 - coverage of goods and services
 - classification of goods and services
- accuracy
 - sampling errors
 - non-sampling errors
 - ◊ frame errors
 - ◊ measurement errors
 - ◊ processing errors
 - ◊ non-response errors
 - ◊ quality adjustment errors
- comparability and coherence
 - comparability over time
 - comparability over space
 - coherence with other statistics
- accessibility and clarity
 - forms of dissemination
 - presentation
 - documentation
 - information services
 - revisions
- timeliness and punctuality
 - production time

- punctuality
- costs
 - costs to the statistical office
 - costs to the respondents

END NOTES

¹ In this section the term 'bias' is not used in the usual statistical meaning. Normally bias is defined as the difference between the expected value of the estimator and the true population value of the CPI.

² Some countries use data from National Accounts instead of a household expenditure survey to obtain the expenditure shares.
