Data and Metadata Reporting and Presentation Handbook

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FOREWORD

The *Data and Metadata Reporting and Presentation Handbook* provides a single comprehensive reference set of international guidelines and recommendations for the reporting and presentation of statistical data and metadata. Although, the Handbook was prepared primarily for short-term economic statistics, many, if not most of the recommendations presented are also relevant for annual (structural) statistics and for social and population statistics. The Handbook draws heavily on existing international statistical guidelines and recommendations that have been developed over the last twenty years by international organisations and national statistical agencies. These international standards have been developed for implementation by international organisations themselves and by national agencies in both developed and developing economies.

The need for the articulation of a comprehensive set of recommendations on the reporting and presentation of statistical data and metadata is one aspect of the overall demand for improved international comparability and consistency of statistics compiled and published by national agencies and international organisations. This requirement has itself been driven by closer economic and social linkages between both the 30 OECD Member countries and between those countries and large emerging non-member economies. As discussed in the Handbook, the major causes of differences in statistics compiled in different countries flow from the use of different definitions and concepts and differences arising from varying collection and statistical data transformation practices. Even where differences in these areas are minimal the statistics disseminated by different countries may actually look different because of the use of different data reporting and presentation practices. These differences can have considerable impact in an environment where users have ready access to a bewildering amount of statistical information facilitated through the availability of on-line databases and statistics on the Internet at both the national and international levels.

Data and metadata reporting and presentation standards cover a very large number of issues and some subjectivity has been applied in the selection of issues covered in the present Handbook. Following the release of this publication the intention is to locate a more interactive version on the OECD statistics website where existing guidelines can be modified or new issues emerging over time can be incorporated. Such new issues could for example be driven by the continuing impact of new technologies used for the dissemination of statistics to both generalist and specialist users.

It is unreasonable to expect that differences in statistics compiled by national agencies in the context of national social and economic environments to address specific national requirements will disappear overnight, if at all. For this reason, one of the underlying themes throughout the Handbook is the need for both national agencies and international organisations to improve the transparency of methodologies, concepts, etc., they apply in the collection and compilation of statistics. Internet based technologies provide an ideal platform that gives users ready access to such information as well as the statistics they describe.

It is recognised that the implementation of some (though not all) of the recommendations included in this Handbook (which are summarised in Section 1.2.3) will require expenditure of resources. Options to minimise this therefore entail:

- selective / co-ordinated implementation through phasing in on the basis of dialogue between national agencies and international organisations; or

- progressive implementation at the time of the revision of the various statistics, etc., according to the specific rates / rhythms of each country.

This Handbook draws heavily on the work of many national statistical institutes, central banks, etc., working in the OECD's Short-term Economic Statistics Working Party (STESWP) over the last two years and from detailed comments and suggestions from other international organisations, in particular, the European Commission's Eurostat, the International Monetary Fund, the World Bank and other participants of the Co-ordinating Committee for Statistical Activities (CCSA). The work was coordinated and prepared by Denis Ward, Statistics Directorate, OECD.

Enrico Giovannini
Chief Statistician and
Director of the Statistics Directorate
OECD
Paris

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1. INTRODUCTION AND OVERVIEW

1. The purpose of this Handbook is to provide a single comprehensive reference set of international guidelines and recommendations for the reporting and presentation of statistical data and metadata, covering both economic and socio-demographic statistics. The Handbook is designed for use by statistical agencies in both developed and developing countries and by international organisations. To arrive at this set of standards, the Handbook draws heavily from existing guidelines and recommendations on data and metadata reporting and presentation.

2. The benefits of providing such international standards in a single reference source are that it will, among other things, assist in:

- promoting the consistency of methodologies through the standardisation of format, terminology and dissemination of data and metadata used by international and national agencies;
- promoting the comparability of statistical data;
- promoting the use of recommended practice in the presentation of statistics and improve the transparency of such practices to users;
- minimising the reporting burden of providing data and metadata to international organisations; and
- identifying areas where additional guidelines for the reporting and presentation of data and metadata need to be prepared in the future.

3. The remainder of this Section provides an introduction and overview to the Handbook, discussing in Section 1.1 the need for data and metadata reporting and presentation standards and in Section 1.2 the scope of reporting standards covered. Section 1.2.3 contains a summary of all the recommendations provided in the body of the Handbook.

4. The remaining Sections of the Handbook provide: an overview of existing presentation and reporting standards and those currently under development (Section 2); the importance of the use of common terminology (Section 3); guidelines and recommendations for the reporting and presentation of different types and forms of data in time series (Sections 4 and 5 respectively); guidelines for the reporting and dissemination of metadata (Section 6); and finally, recommendations on key reporting practices (Section 7). A comprehensive set of references is provided in Section 8 and, a Glossary of key presentation and reporting terms is located in an Annex at the end of the Handbook.

1.1 Need for data and metadata reporting and presentation standards

5. The need for the articulation of international guidelines and recommendations in this area in one comprehensive document for use by developed and developing countries, and international organisations, has been recognised for some time. The statistics referred to in this Handbook encompass all domains including economic, social and population statistics, and both short-term and structural statistics, together with their associated metadata.

6. With the demand for closer integration and co-ordination of the work of the various international organisations, the need for agreement and adoption of a common set of data reporting and presentation practices has become even more pressing. For this demand to be met, agreement on a basic set of practices and guidelines is required not only between international organisations but also by national agencies, the initial source of almost all statistics and metadata entering the international environment.

7. Greater economic integration between the major trading blocs around the globe has also led to further user demand for improved comparability of statistics between countries, and greater data comparability over time for the same time series within the one country. The major causes of real differences in statistics have been identified (Eurostat 2002a, p. 35) as:

- the use of different variable definitions, concepts, units and classifications; and
- differences arising from varying collection and processing (transformation) practices.

8. However, even where differences from these factors are minimal, statistics disseminated by different countries, etc. may actually look different because of the use of diverse data reporting and presentation practices. Similarly, statistics for identical statistical domains disseminated by various international organisations, although coming from the same national source, may also appear different due to the application of dissimilar presentation practices and statistical data transformation processes at the international level.

9. There are two broad imperatives relevant at both the national and international levels that justify the need for the articulation of a comprehensive set of standards for the reporting and presentation of statistics and metadata. These concern the need to improve data quality, and to minimise the reporting burden in the provision of statistics (data) and metadata to international organisations.

1.1.1 Improved data quality - interpretability and coherence

10. The first imperative relates to the need to improve the quality of statistics at both the national and international levels. Over the last ten years a number of international organisations and national statistical agencies (such as Eurostat (Eurostat 2003d and Eurostat 2003e[1]), the IMF (IMF 2003c), OECD (OECD 2003e), Statistics Canada (Statistics Canada 2003), Statistics Denmark (Statistics Denmark 2004), Statistics Finland (Statistics Finland 2002), etc.) have developed quality frameworks as part of initiatives to improve the quality of statistical output disseminated to internal and external users.

11. Each of these frameworks contains a number of common features such as a definition of the "quality" concept, and a list of dimensions that define quality. These dimensions normally include relevance, accuracy, timeliness, interpretability, coherence, etc[2]. Although each organisation has formulated its own dimension list there is considerable overlap and commonality between them, if not for the actual label applied to the concept, then for meaning. For example, most include "relevance"

[1] The quality dimensions outlined in the Eurostat document, *Definition of Quality in Statistics* (2003e), is used as the basis for the quality systems and processes implemented by many EU member states.

[2] For example, the seven dimensions defined in the OECD's quality framework are: relevance, accuracy, credibility, timeliness, accessibility, interpretability, coherence (OECD 2003e, pp. 7-10)

and "consistency", though a range of labels are applied to the "accuracy" dimension (such as validation, overall accuracy, assessment and validation)[3].

12. Most of the dimensions defined in quality frameworks are relevant for data and metadata presentation and reporting, and the quality frameworks cited above contain numerous specific examples of the compilation of quantitative and qualitative indicators to measure the various dimensions for specific statistical output. However, the quality dimensions that are particularly relevant to the need for the articulation of a set of guidelines for data and metadata presentation and reporting are "interpretability" and "coherence".

13. Interpretability reflects the ease with which the user may understand and appropriately use and analyse statistical information. The adequacy of concept definitions, target populations, variables and terminology included in information describing the possible limitations of the statistics, largely determines the degree of interpretability. Interpretability is assisted through the presentation of metadata which is appropriate to the needs of a range of different users and uses of the statistics, and which is both well structured (readable) and readily accessible.

14. With respect to coherence (*i.e.* the degree to which different but related statistical data are logically connected and mutually consistent[4]) users are often confronted by difficulties in comparing statistics compiled over time and / or across data-sets within the one agency, or by agencies in different countries and different international organisations. This Handbook focuses on different practices in the reporting of statistics and discusses the main reporting practices outlined in Section 1.2 below in the context of a framework, together with recommendations and guidelines for use by both international organisations and national agencies in their various forms of disseminated output.

1.1.2 Minimisation of reporting burden

15. The second imperative driving the need for the development of data and metadata presentation and reporting standards refers to the requirement to minimise the reporting burden of national agencies in their provision of statistics and metadata to international organisations. Emphasis here is on the development of more efficient practices and processes for such reporting which are undertaken within the context of the range of processes and mechanisms described in Section 2.3.1 below such as bilateral exchange, data sharing, etc.

16. Discussions at international forums (such as the 2002 Conference of European Statisticians (CES) (OECD/IMF 2002) and the 2003 meeting of the OECD High Level Group for Statistics[5]

[3] An analysis undertaken by the IMF (IMF 2005) that compared high level metadata concepts, identified a number of quality dimensions common across the quality framework initiatives of the IMF, Eurostat, OECD, Statistics Norway, Statistics Sweden, and Statistics Canada. Although not specifically mentioning the impact of recommended data presentation practice on clarity and interpretability, the Fund's view was that such initiatives could be used to help structure the analyses and assessment of reference metadata content – refer para. 151 below.

[4] The terms "coherence", "consistency", and "comparability" are often used interchangeably. However, coherence reflects the ability of statistical data to be combined / brought together with other statistical information (in particular, but not only, when derived from different sources) within a common framework of concepts, classifications, methodological standards, etc. Coherence encompasses the internal consistency of a collection and its comparability both over time and with other sources (ABS 2006a, ch. 12). Coherence does not necessarily imply full numerical consistency (Statistics Canada 2003, p. 7). Assessments of comparability seek to measure the impact of differences in applied statistical concepts and definitions on the comparison of statistics between geographical areas, over time and between different domains (such as economic activity, size classes, etc.) (Eurostat 2003c).

[5] The forerunner of the OECD Committee on Statistics (CSTAT) created in May 2004.

(OECD 2003a)) outlined the benefits of using a data sharing model in the transfer of statistics and its associated metadata between national sources and the various international organisations. Data sharing refers to the sharing of both input files (common questionnaires, etc.) and the output of national and international organisations to help ensure the consistency of published statistics. Such a model envisages the extraction of common data requirements by international organisations from data (input or output files) located on national agency websites. This model is particularly beneficial for either statistical time series that are collected regularly (*i.e.* daily, weekly, monthly, quarterly) or where the requirements of international organisations collectively are relatively stable over long periods of time (*e.g.* for annual national accounts).

17. International organisations have also introduced a wide variety of other processes to minimise the reporting burden of national agencies. These include the despatch of common questionnaires (for example by Eurostat and the OECD for research and development (R&D) statistics) and the use of regional organisations' data (for example, Eurostat and the European Central Bank) in lieu of direct collection by all international organisations from national sources. Such sharing of statistics and metadata often requires the sharing of classifications and the adoption of common statistical units.

18. The introduction of new technologies over the last five years, particularly web-based technologies, has provided the technical possibility for the implementation of the data sharing model and other processes for minimising reporting burden. Prerequisites for implementation involve not only the resolution of a number of information technology and communications (ITC) issues but also agreement between national agencies and international organisations on a number of data "content" issues including:

- Identification of a set of common requirements for key statistical aggregates. A brief list is provided below in Section 2.3.3 below on a number of related initiatives within the context the Statistical Data and Metadata Exchange (SDMX) initiative that are designed to further the co-ordinated collection of statistics and metadata by international organisations from national sources, and which either directly or indirectly contribute to the evolution of the data sharing model referred to above.

- Adoption of common or at least consistent classifications such as International Standard Industrial Classification (ISIC), Harmonised System (HS), International Standard Classification of Occupations (ISCO) and the International Standard Classification of Education (ISCED). These and other international classifications are readily available on Eurostat's Classification Server (RAMON) (Eurostat 2006b) or on the United Nations Statistical Division website (UNSD 2004).

- Agreement on key data reporting and presentation practices that would facilitate both the identification of identical series disseminated by national agencies and international organisations and the dissemination of consistent statistics, in particular, by different international organisations.

19. The need for further international work on data presentation was also highlighted in a presentation by Eugenio Domingo Solans (Solans 2003), a (then) member of the Governing Council and Executive Board of the European Central Bank, at the 54th Session of the International Statistical Institute in Berlin in 2003. Solans acknowledged the impact of modern website technology in improving timely access to official statistics. However, he also emphasized the need for ITC developments to be accompanied by the development and implementation of standards for data presentation, citing specific issues such as growth rate presentation, revision policy, provision of quality indicators, etc.

20. The development of the required guidelines in these and other areas is the responsibility of international organisations working in co-operation with national agencies. Obviously, the implementation of the data sharing model will only occur with the active participation of national agencies in whose databases the shared statistics and metadata will largely reside. Data sharing implies a fundamental change in data dissemination with respect to co-ordination between international organisations and the role of national agencies in disseminating data to international organisations through their implementation of data and metadata reporting guidelines that are designed not only to improve the interpretability and coherence of statistics but also to facilitate dissemination of data, and ultimately minimise their reporting burden.

21. Finally, the wider range of options now available for the dissemination of statistics further strengthens the need for the development and adoption of data and metadata reporting and presentation standards by national agencies and international organisations. In the past, most users accessed their statistical needs solely via paper publications and although such publications are still an important means of dissemination, access via electronic media, in particular, through the Internet, is now very common. Users frequently identify the availability of the statistics they need in electronic databases through use of search engines, etc. Such searches often involve interrogations across a number of databases prepared by different statistical agencies and the efficiency of this process is enhanced significantly if the statistics are presented in a common format using standardised terminology. This issue is taken up in more detail below in the discussion on terminology (Section 3).

22. The ultimate objectives of the implementation of the recommendations presented in this Handbook are to ensure that all types of users – the general public, informed users and analytical specialists – can access their statistical needs efficiently, and that methodologies used in their compilation are sufficiently transparent for users to assess the relevance of the statistics accessed to their needs.

1.2 Scope of reporting standards referred to in this Handbook

23. The standards outlined in this Handbook (all of which are summarised in Section 1.2.3) are by and large relevant for all domains comprising economic, social and population statistics, and are a prerequisite for clarity and transparency and for statistical comparisons between countries around the world.

24. Data and metadata reporting and presentation covers a very broad range of issues and topics, and before proceeding further it is worthwhile outlining the relatively limited scope of the issues covered in this Handbook. The Handbook makes the distinction between data presentation standards involving table layout, font, type faces, readability, graphical presentation, etc., used by both international organisations and national agencies, and standards for the reporting of data by national agencies to international organisations through submission of data files by national agencies or through international agency access to national agency databases and the use of web query tools, etc.

25. Irrespective of how data are exchanged, the boundary between “presentation” and “reporting” issues is often very fuzzy and although the main focus of this Handbook are standards for data reporting and exchange between organisations it necessarily touches on some issues that could be regarded as presentation.

Recommendations for different types and forms of statistical data

26. This Handbook provides a number of specific recommendations covering the two broad dimensions in which all statistical data may be reported, namely:

- *Types of data:* Refers either to original data[6] or original data that has been transformed for presentation as indices, growth rates, ratios, rates, percentages, etc. Original data may be either stock series which are measures at a point in time, or flow series which comprise measures during periods of time. Original data may be presented either in:

  – terms of physical units (tonnes, cubic metres, gigajoules, etc.); or

  – in value terms expressed at current or constant prices.

  The dissemination of original data is common for statistics published at annual or less frequent intervals, though such data are also disseminated for some short-term indicators such as monthly or quarterly statistics on motor vehicle registrations, construction permits, employment, etc. It is more common to disseminate short-term statistics in the form of indices or growth rates which highlights more readily changes over time in economic and social phenomena. As will be shown in Section 4.4 below, there are a number of different types of growth rates.

  The Handbook provides recommendations for the reporting and presentation of both quantitative and qualitative statistics[7], though in most instances the recommendations in this Handbook are relevant to both types of statistics.

  In recent years data producers have also been requested to provide users with access to micro-level statistics, in particular, to record-level sample survey datasets. This is particularly the situation for users of social and population statistics derived from household surveys. The proper documentation and dissemination for such statistics is of paramount importance and raises issues of confidentiality and others specific to this type of statistic. Data and metadata standards have been developed for the documentation of micro-level datasets under the Data Documentation Initiative (or DDI)[8]. Although, the DDI is briefly described below in Section 6.4, the presentation and reporting of micro-data are however outside the scope of this Handbook.

- *Form of time series data:* Refers to raw (original or non-seasonally adjusted) series, working day adjusted, seasonally adjusted, trend-cycle estimates, etc.

27. The focus of this Handbook is the reporting and presentation of statistical data in tabular form. It is also common practice to present key aggregates disseminated in paper publications, press releases, etc., in graphical form. A detailed discussion of graphical presentation is also currently outside the scope of this Handbook, though a number of national statistical agencies have prepared manuals outlining recommended practice in this area, for example, those presented in the *Statistics New Zealand Graphics Guidelines* (Statistics New Zealand 2001a) and Statistics Sweden's, *Graphing Statistics and Data* (Wallgren *et al* 1996).

[6] Sometimes referred to as "absolute figures" or "absolute data", though use of these terms in this context should be avoided due to the specific mathematical meaning of the term "absolute", i.e. the numeric value of a number without regard to its sign.

[7] Information collected in qualitative surveys request respondents to assign qualities, rather than quantities, to the variables of interest (OECD 2003f, p. 7).

[8] Published on-line by the DDI Alliance, available at www.icpsr.umich.edu/DDI

Recommendations for the presentation and dissemination of metadata

28. Section 6 of this Handbook emphasizes the need for national agencies and international organisations to prepare and disseminate adequate metadata describing concepts, collection and processing processes and data reporting and presentation practices. Such metadata must also be readily accessible and understood by users with different degrees of statistical expertise.

29. The metadata presentation and dissemination guidelines discussed in Section 6 draw heavily on current and previous work of a number of international initiatives, in particular, that of the UNECE – Eurostat – OECD Work Session on Statistical Metadata (METIS). Section 6 focuses on recommendations on where and how metadata should be disseminated. Other Sections of this Handbook also touch on specific metadata issues such as: those required for micro-data (Section 6.4); describing methodology used in seasonal adjustment (Section 5.6.3) and the provision of information on data revisions (Section 7.1); series breaks (Section 7.2); and on sampling and non-sampling errors (Section 7.3).

Importance of use of common terminology

30. Ideally, metadata should be expressed by different organisations in different countries around the globe on the basis of a common terminology. The importance of the use of common terminology is discussed below in Section 3. The Glossary at the end of this Handbook contains a comprehensive set of definitions for concepts related to data and metadata reporting and presentation.

Key data reporting practices

31. In addition, there are a small number of key data reporting practices that also have a significant impact on data interpretability, and where different approaches currently used by national statistical agencies and international agencies complicate comparisons of national statistics. These include the use of different:

- data revision presentation practices;
- reporting practices for the presentation of breaks in time series;
- practices for the reporting of sampling and non-sampling errors;
- base years in the presentation of indices;
- data and metadata citation practices;
- practices for the reporting of administrative data.

32. This Handbook outlines guidelines and/or recommended practice with regard to each of these. Such practices are consistent with sound governance in statistics encompassed, either implicitly or explicitly, in the UN *Fundamental Principles of Official Statistics* (UNSC 1994) and the UN *Handbook on the Operation and Organisation of a Statistical Agency* (UNSD 2001).

1.2.1 Recommendations relevant for different dissemination media

33. Another aspect relevant to the development of data reporting and presentation guidelines and recommendations is the data dissemination medium or format (on-line database, Internet web pages,

CD-ROM, paper publication or press release) used to disseminate data. The reality is that different forms of data reporting and presentation are more suited to different means of data dissemination. Where appropriate, such differences are reflected in the recommendations outlined in this Handbook. Also, because of their increased importance in recent years, consideration is particularly given to the presentation of key statistics in press releases, especially with respect to recommendations on the presentation of original (or non-seasonally adjusted) and seasonally adjusted series in Section 5.

1.2.2 Future editions of this Handbook

34. New data and metadata presentation and reporting issues will emerge over time, or existing guidelines will need to be modified to meet the needs of new standards that will be required in future for various statistical domains. Change will also arise through the use of new technologies, etc., for the dissemination of statistics to users. The range of recommended reporting practices outlined initially in this version of the Handbook could be expanded in subsequent versions to include others, in particular, those of specific interest to users in developing countries. Such recommended practices are also outlined in the IMF's Reports on the Observance of Standards and Codes (ROSC) (IMF 2003a) which summarise the extent to which countries observe internationally recognised standards including those related to data dissemination[9].

35. Following the initial publication of this Handbook in paper form it is intended to incorporate emerging issues, etc., in a dynamic web version located on the OECD statistics website. Issues under consideration for inclusion in future include: linking time series, and the graphical presentation of statistics. Other possibilities include: clearly understanding user needs (particularly to ensure the relevance of the information presented); problems related to data confidentiality; and problems associated with the presentation of chained indexes and chain linking.

[9] In the main, the recommended practices described in ROSCs relevant to the data reporting practices described in this Handbook are largely restricted to data revision and the availability of appropriate metadata.

1.2.3 Summary of recommendations presented in this Handbook

36. For quick reference, the data and metadata reporting and presentation recommendations provided in the following Sections of this Handbook are presented below. The Section numbers used in the body of the Handbook have been included to facilitate user reference to the complete text in order to obtain background information behind each guideline, etc. For further information, extensive citations are provided in the Handbook (refer References - Section 8), where in most instances web links have been provided to the entire source document.

The Glossary in the Annex of this Handbook contains definitions of key terms and concepts used in the recommendations. Source information are also provided for each entry in the Glossary.

2.1.2 Recommended practices to ensure consistency in presentation and reporting practices included in future international statistical guidelines and recommendations

It is recommended that the authors of future international statistical guidelines and recommendations for various statistical domains take a more modular approach in the preparation of those standards by using, as required, existing international recommendations in key areas such as the reporting and presentation practices outlined in this Handbook and terminology and definitions presented international glossaries such as the *Metadata Common Vocabulary* (MCV) described in Section 6.3.4. Such use may take the form of either the direct incorporation of text within future guidelines or by reference / link to the recommendations in this Handbook, etc.

2.2.1 National and international publishing manuals and guidelines

Recommended practices for publication manuals:

- In the interests ensuring consistency in the presentation of data disseminated across different paper publications and electronic media within an organisation, it is recommended that each statistical agency compile a publishing manual or set of guidelines providing guidance to author areas within the organisation.

- It is also recommended that statistical agencies place such publication manuals and guidelines in the public domain by locating them on their websites. This would give greater transparency and external scrutiny to internal practices and provide a means of disseminating recommended practices to organisations in other parts of the national statistical system.

3.5 Recommended practices to ensure the use of consistent terminology and definitions

The recommended practices outlined below are primarily designed to minimise the current common practice of different author areas within national and international organisations developing their own, often inconsistent, sets of terms and related definitions. Even where differences in terminology are appropriate there is still a need to provide users with information about the context / reasons for such differences.

Agencies should therefore:

- Establish a terminology management strategy and associated structures appropriate to their needs, requirements and resource capacity to reduce the use of inconsistent terminology and related concepts by the different author areas in the organisation which in turn are applied in various questionnaires and disseminated output.

There are a range of options available to achieve this objective. These include the creation of a corporate thesaurus which can be readily accessed by different parts of the organisation and in which existing inconsistent definitions for the same term are confronted and differences either eliminated or explained. Where possible, definitions applied at the national level should align with international definitions, modified as appropriate to provide further elaboration and / or to meet national circumstances.

- Irrespective of the tool(s) adopted (glossaries, thesauri), there is still the need for senior management within an organisation to ensure that appropriate practices and principles involving the use consistent terminology are developed and adopted across the organisation.

- Ensure that any thesaurus developed by an agency contains the minimum structures outlined in existing international guidelines such as those formulated by the ISO, OMG and W3C.

  Corporate glossaries should contain the following in order to facilitate their interoperability: concept label; definition; detailed source information about where the definition was derived; related terms; and context field providing additional information or highlighting how a definition is used within one statistical domain or geographical context. Finally, the glossary should also be translated into various languages used by the institution in question.

- Provide appropriate cross references or links in domain specific glossaries, on Internet or intranet sites to general glossary databases that have been developed either at the national or international levels, the purpose being to make existing standard terms and definitions more readily available.

- Avoid attaching precisely the same label or title for different definitions (for further discussion refer Section 6.3.5).

4. Guidelines for the reporting of different types of statistical data

4.2.1 For original data

- The availability of original data affords maximum flexibility for users interested in undertaking further analysis or transformation beyond how it is presented in the data source on hand. Therefore, users should have access to at least some of the key aggregates of original data where they exist for a particular series, either directly in the publication or through the provision of references or hyperlinks. The provisions under which access to detailed original, confidentialised data is given would be governed by the organisation's dissemination policy.

- In situations where original data are known to have significant non-sampling errors, appropriate metadata should be provided to facilitate appropriate use of the data. In such instances consideration should also be given to the presentation and use of other types of data such as percentages in any analyses of main features.

- Original data are frequently transformed into growth rates or indices, for example, in a press release to facilitate interpretation and understanding. Ideally, original data should be presented in addition to the transformed series. However, this may not be possible in some dissemination media due to space considerations and in this situation it would be sufficient to provide a clear indication of their availability and how they could be accessed.

4.3.2 For indices

The Statistics Canada Policy on Informing Users of Data Quality and Methodology (Statistics Canada 2000, Section E.3) states that the provision of an adequate description of characteristics and methodologies specific to indices is as important to users as quality assessments of the data. Statistics Canada therefore recommends the provision of the following metadata:

- precise definitions of the underlying economic concepts the indices are intended to measure. Specific mention should be given to any limitations in the use or application of the index, citing the example of deflation of macro-economic aggregates; and

- descriptions of the methodologies used in the compilation of the index, with particular reference to the:

    - index calculation methods entailing the choice of index formula (*e.g.* Laspeyres, Paasche, Fisher) and the strategy for constructing the index series (*i.e.* as either fixed base or chain indices);
    - weighting system used, weight revision practices and frequency of weight revision;
    - computation at various aggregation levels;
    - selection of base year;
    - frequency of re-basing;
    - procedures for linking indices;
    - treatment of changes in the composition of commodities in the market as well as changes in quality.

  The methodologies applied should be compared with underlying index concepts and the impact of departures described.

Finally, as much of the above information is of specific interest to specialised users, consideration should be given to having differing levels of information targeted to different kinds of users. The guidelines for the reporting and dissemination of metadata provided in Section 6 emphasize the desirability of structuring metadata appropriately for users with differing degrees of expertise and need.

4.4.3 For growth rates

The two key recommendations with respect to growth rate terminology entail the need for statistical agencies to:

- minimise the risk of user misunderstanding of the growth rates being applied through the consistent use of growth rate terminology and the provision of definitions such as those provided in Section 4.4.2 in accompanying metadata; and

- develop a consistent (and unambiguous) set of expressions for use in analytical text to describe changes in annual and infra-annual growth rates and to apply those expressions consistently both within the same press releases and in other press releases disseminated by the same organisation.

Recommendations for the presentation of growth rates in the context of different forms of data used in time series analyses are summarised in Section 4.6.

4.5.2 For ratios, proportions, percentages and rates

The main issues for the presentation of and ratios centre around the provision of appropriate methodological information (metadata) describing both the actual rates / ratios and, the component series used in their derivation. Precision is required in the provision of information for the user about the time period referred to, the nature of the population being described and the type of occurrence being measured (Palmore and Gardner 1994). More specifically:

- the term "rate", "percentage", or "ratio" should be included in the actual label, *e.g.* maternal mortality rate, crude death rate, etc., to ensure user understanding that the original data has been transformed;

- for rates where the total population is expressed as unity the unit of measurement used in the population should be included in the table heading for the rate, *e.g.* per 1 000 live births;

- the series labels in the components that make up the rate or ratio should be based where possible on existing international terminology. These are generally outlined in the international guidelines and recommendations for the relevant statistical domain (refer UNSD 2002a) or glossary databases disseminated by international organisations such the OECD's *Glossary of Statistical Terms* (OECD 2002a); the Eurostat *Concepts and Definitions Database* (CODED) (Eurostat 2006a), or UNSD's *Definitions for United Nations Common Database* (UNSD 2002b). Departures from international concepts should be documented in the metadata accompanying the rate / ratio;

- detailed information about the source(s) of the component series used in the derivation of the rate or ratio should be provided. Minimum information comprises: type of data source (administrative, household survey or census, business survey or census), reference period, full official title of the series, full name of the source agency or institution;

- users should have access to the original data used in the derivation of the rate / ratio. This could be included in the body of the publication where the rates or ratios are disseminated (*e.g.* as annex tables) or through the provision of sufficient reference information or hyperlinks that will enable users to access the original data;

- users should be provided with information on methodologies used in the compilation of the component series used in the derivation of the rate / ratio. The quality (in particular, comparability both over time and between countries) of the rate or ratio is only as good as the quality of the series used in its calculation, and appropriate metadata is therefore essential to enable users to form an understanding of quality and relevance of the rate /ratio for a particular need or purpose.

The final issue involves the need to standardise extraneous variables used in the compilation of ratios, proportions, rates, etc. As mentioned in Section 4.5.1, such standardisation is necessary to enable the comparison of ratios, etc. between countries, regions, etc., and in some instances over time in the same geographic area.

5.6 Recommended practices for the reporting of different forms of time series data

Forms of time series data to be presented

Recommendation 1: When seasonality is present and can be identified, sub-annual indicators should be made available in seasonally adjusted form. The level of detail of indicators to be adjusted should be chosen taking into account user demand and cost-effectiveness criteria. The adjustment should be applied appropriately using the method chosen as a standard by the agency. The method used should be explicitly mentioned in metadata accompanying the series.

Recommendation 2: When applicable, the focus of press releases (or similar releases to the general public) concerning the main sub-annual indicators should be on their appropriately seasonally adjusted version. Users should also be given access to the original (or raw) series, either in the publication (if space permits) or by reference to it.

Where there is a user demand, the agency may also disseminate intermediate components of the seasonal adjustment process (*e.g.* series adjusted for calendar effects) and / or trend-cycle estimates but it should be clearly indicated that the focus is on the seasonally adjusted estimate when short-term variation is of interest.

Analytical transformations

Recommendation 3: Press releases presenting seasonally adjusted flow series should at the minimum provide period-to-period growth rates for the latest period and, if space permits, period-to-period (*e.g.* month-on-previous-month, quarter-on-previous-quarter) change in levels.

Recommendation 4: For month-on-previous-month and quarter-on-previous-quarter rates of change, seasonally adjusted data is the best way of presenting information about a time series (trend-cycle and irregular movements) and for presenting short-term developments, even if the irregular component is relatively large. To deal with irregular movements that blur the trend the rate of change bases on two or three months' (or quarters) worth of values can be utilised.

Recommendation 5: For rate of change with respect to the same period of previous year the year-on-year changes should be applied to raw data and to data adjusted for calendar effects if the latter are available. Where necessary, special effects contained in the base period should be highlighted when presenting YoY (base effect).

Recommendation 6: Because of the risk of providing misleading signals, especially where series display significant volatility, the presentation of annualised level changes is not recommended, especially as the key headline series.

Where annualised changes are used, users should be provided with information regarding the possibility of misleading signals due to series volatility.

Recommendation 7: Annualized period-to-period growth rates are not recommended for the presentation of quarterly or monthly growth rates.

Preference should be given to the use of year-on-year growth rates.

Information about seasonal adjustment to be provided to users

Recommendation 8: Statistical agencies should disseminate a non-technical explanation of seasonal adjustment and its interpretation for the benefit of, and aimed at, the general public.

Recommendation 9: For the benefit of users requiring information about the appropriateness of the seasonal adjustment method applied, statistical agencies should provide a minimum amount of information that would enable an assessment of the reliability of each seasonally adjusted series.

Recommendation 10: Statistical agencies should maintain metadata on seasonal adjustment of sufficient extent to enable outside users to seasonally adjust in a consistent way other series from the same statistical program that may not have been seasonally adjusted.

6.3 Recommended practices for the reporting and dissemination of metadata

6.3.1 The need for metadata

All statistical agencies should:

- compile metadata required for users to understand the strengths and limitations of the statistics it describes; and

- keep their metadata up-to-date, incorporating the latest changes in definitions, classifications and methodology, etc.

6.3.2 *Access to metadata*

Key recommendations in this area include:

- ensuring that users have ready access to such metadata through its dissemination via a range of different media – paper publications, CD-ROMs, etc. However, it is important for all metadata to be available to users on the Internet, given that it provides the most accessible medium for obtaining the most up-to-date metadata. It is also recommended practice for metadata to be structured in such a way as to meet the needs of a range of users with different requirements and/or statistical expertise. This does not necessarily entail the physical presentation of different metadata to each group of users with different statistical expertise. However, a layered presentation of metadata is recommended, progressing from summary metadata to more detailed metadata. Each layer should use clear and precise text;

- dissemination of metadata free of charge on the Internet. There is strong support for the notion that metadata describing statistics has a high public good component and should therefore be disseminated free of charge on the Internet even if the actual economic and social statistics they describe and paper publication versions of the metadata are subject to an organisation's price regime;

- active linkage of metadata to the statistical tables and graphs they describe and vice versa;

- the availability of metadata not only in the national language but also, where resources permit, in a common language such as English;

- structuring the metadata for different statistical domains on the basis of some hierarchic classification. Consideration could be given to the adoption of the UNECE *Classification of International Statistical Activities* as the international standard for metadata. The September 2005 version is available at http://www.unece.org/stats/documents/ece/ces/bur/2005/5.e.pdf;

- provision of a local search engine based on free text search;

- implementing recommended practice for ensuring either the stability of URLs (Uniform Resource Locators) or providing links between the old and new URLs that will redirect users to the new address. This is a key issue given the importance of links between websites;

- providing the names of contact persons or email addresses where further information about concepts, definitions and statistical methodologies may be obtained. In some organisations the "contact" would be a generic corporate contact point or referral service for all client enquiries.

6.3.3. Adoption of a set of common metadata items

International agencies should work with national statistical agencies to develop a core set of non-domain specific metadata items (or prompt points) such as those being developed under the Statistical Data and Metadata Exchange (SDMX) initiative – refer para. 175.

6.3.4 Adoption of a common set of terminology for metadata preparation

Considerable resources are often expended by international organisations in verifying text, etc., to ensure that methodological descriptions are as consistent as possible between countries. A mechanism for achieving this would be the rigorous use of terminology imbedded in the various international statistical guidelines and recommendations. This could be facilitated by the use of glossaries published by international organisations which contain definitions derived from those standards, in particular, the *Metadata Common Vocabulary* (MCV) developed under the umbrella of the SDMX initiative

6.3.5 Unambiguous presentation of similar but not identical statistical data

Five broad recommendations of good practice in this area comprise (Friez 2003):

- Similar but different series should be given different titles to facilitate clear differentiation by users.

- International organisations that disseminate national data should always be aware of and clearly state in their metadata whether or not the precise series they disseminate that are derived from national sources are also disseminated in the country of origin, or compiled and / or transformed by national agencies specifically to meet the requirements of international organisations.

- International organisations should clearly describe in their metadata, specific details of any transformation of national data they perform to make the series more internationally comparable. Data transformed by international organisations should be clearly indicated as such, particularly, but not only where, published alongside different national series for the same statistical domain. The two sets of series must be clearly differentiated in the mind of the user.

- The precise name of the classification used in statistics disseminated by national agencies and international organisations (especially when transformed to an international classification to enhance international comparability) should always be clearly indicated (for instance, NACE Rev. 1, CITI, Main Industrial Grouping (MIG) or national classification) so that when the same denomination is used in various classifications such as intermediate goods, the user clearly knows which classification has been used.

- When a field of activity is only partially covered (such as MIG-intermediate goods or MIG-consumer goods in the new orders indicators of the European Commission's Short-term Statistics Regulation), it should be clearly indicated for instance with an asterisk or a footnote (for example, in the Eurostat's short-term statistics new orders series, MIG-non durable goods (1) - *(1) Partial ; does not include NACE 151-155, 158, 159, 16, 19, 22, 364-366*).

7.1.3 Recommended practices for data revision

7.1.3.1 Consultations with users elicit views about revisions practices

Preliminary to elaborating a country's revisions policy, it is important to consult the main users of official statistics to identify needs and priorities specific to individual countries. Their views could be sought, for example, about their particular needs for timeliness of data, problems they experience because of revisions, and their priorities about balancing timeliness with accuracy and consistency.

7.1.3.2 Provision of a clear, short readily accessible summary statements to users of when to expect revisions and why revisions are undertaken

7.1.3.3 Where possible establish a stable revisions cycle from year to year.

7.1.3.4 Balance stability of a time series against the need to revise series because of the need introduce new methodologies, concepts, classifications, etc.

7.1.3.5 Ensure that revisions are carried back several years to give consistent time series

To maintain the serviceability of data following major revisions, data should be revised back as far as is reasonable based on a balancing of user needs, costs, and availability of source data. The revised time series should be released simultaneously with the revised current data or soon thereafter, preferably in easily accessible electronic format. The revised series should be of sufficient detail and not so aggregated that users are not able to detect the sources of the changes.

7.1.3.6 Provide appropriate documentation on revisions

Such documentation should include:

- clear identification of preliminary (or provisional) data and revised data;
- provision of advance notice of major changes in concepts, definitions, and classification and in statistical methods;
- information on the sources of revision are explained when the revised series are released;
- information on breaks in series when consistent series cannot be constructed;
- information on the size of possible future revisions based on past history;

7.1.3.7 Users are reminded of the size of the likely revisions based on past history

Users should be provided with information sufficient for them to make an informed judgment about the reliability and accuracy of preliminary or provisional statistics. The following two recommended practices for revision studies have been identified:

- periodic analyses of revisions investigate the sources of revision from earlier estimates and statistical measures of the revisions;
- the analyses are published for major aggregates to facilitate assessment of the reliability of the preliminary estimates.

7.1.3.8 Transparent and timely reporting of errors and mistakes

7.2.3 Recommended practices on the presentation of series breaks

Recommended practice with regards to time series breaks entails:

- The compiling agency taking all possible steps to avoid and minimise changes to questionnaires, definitions and classifications used to collect and compile data. Methodologies should be developed to reduce the frequency of revisions.

  However, there comes a time when the time series may be disrupted even when outdated classifications, concepts and questionnaires are maintained. In such instances a complete break in series may be preferred to series that continue to be collected on the basis of outmoded classifications and concepts that do not approximate reality. There is clearly a tradeoff between costs imposed by breaking a time series on one hand and the benefits from improving the relevance of the time series on the other (BEA 1993).

- Where significant breaks in a time series are unavoidable, users should be given warning well in advance of the implementation of the series break outlining the timing of implementation and a detailed explanation of the reason(s) for the change. "In advance" is taken to mean not just the time of implemention but sufficient time to enable users to implement modifications to their systems, programmes or databases and to seek further clarification if necessary. A common practice adopted by many statistical agencies is to issue a detailed discussion paper many months in advance of the change.

- Actual breaks in the series should be clearly identified in both the statistical table and any accompanying graphs. A variety of methods are commonly used by national agencies and international organisations to highlight in tables that a series break has actually ocurred. These include the insertion of a line in the table at the break point, inclusion of a footnote or tabular presentation as an entirely new series. Whichever method is adopted, the main point is that the break is completely clear to users. Consideration will also need to be given to the identification of series breaks (together with appropriate explanatory information) in data disseminated electronically such as via on-line databases, etc.

  The following information drawn directly from Eurostat guidelines should also be provided (Eurostat 2003c, p. 16):

  - the reference period of the survey where the break occurred;
  - whether or not the difference reported is one-off with limited implications for the time series and / or if the reported change led to harmonisation with any standards;
  - a precise outline of the difference in concepts and methods of measurement before and after the series break;
  - a description of the cause(s) of the difference, *e.g.* changes in classification, in statistical methodology, statistical population, methods of data transformation, concepts, administrative procedures with regard to statistical data from administrative sources;
  - an assessment of the magnitude of the effect of the change, where possible, with a quantitative measure.

  Links and references to more detailed information should also be provided.

- Points in line graphs should not be joined across discontinuities in data. The reason for the series break should be explained in a footnote accompanying the graph with appropriate links or references to more detailed explanations of the causes of the breaks.

- When methodological changes are introduced, an attempt should be made to revise the historical series as far back as data and available resources permit. Ideally, such backcasting should extend back 2-3 years to reflect the new methodology, etc.

7.3 Presentation of information on sampling and non-sampling errors

7.3.1 Sampling errors

In the interests of data transparency, and to help ensure the appropriate use of data, statistics derived from all sample surveys should be accompanied by information on sampling errors. Such information should be provided for all dissemination media – online databases, websites, other electronic products, paper publications and press releases. It is also important for the information to be expressed in non-technical terms capable of being understood by the non-specialist user. The mode of presentation and the amount of detail provided should therefore meet the specific needs of particular categories of users (UNSD 1993, p. 176). The required information comprises the provision of the following information in accompanying or clearly linked technical notes outlining (OMB 2001, p. 3-8):

- Alerting users to the fact that data are derived from a random or non-random sample. If the latter then inference implications should be clearly stated.

- Sampling error should be identified as a source of error which should be explained and interpreted for data users through provision of a brief definition of sampling error. For example, strong warnings about the unreliability of data with high sampling error.

- Sampling errors must be presented in the context of total survey error. In this context users should be made aware of the fact that sampling error is just one, and often not the most significant, component of total error (UNSD 1993, p. 176, 7.1 (1)).

- If statistical tests are used in the report, the significance level at which statistical tests are conducted should be stated explicitly.

- Sampling errors for key estimates should be available to the user either in a table in the publication or linked on the Internet. Some form of notation should also be placed directly beside estimates with very high sampling (or non-sampling) error.

  Sampling errors may be presented in one of a number of different forms, for example:

  - as absolute values of the standard error (se);

  - as relative values, standard error divided by the estimate (rse); or

  - in the form of probability or confidence intervals.

  The preferred use of either the absolute or relative forms depends on the nature of the estimate and readers are referred to the United Nations publication, *Sampling Errors in Household Surveys* (UNSD 1993, p.178) for a detailed evaluation of the different forms of presentation and several examples of recommended practice. The UN evaluation emphasizes the importance of ensuring that the chosen method is clearly and unambiguously described and presented with accompanying definitions and notation.

In order to ensure consistency in the dissemination of this information across the organisation in all published output subject to sampling error, some statistical agencies mandate a standard set of words to be included in all relevant publications.

Where space considerations preclude the inclusion of detailed information, either references or hyperlinks to more detailed technical reports or user manuals should be provided. Such information should enable specialist users to analyse detailed data or compile new tabulations and would therefore:

- identify the specific method used for calculating the sampling error;

- provide sampling error calculations (tabulations) for different types of estimates (*e.g.* levels, percents, ratios, movements, means and medians) for a number of variables and disaggregations. The aim is to provide a basis for extrapolation to statistics for which sampling errors have not been computed by the source agency (UNSD 1993, p. 180);

- contain evaluations of the procedures used for estimating sampling errors.

7.3.2 Non-sampling errors

The focus of the recommended practice on non-sampling errors outlined below is not the methods by which national agencies minimise their impact but rather guidelines on the type of information on such errors to be reported with disseminated statistics:

- As for the reporting of information on sampling error for all sample surveys, all statistical output disseminated by national agencies and international organisations should be also accompanied by information on non-sampling errors. Such information should be accessible for statistics disseminated on all types of media – online databases, websites, other electronic products, paper publications and press releases. It is also important for the information to be expressed in non-technical terms capable of being understood by the non-specialist user. Such information should either accompany the data disseminated or be provided in clearly linked technical notes.

- Where possible, quantitative measures of non-sampling error should be provided. However, because of the difficulty in quantifying some non-sampling errors, agencies will need to disseminate a mixture of quantitative and qualitative information that enables a non-technical user to clearly understand the strengths and limitations of the data. In particular, information on non-sampling errors should clearly convey to the user the fact that such errors, either individually or in total, may have a greater impact on the reliability of the data than sampling error and that the "ready" availability of quantitative measures of sampling error is not necessarily an indication of their relative significance.

- With respect to precisely what information on non-sampling errors that should be reported, the ideal recommendation is for national agencies and international organisations to disseminate information on all of the non-observation and observation errors summarised above. The second-best option is the adoption of a more pragmatic approach which entails national agencies using their professional judgement and more detailed knowledge about the data to identify a sub-set of key non-sampling errors that have a significant impact on the reliability of the data in question. The important thing is for these agencies to develop a culture of critical appraisal of their statistical output and for key strengths and weaknesses to be documented and disseminated.

7.4.5 Recommended practices for rebasing

It is recommended that rebasing be undertaken every five years and within three years from the end of the base year.

Unless the year was "unusual" it is also recommended that the base year selected be one ending with a "0" or "5".

In order to provide sufficient transparency to users with regards to a rebase it is necessary to ensure that the following metadata accompanies any rebased data, either directly or through the provision of: appropriate references or links:

- the methodological approach adopted for the rebase, in particular, the processes actually undertaken during the rebase, *e.g.* simple rereferencing, introduction of new weights, etc.;
- the link year;
- the classification level at which index numbers are rebased and disseminated;
- the rounding policy followed in the rebasing, even though rounding should only be carried out at the very last stage for presentation purposes;
- a transition table from the old to the new classification system, if this is introduced;
- the description of any new weighting system and its impact on the aggregation of lower level indices;
- when the direct approach is adopted, a note of caution is useful to alert users that any aggregation of rebased indices needs the updating of the weights of the previous bases.

7.5.4 Recommended practices for citation

Citation of datasets

If citation of datasets is to be taken seriously, a concerted effort must be made by national agencies and international organisations to:

- Formulate and then place their data citation policy in an obvious position on websites, including the policy for the citation of data disseminated via electronic datasets. Furthermore, this policy should be accompanied by detailed sample citations to be included in specific web pages for users to copy as required. This makes it easy for users to include the correct information in the citation. The following example of this practice is from Statistics Canada's Census web module *Community Profiles* where the following citation instruction is provided at the bottom of the webpage in printer friendly format:

  > ***How to cite****: Statistics Canada. 2002. 2001 Community Profiles*
  > *Released June 27, 2002. Last modified: 2005-11-30.*
  > *Statistics Canada Catalogue no. 93F0053XIE.*

- Secondly, encourage a culture of data citation both inside and outside the organisation wherever data is being used. This awareness can be raised by contacting all known users of an organisation's data, all editors of publications known to use an organisation's data, etc., requesting that they follow the citation policy for the organisation in future publications.

A simple but effective citation style for datasets would be to include the following elements:

- unambiguous name of the dataset;
- author of the dataset;
- agency (or part of the agency) responsible for the dataset;
- date of the dataset (or version number);
- contact details for queries;
- address of the archive or other place of storage or system for accessing data;
- publisher (if this is different from the author, though for many agencies' publications the author and publisher are the same);
- if appropriate, the paragraph, table or page number.

This citation style should be followed for any data that is published internally or externally as well as for the documentation of any datasets that are created or modified. The actual ordering of the elements outlined above, punctuation, use of italics, etc., is a matter of individual (or organisational) choice.

Citation of text

The main recommendation for text citation entails the systematic use in all metadata of one of the widely accepted bibliographic reference styles listed in Section 7.5.2. The two commonly used systems for presenting references in text for a bibliography are the Harvard system and the Numeric system. It is beyond the scope of the current Handbook to outline these systems in any detail beyond outlining a number of specific areas in metadata presentation where such systems should be used. These include the provision of:

- References or source for concept or variable definitions used in all published output, *e.g.* definitions appearing in explanatory notes, glossaries, etc. At the moment it is almost impossible to identify the primary source of concept and variable definitions published by both national agencies and international organisations. In particular, it is seldom possible for the user to identify whether or not a specific definition: has been taken directly from existing international statistical standards; is a modified version adapted for a specific use (say at the national level); or an entirely new definition.
- Sufficient reference (citation) information to enable the user to readily identify the availability of more detailed information on definitions and concepts, collection methodology, etc.

An example of a clear statement of citation policy at the national level is provided in Statistics Canada's publication, *How to Cite Statistics Canada Products* (Statistics Canada 2006a), which provides examples of recommended citation practices for a wide range of statistics products: publications; data products; census products; microdata products; maps and geospatial products; and E-STAT products.

7.6.2 Recommended practices for the presentation and reporting of administrative data

Because statistics derived from administrative sources will be based on data that were not originally compiled or produced for statistical purposes and frequently by other non-statistical agencies, Statistics Canada in their policy guidelines for informing users on data quality and methodology (Statistics Canada 2000, p. 12) states that it is particularly important for such data to be methodologically transparent to users and stressed the need for such data to accompanied by the following types of metadata:

- the name of the source agency for the administrative data. If more than one agency or ministry provides the services and collates data on these (*e.g.* health or education services provided by several agencies in some countries) specific information should be provided as to whether or not the data are from all agencies, or only from the main agency or ministry;

- a precise description of the purposes for which the statistical data were originally compiled and collected by the administrative agency;

- an outline of the strengths and weaknesses of the data in terms of the statistical application of the data. Particular attention should be given to the impact of issues relating to coverage and possible coverage bias, differences in concepts from international statistical guidelines and recommendations, in particular, the use of non-standard classifications and the use of unit concepts that differ from statistical units concepts;

- a description of processing or transformation (if any) undertaken by the statistical agency following receipt of the administrative data. Such processing may attempt to reduce or minimise inherent weaknesses in the original data;

- descriptions of the reliability of the data, including adherence to international norms and standards and caveats / limitations on the statistical use(s) of the data, *e.g.* for social indicator generation.

2. STANDARDS FOR THE REPORTING AND PRESENTATION OF STATISTICS

37. This Section provides an overview of guidelines and recommendations for the reporting and presentation of statistics. Standards for the reporting and dissemination of metadata are discussed in Section 6 below. The current Section commences with an outline of relevant existing international statistical standards and the need for consistency between such standards for different statistical domains (Section 2.1). This is followed by a discussion of the relevance of national and international publishing manuals and guidelines (Section 2.2). The Section concludes with a review of international data and metadata exchange standards currently being developed under the auspices of the Statistical Data and Metadata Exchange (SDMX) initiative (Section 2.3).

2.1 Overview of relevant existing statistical standards

38. The reporting and presentation recommendations and guidelines presented in this Handbook draw on the extensive array of existing international statistical standards dealing with a broad range of economic, social and population statistical domains (such as labour force, national accounts, education, health) that have been developed by international organisations in co-operation with national agencies ((UNSD 2002a) and (Eurostat 2003b)) – refer Figure 1. The focus of these statistical domain standards are primarily conceptual and encompass definitional issues, classifications, coverage, etc., though some also outline recommended practice for the collection of data. However, in the main, international statistical standards are largely silent, or give only brief mention to a limited range of reporting and presentation issues and practices, though there are exceptions. For example:

- The European Commission's Short-term Statistics Regulation (European Commission 1998) specifies the reference period, type and form of data to be transmitted to Eurostat, *e.g.* unadjusted form, seasonally adjusted, trend-cycle, as indices, etc. However, the Regulations do not tend to go into presentation in any detail and specify the provision of data to Eurostat through file transfer. Eurostat's manual on short-term business statistics cites the need for greater harmonisation of EU Member state presentation of indices and growth rates which it believes would assist Eurostat in checking that statistics disseminated by Eurostat are consistent with nationally released series (Eurostat 2002, p. 135).

- The IMF Special Data Dissemination Standards (SDDS) (IMF 2003b), General Data Dissemination System (GDDS) (IMF 2004a) and the Fund's Data Quality Assessment Framework (DQAF) (IMF 2003c) touch on a number of key presentation issues such as the provision of metadata to enhance interpretability, coherence over time and the adoption of recommended practice for data revision. The guidelines and recommendations on data revision presented in Section 7.1 of this Handbook draw extensively and directly from text prepared by the Fund in the context of the SDDS and IMF Reports on the Observance of Standards and Codes (ROSC).

- The work of METIS on the presentation of statistical metadata on the Internet and terminology on statistical metadata published by the United Nations (UN) in 2000 (UNSC and UNECE 2000 and 2000a). This work, together with other related initiatives at the international level, are discussed below in Section 6 in the context of international metadata standards.

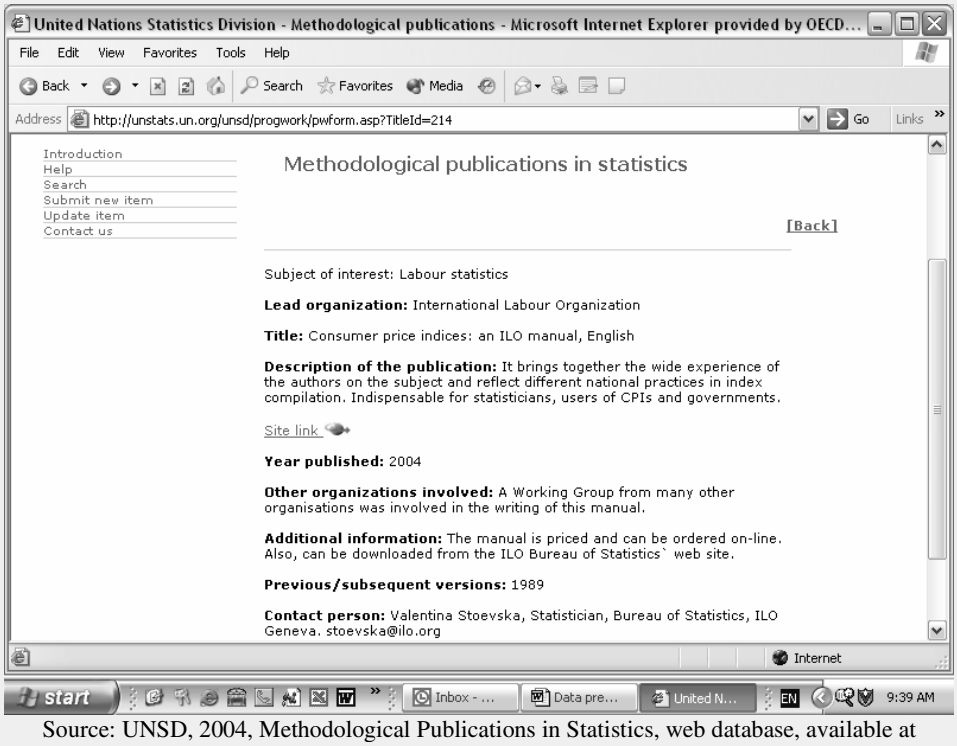
- Work undertaken by the Committee for the Coordination of Statistical Activities (CCSA) on rebasing and citation prepared by the United Nations Conference on Trade and Development (UNCTAD) and the United Nations Educational, Scientific and Cultural Organisation (UNESCO) respectively in 2003, and presented below in Sections 7.4 and 7.5.

Figure 1: United Nations Statistical Divisions Methodological Publications in Statistics website

The Methodological Publications in Statistics website was created by the United Nations Statistical Division (UNSD) at the request of the United Nations Statistical Commission (UNSC) in 1999. The website contains statistical standards (including classifications) across all statistical domains that have been developed by international organisations, in addition to those under development and planned. The website database is updated more or less annually and all international organisations are requested to provide the required information.

International organisations contributing to the database include: Commonwealth of Independent States, Economic Commission for Europe, Eurostat, Food and Agriculture Organisation of the United Nations, IMF, International Civil Aviation Organisation, International Labour Organisation, OECD, UNESCO, United Nations City Groups, Universal Postal Union, UNSD, World Bank, World Health Organisation, World Tourism Organisation.

The following information is provided in the database for each of the methodological guidelines and recommended guidelines listed: name of lead organisation; other organisations involved in the development of the standard (if any); formal title of the standard; brief description of the contents of the standard; year published; previous or subsequent version(s) of the standard. In some instances a hyperlink is provided to a site containing a complete electronic version of the standard.



Source: UNSD, 2004, Methodological Publications in Statistics, web database, available at http://unstats.un.org/unsd/progwork/pwabout.asp

39. The current Handbook provides a single comprehensive reference source for presentation and reporting guidelines, etc., standards drawn from all the specific standards listed above and from other existing international statistical guidelines and recommendations. It also provides a focus for the evolution of new standards on topics / issues not adequately covered in those standards at the moment. The recommendations and practices included this Handbook could either be imbedded in future international statistical standards for specific statistical domains, or be linked to it.

2.1.1 Need for consistency between different international statistical standards

40. Over the last 10 to 15 years more emphasis has been given to the linkages between international standards that have been developed for different statistical domains in order to ensure conceptual and terminological consistency, etc. Examples of such linkages include the interface between: 1993 System of National Accounts (SNA 93) and the Balance of Payments Manual, Version 5 (BPM5); SNA 93 (Chapter XVII, population and labour inputs) and the relevant International Conference of Labour Statistician (ICLS) Resolutions on employment; and the recently published manuals on consumer price indices and producer price indices. This process will continue as guidelines for emerging statistical domains (such as services, and information and communication technologies) are developed or existing standards (such as the 1962 ICLS Resolution on working time measurement) are revised to maintain their relevance to current circumstances. Again, this Handbook could be used as a resource to ensure consistency between international standards in the area of data and metadata presentation and reporting.

2.1.2 Recommended practices to ensure consistency in presentation and reporting practices included in future international statistical guidelines and recommendations

41. It is recommended that the authors of future international statistical guidelines and recommendations for various statistical domains take a more modular approach in the preparation of those standards by using, as required, existing international recommendations in key areas such as the reporting and presentation practices outlined in this Handbook and terminology and definitions presented international glossaries such as the *Metadata Common Vocabulary* (MCV) described in Section 6.3.4 below. Such use may take the form of either the direct incorporation of text within future guidelines or by reference / link to the recommendations in this Handbook, etc.

2.2 National and international publishing manuals and guidelines

42. Almost all agencies at both national and international levels have publishing manuals containing technical guidelines that touch on a very wide range of issues such as corporate standards concerning data presentation, layout of tables, graphs, maps, fonts and type faces, etc., for use by internal authors involved in the preparation of both paper and electronic statistical dissemination. In the main, such manuals tend to focus on corporate policy on the publication preparation process and data and metadata presentation to help ensure that disseminated output comply with a set of professional standards. They are also designed to ensure that the range of output disseminated by the organisation have a common look and feel.

43. However, such manuals also frequently deal with some of the reporting issues covered in this Handbook such as data revision, citation, presentation of sampling and non-sampling errors, etc. Ideally therefore, key elements of international guidelines on data and metadata reporting included in this Handbook should also be imbedded in publishing manuals at both the national and international levels and/or be linked to it.

44. Although some of the guidelines and practices included in publishing manuals prepared by both national agencies and international organisations may be relevant only in the context of a specific institution or country, the desirable objective of increasing the transparency of internal publication guidelines and processes to external view would be achieved if these manuals were placed on the Internet. This could either be in their entirety or parts of the manual not containing sensitive / confidential policy or procedures deemed inappropriate for transmission outside the organisation. At the moment, only a very small number of such manuals are accessible to external readers via the web.

2.2.1 Recommended practices for publication manuals

45. There are two recommended practices for publication manuals:

In the interests ensuring consistency in the presentation of data disseminated across different paper publications and electronic media within an organisation, it is recommended that each statistical agency compile a publishing manual or set of guidelines providing guidance to author areas within the organisation.

- The content of such a manual will of course be determined largely by corporate priorities and resources available for implementation, though it should at a minimum provide clear guidance on issues relating to: the presentation of statistics in tables (including practices for titles, use of footnotes, etc.) and graphs; the use and presentation of growth rates and seasonally adjusted data; citation; and recommended practices for data revision, presentation of series breaks, provision of information on sampling and non-sampling errors and the presentation of administrative data.

- Not all these issues are within the scope of the present Handbook. The recommendations for those issues that are, are summarised above in Section 1.2.3. Where appropriate, publication manuals could also include links and references to the recommendations in this Handbook.

- It is also recommended that statistical agencies place such publication manuals and guidelines in the public domain by locating them on their websites. This would give greater transparency and external scrutiny to internal practices and provide a means of disseminating recommended practices to organisations in other parts of the national statistical system.

2.3 Data and metadata exchange standards

2.3.1 Overview of data and metadata exchange processes and mechanisms

46. There are a number of processes and mechanisms for the exchange of data and metadata between different organisations, and as mentioned in Section 1.1.2 above, a number of initiatives at the national and international levels are currently underway which are aimed at improving data and metadata exchange efficiency. Three kinds of exchange can be identified (SDMX 2005, p. 2), according to the number of partners and the nature of agreements between those partners:

- *Bilateral exchange*: Comprise situations where all aspects of the exchange process are agreed between the partners, including the mechanism for exchange of statistics and metadata, formats, frequency or schedule, and the mode used for communications regarding the exchange. This is perhaps one of the most basic process patterns.

- *Gateway exchange:* Gateway exchange is an organised set of bilateral reporting, in which several statistics and metadata sending organisations or individuals agree to exchange the collected

information with each other in a single, known format, and according to a single, known process. This pattern has the effect of reducing the burden of managing multiple bilateral exchanges (in statistics and metadata collection) across the sharing organisations/ individuals. This is also a very common process pattern in the statistical area, where communities of institutions agree on ways to gain efficiencies within the scope of their collective responsibilities.

- *Data-sharing exchange:* Comprise situations where organisations use standards to allow their statistics and metadata to become available to any organisation that has permission to access them. This requires adherence to certain data and metadata publication standards (some of which may involve registering the existence of the data and metadata in an electronic catalogue). This model does not mandate a pre-defined agreement, but requires that statistics and metadata providers and consumers adhere to the standards.

47. In the context of these three forms of exchange, data can be reported or accessed in two different modes - push or pull:

- *Push mode* means that the party who provides the data takes the necessary action to send the data to the party collecting the data. This can take place using different means, such as e-mail or file transfer, and in some cases the transfer can be supported by systems such as Eurostat's Stadium and Statel. These are the "traditional" modes of data collection, as carried out by international organisations for many years.

- *Pull mode* implies that the data provider simply makes the data available on a server. The data collector fetches the file on his / her own initiative. In this case, more than one data collector may be allowed to take the pieces of data needed by each collector. This mode also resembles dissemination in the sense that access might be given to final users of information, who will then, according to their needs, access multiple web sites all using the same formats. The pull mode requires adherence to the standards demanded by the data sharing exchange and can also be used within organisations via intranets or between organisations using secure extranets.

48. The key initiative currently underway at the international level that will impact on the imperatives driving the need for the articulation of data and metadata reporting standards described above is the Statistical Data and Metadata Exchange (SDMX) project. This initiative would benefit either directly or indirectly from the development and adoption (by international organisations and national statistical agencies around the world) of a common set of data reporting practices. Furthermore, as stated in Section 1.1.2 above, the data reporting standards described in this Handbook are key elements of the implementation of the data sharing model, the aims of which are to:

- avoid duplication and enhance efficiency in the transfer of data between systems whilst at the same time reducing the reporting burden of national agencies; and

- ensure the consistency of data disseminated by different international organisations.

49. International initiatives on metadata standards also seek to enhance the interpretability of statistics presented to users. Finally, although issues surrounding the presentation of micro-data are not dealt with in any detail in this Handbook, the Data Documentation Initiative (DDI) outlining metadata standards for such statistics are described briefly in Section 6.4 below.

2.3.2 Statistical Data and Metadata Exchange (SDMX) initiative

50. Statistical Data and Metadata Exchange (SDMX) is an international co-operation initiative aimed at developing standards and the employment of more efficient processes for the exchange and sharing of statistical data and metadata among international organisations and their member countries. The initiative commenced in 2001 and is sponsored by seven international organisations: Bank for International Settlements (BIS), European Central Bank (ECB), Eurostat, International Monetary Fund (IMF), OECD, United Nations (UN) and the World Bank.

51. The rationale of SDMX is standardisation for statistical data and metadata access and exchange. With the ever increasing ease of use of the Internet, the electronic exchange and sharing of data is becoming easier, more frequent and important. This heightens the need for the development of a set of common standards for exchange and sharing of statistical data and metadata, and for making processes more efficient. As statistical data exchange takes place continuously, the gains to be realized from adopting common standards are considerable both for data providers and users.

52. The objective is to establish a set of commonly recognised standards, adhered to by all players, making it possible not only to have easy access to statistical data, wherever these data may be, but also access to metadata that makes the statistics more meaningful and usable. The standards are envisaged to help national organisations to fulfill their responsibilities towards users and partners, including international organisations, more efficiently. Among other things they are seen as facilitating use of Internet-accessible databases in order to be able to retrieve data as soon as they are released. Several quality dimensions can also be improved through the use of SDMX standards, such as timeliness, accessibility, interpretability, coherence, as well as cost-efficiency.

53. SDMX is currently developing two sets of outputs – technical standards and content-oriented guidelines:

- *Technical standards:* The specifications of the SDMX standard formats build on the specifications of the GESMES (Generic Statistical Message) UN/EDIFACT standard and, more specifically, on the subset of GESMES named GESMES/TS (TS for time series). This latter standard has been successful in standardising several statistical data flows. SDMX-EDI is fully conformant with GESMES/TS, safeguarding investments in this format, and can easily be transformed into SDMX-ML, which uses XML syntax. In addition, SDMX standards contain guidelines for the development of web services.

  SDMX (Version 2.0) technical standards have been published and are available for use for the exchange of statistics and structural metadata. These standards are backward compatible with the earlier Version 1.0 technical efforts, which focused on XML- and EDIFACT-syntax data formats within a common information model. Version 2.0 broadens the technical framework to support wider coverage of metadata exchange as well as a more fully articulated architecture for data and metadata exchange. Steps will also be taken to bring this work forward within the context of the International Organisation for Standardisation (ISO), with a view to updating ISO/Technicial Specification 17369:2005 SDMX.

- *SDMX content-oriented guidelines*: Focus the technical standards on broader benefits that can follow from commonalities across and within statistical domains. The draft guidelines disseminated for public comment early in 2006, cover cross-domain metadata concepts, a list of statistical subject-matter domains (building on previous work in this area by the UN) and the *Metadata Common Vocabulary* (which can help foster better understanding of terminology used within SDMX standards).

54. These standards and guidelines are designed to support all combinations of the data and metadata exchange modes described in Section 2.3.1 above, with significant opportunities for efficiency gains flowing from the implementation of data sharing that relies on the pull mode of exchange. More detailed information about the SDMX initiative is available on the SDMX website (www.sdmx.org)

2.3.3 SDMX implementation projects

55. As part of the SDMX initiative a number of projects are advancing the use of SDMX standards. In mid-2006 these included:

- Joint External Debt Hub (JEDH);
- National Accounts World Wide Exchange (NAWWE);
- SDMX Open Data Interchange (SODI);
- Joint UN / OECD trade project (ComTrade);
- Dissemination of euro area statistics – ECB and euro area national central banks;
- IMF Metadata Repositories Project

56. Information on the current status of these and other SDMX implementation projects are also available on the SDMX website.

3. IMPORTANCE OF USE OF COMMON TERMINOLOGY

3.1 Introduction

57. A major factor complicating the development of international reporting and presentation standards has been the use of inconsistent terminology by different countries (and international organisations); agencies in the same country; and parts of the same organisation. The use of inconsistent labels for the same concept frequently leads to misunderstanding by users and the risk of inappropriate use of statistics. Indeed, issues of terminology are a common thread in much of the discussion in many of the Sections of this Handbook.

58. Problems associated with the inconsistent application of terminology also apply more generally to the actual preparation of metadata text containing definitions, and outlining national practices for data collection, transformation and the dissemination of statistics. Such inconstancies severely limit the use of much existing metadata in comparing national concepts and practices.

59. Users of statistics often comment on different terminologies used to describe the same thing in different publications and databases, and point to instances where individual databases contain different definitions for the same concept. There are two ways of looking at this: the first is to say that because so many institutions use slightly different definitions or terms to describe the same phenomenon, it is acceptable to use different terms interchangeably. The second approach is to say that terminology should be consistent across institutions so that the question of ambiguity does not arise. This Handbook emphasizes the second approach.

60. There are also differences in the impact that ambiguous and unclear terminology have on different users with varying statistical knowledge and expertise. While the general public may not understand what is meant by say, "sampling error", informed users will probably have a reasonable understanding of the term. Even if they do not have such an understanding, glossaries such as the *OECD Glossary of Statistical Terms* (OECD 2002a) contain definitions that can explain terms of interest only to the more informed users of statistical data.

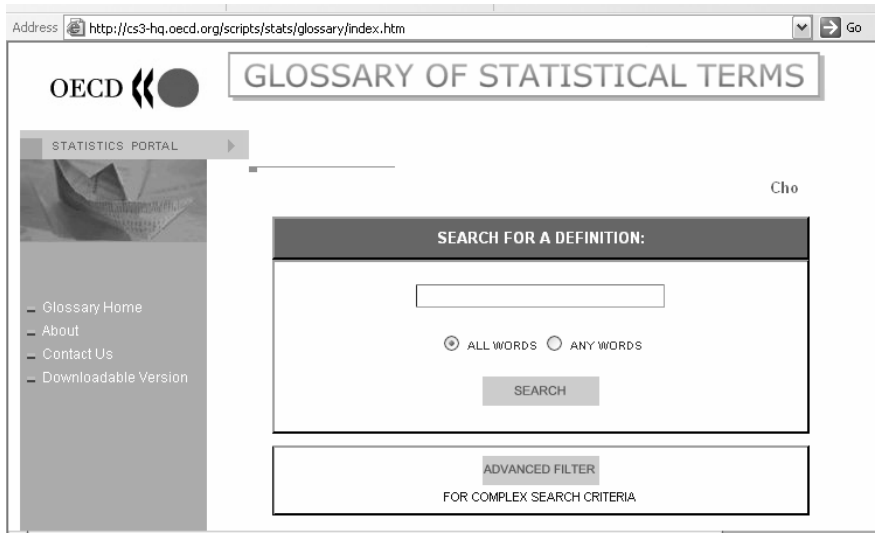
3.2 Glossary systems

61. In recent years the importance of national agencies and international organisations adopting common definitions for variables, concepts, etc., based on international statistical standards has received greater recognition as a precondition for the compilation and dissemination of comparable statistics. As mentioned above, there is also a similar need to adopt common terminology in the preparation of metadata that can be used to compare national practices and concepts. To promote the use of common terminology and an understanding of concepts and definitions many national and international organisations have compiled glossaries that provide definitions of key concepts and statistical domain specific variables, etc. However, in the main these glossaries have been domain (or issue) specific and as a result there are many instances of different and inconsistent definitions being disseminated in multiple glossaries containing the same concepts within the one organisation and country.

62. To help overcome this problem, a number of international organisations have developed extensive glossary databases containing definitions of key terminology and variables covering a wide

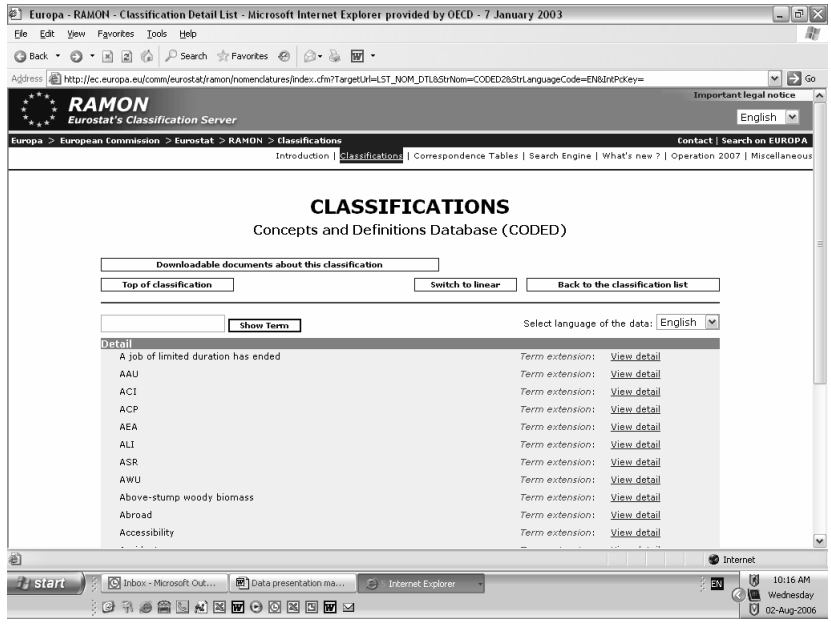
range of statistical concepts, etc. The *OECD Glossary of Statistical Terms* is one example of such a glossary database, though others have been developed by Eurostat (the *Eurostat Concepts and Definitions Database* (CODED)) (Eurostat 2006a) (refer Figure 2) and the United Nations Statistical Division (UNSD 2002b). Similarly, an extensive range of concepts and definitions dealing primarily with population statistics have been assembled by the United Nations Development Group for indicators to be used for monitoring the Millennium Development Goals (refer UNDG 2003)[10]. The definitions included in each of these glossary databases have, by and large, been drawn from existing international statistical guidelines and recommendations and cover economic, social and population statistics.

Figure 2: Home pages for the OECD Glossary of Statistical Terms and the Eurostat Concepts and Definitions Database (CODED)



Source: OECD Glossary of Statistical Terms, available at www.oecd.org/std/glossary

[10] Refer http://www.developmentgoals.org/ and Section 4.5 below for further information on indicators for the Millennium Development Goals.



Source: Eurostat Concepts and Definitions Database (CODED), available at http://ec.europa.eu/comm/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_NOM_DTL&StrNom=CODED2&StrLanguageCode=EN&IntPcKey=

63. The process of compiling these extensive glossary databases has entailed the confrontation of inconsistent definitions covering the same concept that previously resided in different glossaries with narrower domain coverage. The extensive glossary databases developed by the OECD, Eurostat and UNSD also facilitate the preparation of overlapping sub-glossaries covering more specific statistical domains with consistent definitional content. For example, in the OECD context, the *OECD Glossary of Statistical Terms* can be used to derive a number of sub-glossaries, including the:

- *Metadata Common Vocabulary* (MCV) being developed in the context of the Statistical Data and Metadata Exchange (SDMX) initiative;

- System of National Accounts (SNA) Glossary;

- Data and Metadata Reporting and Presentation Glossary provided in the Annex of this Handbook.

These sub-glossaries often contain the same terminology. For example, many of the definitions in the Annex are also to be found in the MCV.

64. As mentioned in Section 2.3.2 above, the MCV is one of the SDMX content-oriented guidelines and is being developed as a tool to help ensure the consistency of metadata prepared by authors at national and international levels, with respect to both the content and the range of methodological issues covered by the metadata. The MCV is designed to include the range of metadata terms and items used in the different metadata models that have been developed by national and international agencies. In the context of the SDMX project, particular care is being taken to ensure MCV coverage of terms used in the metadata dissemination models that have been developed by international organisations such as Eurostat, European Central Bank, IMF and the OECD. The MCV is also intended to be relevant for metadata models developed by national agencies. The MCV is referred to again in Section 6.3.4 below in the context of guidelines for the reporting and dissemination of metadata.

65. Finally, some national statistical agencies and international organisations are taking their use of corporate glossary databases a step further by integrating them into their corporate data and metadata environments that are currently being developed, as a tool for terminology management to reinforce the use of standard concepts and definitions in data collection questionnaires and disseminated output.

3.3 Terminology management

66. Terminology management is an essential element of an organisation's metadata management system, and entails the:

- formulation of a common set of terminology, names and descriptions for standard metadata elements to improve communication across an organisation. It also involves the development of common terminology for metadata elements across all processes in the statistical life-cycle.

- The development of a set a unified concepts requires input from various parts of a statistical organisation including managers, designers, subject matter statisticians and methodologists, as well as from key external stakeholders such as data providers (respondents) and users of an organisation's statistical information system (ABS 2006).

- formulation of processes and procedures for on-going maintenance and updating and rules governing the use of the common set of terminology and the introduction of "new" concepts, etc.; and

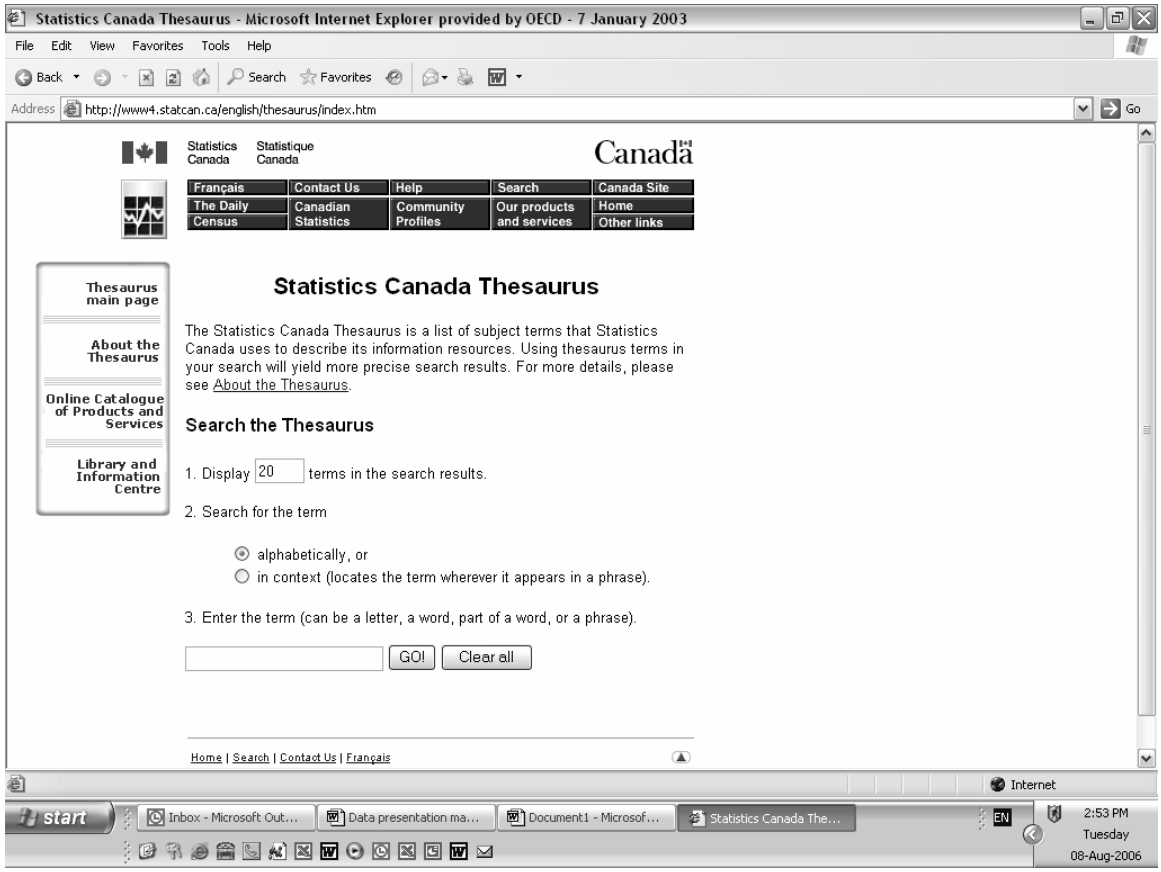
- the development of the required tools such as a thesaurus for the storage and retrieval of those concepts.

67. Over the last few years a number of national and international organisations have developed thesauri which are semantic tools used for the management of a controlled vocabulary, *i.e.* an established list of standardised terminology for use in the indexing and retrieval of information[11]. A controlled vocabulary ensures that a subject will be described using the same preferred term each time it is indexed and this will make it easier to find all information about a specific topic during the search process. When developing an agreed set of definitions and terminology consideration should be given to the adoption national and international terminology standards.

68. Using a thesaurus improves search results. It includes information about the relationships of words and phrases (*i.e.* broader terms, narrower terms, preferred terms, non-preferred, or related terms). A thesaurus is normally restricted to a specific subject field (*e.g.* health, education, government documents). Searchers can use terminology they are familiar with to find the most relevant information (Statistics Canada 1996) – refer Figure 3 below.

[11] The UNSC / UNECE *Terminology on Statistical Metadata* defines a thesaurus as "A controlled set of terms covering a specific domain of knowledge formally organised so that the *a priori* relationships between concepts are made explicit (UNSC and UNECE 2000a)

Figure 3: Statistics Canada Thesaurus



Source: Statistics Canada, n.d., *Statistics Canada Thesaurus*, Ottawa, Statistics Canada, available at http://www4.statcan.ca/english/thesaurus/index.htm

69. A number of international standards have been developed on terminology management, thesauri and other related structures. These include those developed under ISO/IEC 11179 (in particular, Part 5) (ISO/IEC n.d.); by the Object Management Group (OMG n.d.); and the World Wide Web Consortium (W3C n.d.)[12].

3.4 Data reporting and presentation terminology

70. As mentioned above, the adoption of common terminology by national agencies and international organisations is also an important element of the data reporting and presentation recommendations embodied in the following Sections of this Handbook. Where appropriate, recommended definitions and terms are provided (in information "boxes") in some Sections to ensure a common understanding of the concepts and issues described. Issues of terminology are particularly

[12] Other international standards include: ISO 704 (Terminology work – Principles and Methods); ISO 1087-1 (Terminology work – Vocabulary – Part 1: Theory and Application); ISO 12620 (Computer applications in terminology – Data categories); ISO/IEC FCD 24707 (Information Technology – Common Logic (CL) – A framework for a family of logic-based languages); ISO/IEC 19763 (Information Technology – Framework for metamodel interoperability – Part 3: Metamodel for ontology registration); ISO/IEC 13250 (Topic maps); ISO 2788 (Guidelines for the establishment and development of monolingual thesauri); ISO 5964 (Guidelines for the establishment and development of multilingual thesauri); Simple Knowledge Organisation System (SKOS) (W3C n.d.); Resource Description Framework (RDF) (W3C n.d.); OWL Web Ontology Language (W3C n.d.); Ontology Definition Metamodel (ODM) (OMG n.d.); Semantics of Business Vocabulary and Business Rules (SBVR) (OMG n.d.).

important in the discussion of growth rates (Section 4.4) and in guidelines for the reporting of different forms of time series data (Section 5).

71. A comprehensive consolidated Glossary of key data presentation terms is provided in the Annex below. This Glossary includes the source of each definition and in some instances further context information. The definitions in this Glossary are also available in the *OECD Glossary of Statistical Terms* referred to above.

3.5 Recommended practices to ensure the use of consistent terminology and definitions

72. The issue of the use of consistent terminology and definitions in relation to the preparation of metadata is taken up in more detail in Section 6 of this Handbook. The recommended practices outlined below are primarily designed to minimise the current common practice of different author areas within national and international organisations developing their own, often inconsistent, sets of terms and related definitions. Even where differences in terminology are appropriate there is still a need to provide users with information about the context / reasons for such differences.

73. Agencies should therefore:

- Establish a terminology management strategy and associated structures appropriate to their needs, requirements and resource capacity to reduce the use of inconsistent terminology and related concepts by the different author areas in the organisation which in turn are applied in various questionnaires and disseminated output.

- There are a range of options available to achieve this objective. These include the creation of a corporate thesaurus which can be readily accessed by different parts of the organisation and in which existing inconsistent definitions for the same term are confronted and differences either eliminated or explained. Where possible, definitions applied at the national level should align with international definitions, modified as appropriate to provide further elaboration and / or to meet national circumstances.

- Irrespective of the tool(s) adopted (glossaries, thesauri), there is still the need for senior management within an organisation to ensure that appropriate practices and principles involving the use consistent terminology are developed and adopted across the organisation.

- Ensure that any thesaurus developed by an agency contains the minimum structures outlined in existing international guidelines such as those formulated by the ISO, OMG and W3C.

- Corporate glossaries should contain the following in order to facilitate their interoperability: concept label; definition; detailed source information about where the definition was derived; related terms; and context field providing additional information or highlighting how a definition is used within one statistical domain or geographical context. Finally, the glossary should also be translated into various languages used by the institution in question.

- Provide appropriate cross references or links in domain specific glossaries, on Internet or intranet sites to general glossary databases that have been developed either at the national or international levels, the purpose being to make existing standard terms and definitions more readily available.

- Avoid attaching precisely the same label or title for different definitions (for further discussion refer Section 6.3.5 below).

4. GUIDELINES FOR THE REPORTING OF DIFFERENT TYPES OF DATA

74. This Section outlines guidelines for the reporting of the main different types of data. Those covered in this Handbook comprise: original data (Section 4.2); indices (Section 4.3); growth rates (Section 4.4); and ratios, proportions, percentages and rates (Section 4.5). Definitions of the main terminology used in the Section are provided in a number of information boxes.

4.1 Introduction

75. The presentation and reporting of the appropriate type of data, together with the different form of data, is essential to ensure correct use and analyses of the economic, social or population statistics in question. It is the responsibility of the statistician to select the type and form of data appropriate to both the data on hand and the audience of users. Furthermore, some forms of presentation are perhaps more suited to specific methods of data dissemination. For example, the method appropriate for a comprehensive on-line database may not be at all suitable for a press release containing only a limited number of key statistical aggregates. The form and type of data selected should therefore be presented appropriately, if necessary with accompanying metadata, in order to minimise the possibility of misrepresentation by users.

76. The main types of data are original data (some times referred to as "raw data"), indices, growth rates, rates, ratios and percentages. Other types of data in common use are composite indicators, survey balances, and spatial data[13] where variances of regional indicators are calculated. Discussion in this Section of the Handbook is restricted to original data and the main forms of transformation of such data, namely indices, growth rates, rates and ratios. Section 5 below provides guidelines for the presentation of different forms of time series data. The main aim of the data transformations listed above is to facilitate the drawing of main features and generalisations out of a mass of original data. However, as will be shown below, it is necessary to use the most appropriate form of transformation (*e.g.* growth rate, rate, ratio) and to provide adequate information about its calculation or derivation to minimise the risk of misleading users.

4.2 Original data

77. Original data in the context of this Handbook refers to statistical information that has not undergone any transformation. As mentioned in the Introduction to this Handbook, original data may be either stock series which are measures at a point in time (for example, a money supply stock series which refers to money supply on the last working day of the reference period) or flow series which comprise measures during periods of time (for example, passenger car registrations where an estimate for a reference month is the sum of daily car registrations). Indices, growth rates and ratios, etc., are further transformations of original data where the precise treatment differs depending on whether such data are stock or flow series.

78. Original data may be expressed in terms of either physical units (tonnes, cubic metres, gigajoules) or value at current or constant prices. Raw, or data initially collected at source by direct survey or derived from administrative sources, are often expressed initially in terms of original data. The compilation of indices, growth rates, etc, are viewed as further transformation to enhance understanding and appropriate analyses.

[13] Refer Glossary in the Annex of this Handbook for definitions of these three types of data.

79. The main strength of original data (UNEP 2002) is that they provide users with a sense of scale or relative magnitude about the phenomenon being measured and its contribution to an overall effect. The provision of original data enable users to:

- consistently track data;
- aggregate data to derive a total measure; and
- undertake transformations other than those originally presented.

80. In many instances original data will therefore be the most appropriate type of statistical information. On the other hand, the normalisation or standardisation of statistical data through the compilation and presentation of ratios, indices and growth rates, facilitate analysis of change over time, comparisons of change between similar or dissimilar original data or processes, and information on the efficiency, intensity or quality of a value or achievement. Furthermore, in situations where data are known to have significant non-sampling errors (refer Section 7.3) the presentation of original data could be misleading and it may be more appropriate to provide results in the form of percentages. For example, in situations where there is known under enumeration of total business units in a population it could be better to present the number of units in different size classes as a percentage instead of as original data. Similarly, key measures in economic and social statistics may also be expressed in the form of percentages of total GDP.

81. The focus of this Section of the Handbook is not on how original data should be presented in tables or graphs, which are generally dealt with in publication manuals (referred to in Section 2.2 above), but with the decision on whether or not such data should be presented in lieu of, or in addition to, other types of data in different forms of dissemination media.

4.2.1 Recommended practices for original data

- The availability of original data affords maximum flexibility for users interested in undertaking further analysis or transformation beyond how it is presented in the data source on hand. Therefore, users should have access to at least some of the key aggregates of original data where they exist for a particular series, either directly in the publication or through the provision of references or hyperlinks. The provisions under which access to detailed original, confidentialised data is given would be governed by the organisation's dissemination policy.

- In situations where original data are known to have significant non-sampling errors, appropriate metadata should be provided to facilitate appropriate use of the data. In such instances consideration should also be given to the presentation and use of other types of data such as percentages in any analyses of main features.

- Original data are frequently transformed into growth rates or indices, for example, in a press release to facilitate interpretation and understanding. Ideally, original data should be presented in addition to the transformed series. However, this may not be possible in some dissemination media due to space considerations and in this situation it would be sufficient to provide a clear indication of their availability and how they could be accessed.

4.3 Indices

4.3.1 Introduction

82. Indices are commonly indicators of relative change which show the extent of change in prices and/or quantities of a given commodity or commodity group in relative terms from a base period to the comparison period (Statistics Finland 2003)[14]. As this definition states, the extent of change over time in quantities or prices may reflect those of an individual commodity or a collection or group of different commodities that have been aggregated or combined in some way. Analysts monitoring economic activity are more often interested in the latter and the most commonly used indexes for short-term economic monitoring are aggregate indices such as industrial production, retail volume, consumer price, etc. Such indices are typically weighted averages of either price or quantity ratios.

83. The Statistics Finland *Quality Guidelines* disseminated in English on their website states that the focus of the compilation of key indices for short-term economic analysis is the aggregation of individual series, the weights used, the maintenance of those weights and procedures used to take account of changes in the commodity composition and changes in quality. A detailed exposition of these issues is beyond the scope of this Handbook[15] whose focus is the presentation of appropriate information about the index to enable users to assess its relevance to their particular requirement(s).

4.3.2 Recommended practices for indices

84. The Statistics Canada Policy on Informing Users of Data Quality and Methodology (Statistics Canada 2000, Section E.3) states that the provision of an adequate description of characteristics and methodologies specific to indices is as important to users as quality assessments of the data. Statistics Canada therefore recommends the provision of the following metadata:

- precise definitions of the underlying economic concepts the indices are intended to measure. Specific mention should be given to any limitations in the use or application of the index, citing the example of deflation of macro-economic aggregates; and

- descriptions of the methodologies used in the compilation of the index, with particular reference to the:

    - index calculation methods entailing the choice of index formula (*e.g.* Laspeyres, Paasche, Fisher) and the strategy for constructing the index series (*i.e.* as either fixed base or chain indices);
    - weighting system used, weight revision practices and frequency of weight revision;
    - computation at various aggregation levels;
    - selection of base year;
    - frequency of re-basing;
    - procedures for linking indices;

[14] Strictly speaking, this definition is quite narrow as there are indices other than those that make comparisons over time, notably indices that make: spatial comparisons such as purchasing power parities (PPPs); inter-firm comparisons; or comparisons among individuals. Furthermore, there are variables other than prices and quantities that can be expressed as indices.

[15] The Statistics Finland Quality Guidelines provides a small list of references for further information on index theory in the Bibliography to their guidelines on indicators and indices (Statistics Finland 2003).

- treatment of changes in the composition of commodities in the market as well as changes in quality.

The methodologies applied should be compared with underlying index concepts and the impact of departures described.

85. Finally, as much of the above information is of specific interest to specialised users, consideration should be given to having differing levels of information targeted to different kinds of users. The guidelines for the reporting and dissemination of metadata provided in Section 6 below emphasize the desirability of structuring metadata appropriately for users with differing degrees of expertise and need.

4.4 Growth rates

4.4.1 Introduction

86. Growth rates (or rates of change) express the change in value or magnitude of a time series between two or more different periods of time. For this reason growth rates are often included in press releases, analyses and media reports concerning economic activities (such as movements in prices, output or unemployment, etc.) and in social phenomena such as population growth (or decline). Both national agencies and international organisations use a wide variety of different forms of growth rates in their disseminated output.

87. The main issues for growth rates from the perspective of data reporting and presentation entail the use of inconsistent terminology by different agencies to label the different types of rates, and the appropriate use of specific forms of growth rate in different circumstances. Although there may not be an absolutely "correct" form of growth rate, there are instances where some forms are more appropriate than others. Most forms of growth rate can be useful depending on the specific needs of analysts.

88. Recent work by the OECD Short-term Economic Statistics Working Party (STESWP)[16] task force on data presentation and seasonal adjustment sought to identify recommended practice for the use of growth rates for different short-term economic indicators or analyses. The task force also formulated recommendations on terminology for growth rates used in economic statistics. Issues examined in the context of growth rate presentation include (Eurostat 2002a, p. 135):

- the form of the data, *i.e.* whether or not the data are working day adjusted, seasonally adjusted or trend-cycle;

- whether such rates should be based on a given period or should the data be smoothed, for example, through the use of a moving growth rate of the latest three months over the three months before;

- the time horizon that should be referred to. For example, should comparisons be made in relation to quarter-on-previous quarter growth rates (Q_t/Q_{t-1}) or for year-on-year growth rates (M_t/M_{t-12} or Q_t/Q_{t-4})?

89. As will be shown in Section 5, the form of data (seasonally adjusted, trend-cycle, etc.) and the time horizon are closely linked.

[16] Formerly the OECD Short-term Economic Statistics Expert Group (STESEG)

90. As outlined in the *Growth rate terminology* information box presented below, growth rates are frequently expressed in terms of a rate of change over the previous year, quarter, month, etc., for which the terms "month-on-previous month", "quarter-on-previous quarter" and "annual" growth rates are applied. For some phenomena, for example, human population growth, each of these growth rates may be further differentiated by the nature or pattern of the incremental difference between each successive period, and whether or not the values of these increments over a given period are themselves constant or changing. The most commonly used patterns of growth are: arithmetic, geometric and exponential (Rowland 2003). These growth rates are important elements of population statistics where attempts are made to derive a mathematical model that accurately reflects the rate of growth (or decrease) in human populations. The main attributes of these patterns of growth described by Rowland (2003) are summarised below.

- Arithmetic growth occurs when the annual (or quarterly, monthly) growth rates or change commonly used in economic, social and population statistics increase (or decrease) by a constant amount in each succeeding time period being analysed. Arithmetic change results in a linear trend, following a straight line rather than a curve when graphed. Although not commonly used for describing actual human population change, arithmetic growth rates are nevertheless commonly used in demographic and other analyses, *e.g.* the presentation of *average annual increases*.

- Geometric growth on the other hand refers to the situation where successive changes in a population differ by a constant ratio (as distinct from a constant amount for arithmetic change). In geometric growth, incremental changes in population become larger, as increases (or decreases) are said to be "self-reinforcing". The compilation of monthly, quarterly, or annual interest payments using a compound interest formula is an example of the use of geometric change.

- Exponential growth refers to the situation where growth compounds continuously at every instant of time. Because compounding takes place at intervals much longer than an instant, Rowland (2003, p. 51) refers to geometric growth as being a "special case" of exponential growth. When graphed, an exponential graph shows a smooth curve without steps between increments because the change is continuous.

91. Measures of human population growth based on geometric and exponential growth are commonly used, each yielding similar results where either the time interval is short or the rate is within the typical range for national populations (Rowland 2003, p. 61). Variations of both the geometric and exponential growth rate formulae are derived for calculating end-of-period populations and initial populations.

4.4.2 Recommended terminology for growth rates

92. As mentioned above, there is considerable inconsistency in the labels attached to the various forms of growth rates by different agencies, particularly with respect to "annual growth rates", "annualised growth rates", "year-on-year change". In order to minimise the risk of misunderstanding a set of standard growth rate terminology is presented below. These relate to growth rates in common use for the presentation of economic, social and population statistics. The definitions are also presented in the Glossary in the Annex.

Growth rate terminology		
Recommended terminology	**Definition** (M_t denotes the value of a monthly time series in month *t* and Q_t the value of a quarterly time series in quarter *t*.)	**Context**
Year-on-year (YoY) growth rates	Year-on-year growth rates are rates of change expressed over the corresponding period (month or quarter in relation to the frequency of the data) of the previous year. Such rates are expressed as (M_t/M_{t-12}) -1 or (Q_t/Q_{t-4}) -1.	Also often referred to as Year-over-year growth rates, Year-to-year growth rate, Rate of change from the previous year, or 12-month rate of change.
Year-on-year changes	Year-on-year changes are changes in levels expressed over the corresponding period (month or quarter in relation to the frequency of the data) of the previous year. Such changes are expressed as M_t-M_{t-12} or Q_t-Q_{t-4}	Also often referred to as Year-over-year changes, or Year-to-year changes.
Month-on-previous-month growth rates	Month-on-previous-month growth rates are rates of change expressed with respect to the previous month. Such rates are expressed as (M_t/M_{t-1}) -1.	Also often referred to as Month-to-month (Period-to-period) growth rates, Month-over-month growth rates, 1-month rate of change, or Rate of change on the previous month. For some phenomena, month-on-previous-month growth rates may be further differentiated by the nature or pattern of the incremental difference between each successive period and whether or not the values of these increments over a given period are themselves constant or changing. The most commonly used patterns of growth are: arithmetic, geometric and exponential – refer below
Month-on-previous-month changes	Month-on-previous-month changes are changes in levels expressed with respect to the previous month. Such rates are expressed as M_t-M_{t-1}.	Also often referred to as Month-to-month (Period-to-period) changes, or Month-over-month changes.
Quarter-on-previous-quarter growth rates	Quarter-on-previous-quarter growth rates are rates of change expressed with respect to the previous quarter. Such rates are expressed as (Q_t/ Q_{t-1}) - 1.	Also often referred to as Quarter-to-quarter (Period-to-period) growth rates, Quarter-over-quarter growth rates, 1-quarter growth rates, or Rate of change on the previous quarter. For some phenomena, quarter-on-previous quarter growth rates may be further differentiated by the nature or pattern of the incremental difference between each successive period and whether or not the values of these increments over a given period are themselves constant or changing. The most commonly used patterns of growth are: arithmetic, geometric and exponential – refer below
Quarter-on-previous-quarter changes	Quarter-on-previous-quarter changes are changes in levels expressed with respect to the previous quarter. Such rates are expressed as Q_t - Q_{t-1}.	Also often referred to as Quarter-to-quarter (Period-to-period) changes, or Quarter-over-quarter changes.
Annual growth rates	Annual growth rates are annual rates of change expressed over the previous year. Such rates are expressed (in terms of an arithmetic growth rate) as (Y_t/Y_{t-1}) -1.	It should be noted that for some phenomena, annual growth rates may be further differentiated and expressed by the nature or pattern of the incremental difference between each successive period and whether or not the values of these increments over a given period are themselves constant or changing. The most commonly used patterns of growth are therefore: arithmetic, geometric and exponential – refer below

Growth rate terminology		
Recommended terminology	**Definition** (M_t denotes the value of a monthly time series in month *t* and Q_t the value of a quarterly time series in quarter *t*.)	**Context**
Annual changes	Annual changes refer to annual changes in levels expressed over the previous year. Such changes are expressed as Y_t-Y_{t-1}.	
Annualised growth rate (Annualised rate of change)	Annualised growth rates (Annualised rate of change) show the value that would be registered if the quarter-on-previous-quarter or month-on-previous-month rate of change were maintained for a full year. Such rates are expressed as $((Q_t/Q_{t-1})^4)$-1 for quarterly data and $((M_t/M_{t-1})^{12})$-1 for monthly data. Annualised growth rates attempt to facilitate comparison of data for different time periods (*e.g.* years and quarters). However, because the impact of any irregular is magnified, use of this form of growth rate presentation is not recommended, especially as the key headline series.	In addition to the compounded form of the Annualised growth rate presented here, the term "Annualised growth rate" is sometimes used to describe the quarterly or monthly growth rate multiplied by four or twelve. Multiplying the quarterly or monthly growth rate by four or twelve is more appropriately referred to as "Linear approximation of the annualised growth rate" – refer below. Some agencies use the expression "1-month rate of change, annualised", etc., for such rates.
Linear approximation of the annualised growth rate	Linear approximation of the annualised growth rate is a quick calculation of the annualised growth rate that show the rate of change that would be measured for a quarter or month if maintained for a full year. Quarterly rates of change are multiplied by 4 and monthly rates of change are multiplied by 12. Such rates are expressed as $4*([Q_t-Q_{t-1}]/Q_{t-1})$ for quarterly data or $12*([M_t-M_{t-1}]/M_{t-1})$ for monthly data. Such rates attempt to facilitate comparison of data for different time periods (*e.g.* years and quarters). However, because the impact of any irregular is magnified, use of this form of growth rate presentation is not recommended, especially as the key headline series.	
Annualised semi-annual growth rate	Annualised semi-annual growth rates show the value that would be registered if the rate of change measured with reference to two quarters or six months behind were maintained for a full year. Such rates are expressed as $((Q_t/Q_{t-2})^2)$-1, $((M_t/M_{t-6})^2)$-1. Annualised semi-annual growth rates attempt to facilitate comparison of data for different time periods (*e.g.* years and quarters). However, because the impact of any irregular is magnified, use of this form of growth rate presentation is not recommended, especially as the key headline series.	
Arithmetic growth	Arithmetic growth refers to the situation where a variable increases by a constant [amount in terms of the] number of persons (or other objects) in each period being analysed. In general terms an arithmetic growth rate may be expressed as: $\left(\frac{Xn - Xo}{n}\right) \div Xo \times 100$	Arithmetic growth rates may take the form of annual growth rates, quarter-on-previous-quarter growth rates or month-on-previous-month growth rates – see above.

Growth rate terminology		
Recommended terminology	**Definition** (M_t denotes the value of a monthly time series in month t and Q_t the value of a quarterly time series in quarter t.)	**Context**
	Where X_o = variable at the start; X_n = variable at the end; n = number of intervals between X_o and X_n (Rowland 2003)	
Geometric growth	Geometric growth refers to the situation where successive changes in a variable differ by a constant ratio (as distinct from a constant amount for arithmetic change). In general terms a geometric growth rate may be expressed as $$\sqrt[n]{\frac{Xn}{Xo}} - 1$$ Where X_o = variable at the start; X_n = variable at the end; n = number of intervals between X_o and X_n (Rowland 2003, p. 62)	Geometric growth rates may take the form of annual growth rates, quarter-on-previous-quarter growth rates or month-on-previous-month growth rates – see above. The geometric growth rate is applicable to compound growth over discrete periods, such as the payment and reinvestment of interest or dividends. Although continuous growth, as modelled by the exponential growth rate, may be more realistic, most economic phenomena are measured only at intervals, in which case the compound growth model is appropriate. As with the exponential growth rate, the geometric growth rate does not take account intermediate values of the series. (World Bank 2004, p. 363)
Exponential growth	Exponential growth refers to the situation where growth compounds continuously at every instant of time. Because compounding takes place at intervals much longer than an instant, geometric growth is regarded as being a "special case" of exponential growth. In general terms an exponential growth rate may be expressed as $$\frac{In\left(\frac{Xn}{Xo}\right)}{n}$$ Where X_o = variable at the start; X_n = variable at the end; n = number of intervals between X_o and X_n; In = natural logarithm. (Rowland 2003, p. 65)	Exponential growth rates may take the form of annual growth rates, quarter-on-previous-quarter growth rates or month-on-previous-month growth rates – see above. The exponential growth rate is the growth rate between two points in time for certain indicators, notably labour force and population. This growth rate is based on a model of continuous exponential growth between two points in time. It does not take into account the intermediate values of the series. Nor does it correspond to the annual rate of change measured at a one-year interval, which is given by: $(X_n - X_{n-1})/X_{n-1}$ (World Bank 2004, p. 363)
Least-squares growth rate	The least-squares growth rate, r, is estimated by fitting a linear regression trend line to the logarithmic annual values of the variable in the relevant period. The regression equation takes the form: $\text{In } X_t = a + bt$ Which is equivalent to the logarithmic transformation of the compound growth equation, $X_t = X_o(1 + r)^t$ In this equation X is the variable, t is time, and a = In X_o and b = In $(1 + r)$ are parameters to be estimated.	Least-squares growth rates are used whenever there is a sufficiently long time series to permit a reliable calculation. No growth rates are calculated if more than half the observations in a period are missing. (World Bank 2004, pp. 362-363)

Growth rate terminology		
Recommended terminology	**Definition** (M_t denotes the value of a monthly time series in month *t* and Q_t the value of a quarterly time series in quarter *t*.)	**Context**
	If b^* is the least-squares estimate of b, then the average annual growth rate , r, is obtained as [exp(b^*) – 1] and is multiplied by 100 for expression as a percentage. The co-efficient b* is also directly interpretable as the average exponential growth rate for the series *X*. No transformation is needed for this. The calculated growth rate is an average rate that is representative of the available observations over the entire period. It does not necessarily match the actual growth rate between any two periods. (World Bank 2004, pp. 362-363)	

93. In addition to the adoption of a consistent and unambiguous set of terms and related definitions that describe the different types of growth rates (such as those presented above), it is also recommended practice for statistical institutes to develop a consistent set of expressions when referring to changes in year-on-year (YoY) or quarter-on-previous-quarter / month-on-previous-month growth rates for use in text, such as that contained in press releases. An example of the development of such terminology is recent work undertaken by Statistics Netherlands (Nieuwstad & Algera 2005) to develop recommendations for the appropriate use of the expressions "increased" / "decreased" and "higher" / "lower" to describe changes in annual and infra-annual growth rates.

94. For YoY rates the expression "increased" (or "decreased") could provide misleading implicit information about the month-on-previous-month rate developments of an index over the entire "in-between period", *i.e.* that <u>all</u> such growth rates are equal to or greater than zero. On the other hand, preferred use of the term "higher" (or "lower") by Statistics Netherlands avoids this problem as it does not give any implicit information about month-on-previous-month growth rates for the "in-between period. On the other hand, there is no "in-between" period for month-on-previous-month growth rates and use of the terms "increased" / "decreased" is preferred by Statistics Netherlands to prevent confusion with the presentation of YoY rates.

95. The important issue raised in the Netherlands initiative is the need for a statistical agency to develop a consistent (and unambiguous) set of expressions for use in text to describe changes in growth rates, and then to apply those expressions consistently both within the same press release and in other press releases disseminated by the same organisation.

4.4.3 Recommended practices for the reporting and presentation of growth rates

96. The OECD task force referred to above undertook a comprehensive review of the issues involved in the presentation of the different types of growth rates for short-term indicators in the dissemination of indicators in press releases and in tables posted on the websites of statistical agencies, etc. Any particular rate of change can be useful depending on the needs of a specific analyst. The focus of task force investigations was the identification of the most suitable way(s) of presenting economic indicators to the general public, in order to prevent misunderstandings in their reading of economic events. The recommendations prepared by the task force for the presentation of growth rates are presented below in Section 5.6 in the context of the recommendations of different forms of data used in time series analyses. The types of growth rates covered in these recommendations comprise:

- rate of change with respect to previous period;
- the use of annualised growth rates; and
- rates of change with respect to the same period of the previous year.

97. However, the two key recommendations with respect to growth rate terminology entail the need for statistical agencies to:

- minimise the risk of user misunderstanding of the growth rates being applied through the consistent use of growth rate terminology and the provision of definitions such as those provided in Section 4.4.2 above in accompanying metadata; and
- develop a consistent (and unambiguous) set of expressions for use in analytical text to describe changes in annual and infra-annual growth rates and to apply those expressions consistently both within the same press releases and in other press releases disseminated by the same organisation.

4.5 Ratios, proportions, percentages and rates

4.5.1 Introduction

98. A ratio is a single number that expresses the relative size of two other numbers. They are used widely in social and population statistics[17] for analysing the composition of a set of events and are usually calculated for subgroups of a population. Examples of such ratios include: sex ratio; ratio of average female wage to male wage; primary school enrolment ratio; house price to income ratio; etc. A proportion is a special type of ratio in which the denominator includes the numerator. A percentage is a special type of proportion where the ratio is multiplied by a constant, 100, so that the ratio is expressed per 100 (Palmore and Gardner 1994).

99. Ratios, and percentages are used for analysing the composition of a set of variables or events of a population. On the other hand, a rate refers to the occurrence of events over a given interval in time and are commonly used to analyze the dynamics of change in social and population statistics. Rates are measures that reflect the frequency of an event relative to the population that may experience that event (McManus 2004). Rates may be presented either as a proportion or percentage of a total population (*e.g.* adult literacy rate as a percentage of the adult population aged 15 years and over) or where the total population is expressed as unity (*e.g.* number of births per 1 000 population). Examples of such rates include: unemployment rate; birth rate; death rate; net migration rate; total fertility rate; adult literacy rate; infant mortality rate; net reproduction rate.

100. The relationship between ratios, proportions, percentages, rates, etc., is summarised below in a typology taken directly from Palmore and Gardner (1994).

[17] The term "demography" refers to the study of the size, distribution, structure and growth (or decline) of populations. In order to incorporate other characteristics of the population such as ethnic, health, social and economic characteristics, the term "population statistics" has been used in this Handbook in lieu of the term "demographic statistics". (Siddiqui 1999)

Terminology for ratios, proportions, percentages and rates		
Recommended terminology	**Definition**	**Context**
Ratio	A ratio is a number that expresses the relative size of two other numbers. The result of dividing a number *X* by another number *Y* is the ratio of *X* to *Y*, *i.e.*: $\frac{X}{Y}$ = ratio of *X* to *Y*	
Proportion	A proportion is a special type of ratio in which the denominator includes the numerator. An example is the proportion of deaths that occurred to males which would be deaths to males *(X)* divided by deaths to males plus deaths to females *(Y)*, (*i.e.* $X/(X+Y)$.	More common usage of the term "proportion" is in the context of a portion or part in its relation to the whole (OED 1989).
Percentage	A percentage is a special type of proportion where the ratio is multiplied by a constant, 100, so that the ratio is expressed per 100.	
Percentage change	A percentage change on the other hand refers to a change from one period to another expressed as a percentage of its value in the first of the two periods.	However, when numbers expressed as percentages are subtracted from each other the result is a <u>percentage point difference</u> and not a percentage change.
Rate	A rate refers to the occurrence of events over a specific interval in time. Similarly, a rate refers to the measure of the frequency of some phenomenon of interest given by: Rate = $\frac{\text{number of events in a specified period}}{\text{average population during the period}}$ (Everitt 1989) The term "rate" can also be used in the context of a proportion.	Caution must be used with the term "rate" as it is sometimes applied to ordinary percentages such as a "literacy rate" which is the percentage of a population that is literate, and an "unemployment rate" which is the percentage of unemployed persons of a labour force population. Different constants (commonly 100, 1 000, 100 000) are used in the presentation of different rates (*e.g.* crude death rates and crude birth rates are usually expressed per 1 000). Palmore and Gardner (1994) recommend that when calculating a rate to proceed without the use of a constant until the final answer is derived and then use the constant to express the rate per 100, 1 000 or whatever is the usual constant for that type of rate.
Probability	A probability is similar to a rate, the difference being that the denominator comprises all those objects in a given population at the beginning of the period of observation. For example: If 10 people die in one year out of a population of 1 000 at the start of a year, the probability of dying during that year was 10/1 000, or 0.01000.	On the other hand the denominator of a rate is frequently the average or mid-period population exposed to the event in question.

Source: Palmore and Gardner 1994, Ch. 2

101. Ratios, proportions, percentages and rates are frequently used to compare events both over time and between countries and are widely used in statistics published by United Nations agencies. For example, the extensive set of indicators for monitoring the United Nation's Millennium Development Goals (refer UNDG 2003) contains many of these types of data transformations.

102. A key source of component series used for the derivation of ratios, rates, etc., commonly used in population statistics are registration data for vital events such as births and deaths and other administrative sources for information on migration, health, education, etc. In countries where civil registration of vital events is incomplete, especially in rural areas, key demographic information are obtained from on-going population surveys and periodic population censuses – refer information box below.

Data sources for component series used in the derivation of rates and ratios

There is often a serious gap between quantitative information essential for estimating demographic rates and ratios (*e.g.* mortality and fertility) in countries and the amount and quality of the data actually available. Countries are making serious efforts to establish registration of births and deaths, while collecting vital statistics from surveys in the interim.

The basic, or direct method, for estimating rates and ratios from surveys is through a retrospective enquiry about birth histories of women of reproductive age and a series of detailed questions. The major problem with this method is the accuracy of reported dates and numbers, especially among older women in the sample. Indirect methods for estimating fertility and mortality were developed to counter this problem. It is based on questions regarding children ever born and children surviving, asked of all women of reproductive age. Methods described in Brass 1975 and UNSC 1983 are applied to these data to estimate period rates 5 or 10 years preceding the survey. Estimates of infant and child mortality and life expectancy at birth require application of model life tables.

The indirect "sisterhood" method for estimating maternal mortality is based on four questions asked of all adults in the household being canvassed (how many sisters, how many alive and dead, and deaths during pregnancy, childbirth or six months post-partum). The approach is analogous to the well established Brass technique for estimating child mortality based on children ever born and surviving.

103. In order to facilitate the comparison of rates, ratios, percentages, etc., for two or more different geographic areas (regions, countries, etc.) it is necessary to "standardise" data to remove the impact of differences in the composition of extraneous variables. Palmore and Gardner (1994, p. 20) refers to the process of removing or controlling the effects of these other variables that could "confound" the comparison. These authors cite the example of a comparison of crude death rates of two populations if they had exactly the same age distribution but each retained their own age-specific death rates. The comparison would hold constant or control the impact of different age distributions in the two populations so that any differences in death rates would result from actual differences in specific mortality rates, rather than differences in the age variable.

104. Rates, ratios or percentages compiled for population statistics could need to control for differences in a range of extraneous variables used in the composition of rates, etc., for two or more different populations. These include differences in urban or rural residence, occupations, income distributions, gender, marital status. The control of similar differences is also relevant in other fields of statistics such as economic statistics. Examples of standardisation processes are given in Palmore and Gardner (1994, p. 21).

4.5.2 Recommended practices for the presentation of ratios, proportions, percentages and rates

105. The main issues for the presentation of and ratios centre around the provision of appropriate methodological information (metadata) describing both the actual rates / ratios and, the component series used in their derivation. Precision is required in the provision of information for the user about the time period referred to, the nature of the population being described and the type of occurrence being measured (Palmore and Gardner 1994). More specifically:

- the term "rate", "percentage", or "ratio" should be included in the actual label, *e.g.* maternal mortality rate, crude death rate, etc., to ensure user understanding that the original data has been transformed;

- for rates where the total population is expressed as unity the unit of measurement used in the population should be included in the table heading for the rate, *e.g.* per 1 000 live births;

- the series labels in the components that make up the rate or ratio should be based where possible on existing international terminology. These are generally outlined in the international guidelines and recommendations for the relevant statistical domain (refer UNSD 2002a) or glossary databases disseminated by international organisations such the OECD's *Glossary of Statistical Terms* (OECD 2002a); the Eurostat *Concepts and Definitions Database* (CODED) (Eurostat 2006a), or UNSD's *Definitions for United Nations Common Database* (UNSD 2002b). Departures from international concepts should be documented in the metadata accompanying the rate / ratio;

- detailed information about the source(s) of the component series used in the derivation of the rate or ratio should be provided. Minimum information comprises: type of data source (administrative, household survey or census, business survey or census), reference period, full official title of the series, full name of the source agency or institution;

- users should have access to the original data used in the derivation of the rate / ratio. This could be included in the body of the publication where the rates or ratios are disseminated (*e.g.* as annex tables) or through the provision of sufficient reference information or hyperlinks that will enable users to access the original data;

- users should be provided with information on methodologies used in the compilation of the component series used in the derivation of the rate / ratio. The quality (in particular, comparability both over time and between countries) of the rate or ratio is only as good as the quality of the series used in its calculation, and appropriate metadata is therefore essential to enable users to form an understanding of quality and relevance of the rate /ratio for a particular need or purpose.

The final issue involves the need to standardise extraneous variables used in the compilation of ratios, proportions, rates, etc. As mentioned above in Section 4.5.1, such standardisation is necessary to enable the comparison of ratios, etc. between countries, regions, etc., and in some instances over time in the same geographic area.

5. GUIDELINES FOR THE REPORTING OF DIFFERENT FORMS OF TIME SERIES DATA

106. This Section outlines a set of guidelines for the reporting of the main different forms of time series data. Those covered in this Handbook comprise: working day adjusted data; seasonally adjusted data; and trend-cycle data. A brief introduction describes a number of issues on the debate at national and international levels on the most appropriate forms of time series data to present to users in various types of dissemination media, in particular, the presentation of "headline" series in press releases, etc. This is followed by an outline of key terminology (in Section 5.2) and a brief description of each of the main forms of data (Sections 5.3 to 5.5) outlined above. The Section concludes with a set of recommendations for the reporting of different forms of time series data (Section 5.6).

5.1 Introduction

107. The different forms of time series data discussed in this Handbook are: raw (or original) data; working day adjusted; seasonally adjusted; and trend-cycle estimates. There is a wealth of references about the compilation of the different forms of data, and a detailed explanation of methodological issues arising out the different approaches to, for example, seasonal adjustment, is outside the terms of reference of this Handbook. The focus of this Section is therefore restricted to issues surrounding the reporting and presentation of the different forms of data, and the brief introduction below is merely intended as a lead in to those issues.

108. The main reason for compiling high frequency series such as monthly or quarterly indicators is to form a time to monitor level changes and the volatility of those series over time. Time series are of interest to analysts because they are useful for the identification of the position of the economy (or specific sectors) over the business cycle and, more specifically, with respect to turning points in those cycles. In the context of sub-annual statistics an original time series (also known as "raw data") may be decomposed into three basic components:

- *Trend-cycle*: Is the underlying path or general direction reflected in data over the longer term, *i.e.* the combined long-term (trend) and medium-to-long-term (cycle) movements in the original series.

- *Seasonal variations*: Include seasonal and other systematic effects. Seasonal effects are reasonably stable in terms of annual timing, direction and magnitude. The causes of such effects are natural factors, administrative or legal measures and social traditions. Other effects on time series may be due to variations in the number of working days or trading days in a period, or events that occur at regular intervals such as pay days for large groups of employees, pension payments, etc. Both the seasonal and other effects represent persistent, predictable calendar-related effects.

- *Irregular variations*: Comprise effects that are very often unpredictable in terms of timing, impact and duration. These may be the result of sampling and non-sampling errors (refer Section 7.3 below), non-seasonal weather changes, natural disasters, strikes and socio-economic changes.

109. It should be emphasized that seasonally adjusted and trend-cycle estimates represent an analytical massaging of the original time series. Furthermore, there is to some extent a degree of

subjectivity in the choice between the various options available for the estimation of trend-cycle and seasonally adjusted series. Both seasonally adjusted and trend-cycle estimates complement the original data and can never replace the original series. The non-seasonally adjusted data shows the actual changes that have taken place (subject to the impact of sampling and non-sampling errors) and the seasonally adjusted and trend-cycle estimates represent an analytical elaboration of the data showing the underlying developments (IMF 2001, para. 8.12). The various packages available for seasonal adjustment or trend-cycle analysis will not remove any underlying deficiencies that may be inherent in the basic data[18]. Such elaborations should therefore not be built into the original data compilation process but should be undertaken after the original data has been compiled.

110. In their *Quarterly National Accounts Manual – Concepts, Data Sources, and Compilation*, the IMF further states that the estimation of seasonally adjusted data exclusively represents a loss of seasonal information to the user. Furthermore, there is no unique solution on how to conduct seasonal adjustment and that seasonally adjusted data are also subject to revisions as future data becomes available even where the original series are not revised. Finally, the IMF states that although errors in source data may be more readily detected in seasonally adjusted series, identification of the source of the error and their correction may be easier through working with unadjusted data (IMF 2001, para. 8.12).

111. Finally, there is continuing debate among statisticians as to which is the most appropriate form for the presentation of a time series to users – original , seasonally adjusted or trend-cycle. The outcome of the discussion is that there is generally no absolute ideal, and as will be discussed below, the final choice depends on the media for the dissemination of data and the main focus or intent of the series. For the former, dissemination of detailed data via an on-line database would imply the availability of original series which affords maximum flexibility to users, whereas dissemination of more aggregated and headline series in a press release would involve the presentation of seasonally adjusted or trend-cycle series, perhaps in addition to original series.

112. The choice between the presentation of seasonally adjusted and trend-cycle estimates depends on whether the intention of the agency disseminating the data is to place more attention on the underlying movement of the time series or on movements and incident variation. If the former, trend-cycle estimates for year-on-year data would be the preferred form. If the focus is on period-to-period changes in the most recent data then seasonally adjusted estimates would be preferred. Here again, there are no absolutes and to a large degree the underlying "dissemination philosophy" of the agency is an important influence in the final choice.

5.2 Terminology

113. The following terminology for terms relating to different forms of time series data are provided in order to ensure a common understanding of the concepts described in subsequent Sections of this Handbook. The terminology presented flows largely out of recent work by the OECD Short-term Economic Statistics Working Party (STESWP) task force on data presentation and seasonal adjustment.

[18] Such as deficiencies in coverage, classifications and definitions, collection practices, compilation practices.

Key terminology relating to time series analysis		
Recommended terminology	**Definition**	**Context**
Time series	A time series is a set of regular time-ordered observations of a quantitative characteristic of an individual or collective phenomenon taken at successive, in most cases equidistant, periods / points of time.	In the context of sub-annual [infra-annual] statistics, a time series (TS) can be decomposed into unobservable components. In the most complete case, these components are the trend (T), the cyclical (C), the seasonal (S) and the irregular (I) components. The four components of the time series may each be independent of all the others, in which case the behaviour of the time series is simply the sum of `the components which are additively related (*i.e.* TS = T+C+S+I). However, most analysts believe that it is unlikely that the time series components are perfectly independent of each other, and are therefore more likely to be multiplicatively related (*i.e.* TS=T*C*S*I).
Trend component of a time series	The trend is the component of a time series that represents variations of low frequency in a time series, the high and medium frequency fluctuations having been filtered out. This component can be viewed as those variations with a period longer than a chosen threshold. Usually, 8 years is considered as the maximum length of the business cycle.	The trend is normally referred to as the long-term movement in a cyclical context (*i.e.* the trend variations have a longer period than the maximum duration of the business cycle). In practice, statistical agencies do not estimate the trend but rather focus on the trend-cycle component (see Trend-cycle). There is no international consensus involving the preferred use of the terms "fluctuation" or "variation". Common usage of the former term is in the context of a rise or fall in number or amount, and the latter in terms of changes or slight differences in amount or level, typically within certain limits. In the main, the term "variations" has been used in this Handbook.
Trend-cycle	The trend-cycle is the component that represents variations of low frequency in a time series, the high frequency fluctuations having been filtered out. This component can be viewed as those variations with a period longer than a chosen threshold. Usually, 1½ years is considered as the minimum length of the business cycle.	In practice, statistical agencies estimate the trend-cycle by estimating and removing the seasonal and irregular components from the original non-adjusted data.
Cyclical component of a time series	The cyclical component of a time series refers to (regular or periodic) fluctuations around the trend, excluding the irregular component, revealing a succession of phases of expansion and contraction. The cyclical component can be viewed as those fluctuations in a time series which are longer than a given threshold, *e.g.* 1½ years, but shorter than those attributed to the trend.	
Seasonal component of a time series	The seasonal component is that part of the variations in a time series representing intra-year fluctuations that are more or less stable year after year with respect to timing, direction and magnitude.	The seasonal component is also referred to as the seasonality of a time series. The seasonal component reflect "normal" variations that recur every year to the same extent, *e.g.* weather fluctuations that are representative of the season, length of months, Christmas effect.

Key terminology relating to time series analysis		
Recommended terminology	**Definition**	**Context**
Calendar effects component of a time series	The calendar effects component is that part of the seasonal component which represents calendar variations in a time series, such as trading days / working days, moving holidays and other calendar effects (such as leap year). The effects of the normal length of a month are assigned to the seasonal component.	The calendar component is often slightly moving and may disturb the stability of the seasonal component.
Irregular component of a time series	The irregular component of a time series is the residual time series after the trend-cycle and the seasonal components (including calendar effects) have been removed. It corresponds to the high frequency fluctuations of the series.	The irregular component results from short term fluctuations in a series which are not systematic and in some instances not predictable, *e.g.* uncharacteristic weather patterns. Some irregular effects can however be expected in advance, *e.g.* changes in value added tax. In a highly irregular series, these fluctuations can dominate movements, which will mask the trend and seasonality. (ABS)
Seasonal adjustment	Seasonal adjustment is a statistical technique to remove the effects of seasonal (including calendar) influences operating on a series. Seasonal effects usually reflect the influence of the seasons themselves either directly or through institutional factors or social conventions.	Other types of calendar variation occur as a result of influences such as the number of days in the calendar period, the accounting or recording practices adopted or the incidence of moving holidays (such as Easter and Chinese New Year).
Seasonally adjusted time series	Seasonally adjusted time series are series that have been adjusted for seasonal variations, including trading-day (working-day) effects and other regular calendar variations if present.	
Seasonally adjusted component of a time series	The seasonally adjusted component is the result of the extraction of the seasonal component (including the calendar effects component) from a time series. If neither seasonal nor calendar influences are present in the original data, the seasonally adjusted series is given by the original data. For series with no identifiable seasonal variations but with identifiable calendar variations, the seasonally adjusted series is given by the calendar adjusted series.	Trading / working day corrections are alternative ways to normalise the time series.
Calendar adjustment	Calendar adjustment refers to the correction for calendar variations. Such calendar adjustments include working day adjustments or the incidence of moving holidays (such as Easter and Chinese New Year).	The terms “calendar adjustment” and “working day adjustment” (also known as “trading day adjustment”) are often used interchangeably. However, the main difference between the two terms is that working day adjustment is merely one type of calendar adjustment. Each variable has its own specific calendar adjustment. For example, “shopping day” adjustment for consumer expenditure or retail trade series. The length of month effect is assigned to the seasonal component because it happens year after year in the same period with the exception of leap year effects.
Working / trading day adjustment	Working day or trading adjustments refer to the correction for differences in the number of working or trading days in a given month or quarter which differ	The number of working or trading days in a given month or quarter can vary significantly for each statistical domain (*e.g.* production,

Key terminology relating to time series analysis		
Recommended terminology	**Definition**	**Context**
	from year to year which will impact upon the level of activity in that month or quarter for flow series or the sort / type of day for stock series. In most countries working day adjustment and trading day adjustment are used as synonyms.	merchandise trade) because of differing institutional arrangements, trade specific holidays, etc.). Some countries also include bridging effects in working day adjustments. These result from people taking holidays, for example, on Mondays and Fridays when an official public holiday occurs on Tuesdays and Thursdays respectively. The type of working / trading day adjustment carried out needs to be tailored to the cultural and institutional environment operating within individual countries. In the United States, for example, working day adjustment classifies the days of the week into workdays (Monday through to Friday) and non-workdays (Sat. and Sun.) and thus the seasonal adjustment estimates two factors – workday and non-workday. Trading day adjustment (as performed in the US at least) allows for a different effect for each day of the week and computes seven factors – a Monday factor, a Tuesday factor and so on. Essentially, trading day adjustment is a more fine tuned seasonal adjustment method to account for calendar variation. In other countries there may be very distinct differences between workdays and non-workdays in the amount of business conducted, but not so much difference between Mondays, Tuesdays, through to Fridays. The US on the other hand, has different distinct patterns of activity each day of the week and methods used in that country try to account for that difference.
Moving holidays	Moving holidays are holidays which occur each year, but where the exact timing shifts. Examples of moving holidays include Easter and Chinese New Year. Easter generally falls in April but it can also fall in late March.	Also known as variable holidays
Moving average	A moving average is a method for smoothing time series by averaging (with or without weights) a fixed number of consecutive terms. The averaging "moves" over time, in that each data point of the series is sequentially included in the averaging, while the oldest data point in the span of the average is removed. In general, the longer the span of the average, the smoother is the resulting series.	Moving averages are used to smooth fluctuations in time series or to identify time series components, such as the trend, the cycle, the seasonal, etc. A moving average replaces each value of a time series by a (weighted) average of p preceding values, the given value, and f following values of a series. If $p = f$ the moving average is said to be centered. The moving average is said to be symmetric if it is centered, and if for each $k = 1, 2, \ldots, p = f$, the weight of the k-th preceding value is equal to the weight of the k-th following one. The moving average is not defined for the first p and the last f time series values. In order to compute the moving average for those values, the series must be backcasted and forecasted.

5.3 Working day adjusted data

114. Many monthly time series contain variations which result from calendar-related systematic effects that are not regular in annual timing and are caused by variations in the calendar from year to year. Such calendar variations include (IMF 2001, para. 8.7):

- trading day effects which result from variations from year to year in the number of working days or trading days and the week day composition of a particular month or quarter relative to the "standard" for that particular month or quarter[19]. Such differences arise from factors such as the number of Saturdays and Sundays in a month[20]; and

- the effects of events that occur at regular intervals but not necessarily at the same time each year such as official holidays and regional official holidays, in particular, moving holidays such as Easter, Chinese New Year and Ramadan. Other similar events include paydays for large groups of employees, pension payments, etc.

115. Variations due to both these factors can have a significant impact on a time series and may obscure important movements in the series and should be adjusted for. However, working day and trading day effects are part of the overall seasonal variation in a time series and any adjustment of a series for them should be regarded as an integral part of the seasonal adjustment process and not as a separate process (IMF 2001, para. 8.30). In terms of timing, working day adjustment is normally undertaken prior to the seasonal adjustment of a series.

5.4 Seasonally adjusted data

116. Most infra-annual time series show intra-year variations which recur regularly every year, possibly slowly evolving, though normally stable with respect to timing, direction and magnitude. In order to gain insight into the current developments measured by a seasonally varying time series, it is necessary to correct it for these regularly repeating intra-year variations. For example, if a monthly time series decreases every July because of holidays, there is little to be gained by noting that it decreased once more last July as it always does. Analysts are interested in whether the last decrease itself was larger or smaller than usual, furthermore, the removal of regularly repeating seasonal effects from a time series also facilitates geographic and sectoral comparisons.

117. Another issue concerning analyses of time series subject to seasonal influences is that of obtaining statistically meaningful comparisons of different periods within the same year; for example, comparing January sales levels to say that of September. Seasonal variations, irrespective of their causes, are a reflection of the fact that each period has its own basis of comparison across the years that differ from those of the other periods. Hence, direct comparisons of periods of the same year for seasonal time series is not meaningful in say a press release where the focus of the discussion for many agencies is on the most recent data. Hence the need for seasonal adjustment.

118. There are numerous seasonal adjustment methods which vary in sophistication. At one end is the simple year-on-year change (or percentage change), and at the more sophisticated end are techniques such as X-12 RegARIMA (Findley *et al*. 1998), Tramo-Seats (Gomez and Maravall 1996), BV4.1 (German Federal Statistical Office 2006), SABL (Cleveland, Dunn and Terpenning 1978),

[19] Stock series should not experience trading day effects as such series only measure the level of activity at a certain point in time and therefore are not affected by how many trading days there are in a given period of time (ABS 2003).

[20] Note that the length of month effect is assigned to the seasonal component – refer to "Calendar adjustment" in Key time series terminology above.

DAINTIES (Eurostat 1998), STAMP (Koopman *et al* 1995), etc. For the majority of time series, only the more sophisticated techniques can produce series adequately seasonally adjusted for most purposes. However, because seasonal adjustment can only be achieved through a model of the seasonal behaviour of the series to be adjusted, and since each of the best seasonal adjustment methods encapsulates a broad but restricted family of seasonal models, there isn't a unique method that would be applicable to all series. Again, the choice of the most appropriate seasonal adjustment software is outside the scope of this Handbook.

119. Almost every national statistical agency, central bank and international organisation compile or at least disseminate seasonally adjusted data for many of their infra-annual time series, though practices vary with regards to how such series are presented to users and the amount and content of metadata describing the treatment of the series or any caveats arising from possible future revisions to the series. The latter may be the result of, for example, the use of updated seasonal factors – see Section 7.1.1 below (Revisions Classified by Timing) and Section 5.6.3 below (Information about seasonal adjustment to be provided to users).

120. The work of the OECD Short-term Economic Statistics Working Party (STESWP) task force on data presentation and seasonal adjustment focused on the issue of how to report seasonally adjusted data, and which information on the seasonal adjustment method and what kind of specification details should be disseminated or made available to users. The recommendations around these issues in Section 5.6 below are also discussed in the context of how the different types of data (particularly, growth rates) are presented to users.

121. The context of task force work was further set by the identification of three types of users: the general public, informed users, and analytical users. The needs of each group are very different and to meet them statistical agencies need to provide differentiated sets of metadata. The information required by each group entails:

- *general public*: require "basic" metadata on seasonal adjustment, *i.e.* a layperson's explanation of the adjustment and its significance. Such users are generally not interested in more technical information (such as diagnostics of the procedure);

- *informed users*: need detailed information on how the statistical program performing the seasonal adjustment was carried out, as well as statistics on the validity of the adjustment for specific series. For this category of users, statistical agencies generally provide at least one comprehensive document per statistical program;

- *analytical users*: need some of the results of the statistical program to reprocess them for their own use(s). Such users should be supplied with all the relevant parameters needed to replicate the official seasonal adjustment, and to modify it if they wish.

5.5 Trend-cycle data

122. The trend component of a time series referred to briefly in the introduction to in Section 5.1 above, refers to the long-term movements of a series. The trend reflects the underlying movement of the series and is typically due to influences such as population growth, price inflation and general economic development. For the purposes of seasonal adjustment both the long-term trend and medium-term cycles are treated as the trend component of a time series. For this reason, the trend component is sometimes referred to as the trend-cycle (ABS 2001, Section 2.1).

123. The main issues with respect to the reporting and presentation of trend-cycle data centre on whether or not to produce trend-cycle series for certain types of indicators, rather than to which techniques should be used to produce them. The following points are considered relevant:

- Should trend-cycle estimates be released for volatile series, or not at all (*i.e.* filtering should be left to users)?

- How to deal with revisions derived from filtering techniques (and with the related end-point problem).

- If volatility is the key feature to discriminate among indicators, perhaps a standard should be set in order to define volatility.

124. National practice varies considerably across countries with regard to the availability of trend-cycle estimates. For example, the Australian Bureau of Statistics (ABS), in addition to raw data and seasonally adjusted data, releases trend data for all series where the irregular component has been filtered out of the seasonally adjusted data. The German Federal Statistical Office generally publishes the trend-cycle component and the irregular components for all series. The Korean National Statistical Office produces trend-cycle series as reference material for Composite Indices of Business Indicators. In Italy, ISTAT does not release filtered time series for any indicator although in some press releases, three-term moving averages are added to graphs but with no values or comments. Other countries such as France do not publish trend-cycle data at all.

125. Much of the discussion on trend-cycle analysis focuses on the so-called end-point problem. Significant differences can arise following revisions to provisional data from which trend data are derived. Since the trend-cycle values at the most recent end of the series are usually estimated by extrapolation, the underlying trend of the most recent series should be presented to users with caution. In this regard particular care is required at turning points where it often takes months until the new correct direction of development appears. Therefore, this problem should be made very clear when publishing trend-cycle data at the current end of the time series.

126. When utilising X-11, the Australian Bureau of Statistics (ABS) uses surrogate (or asymmetric) filters (see details in Musgrave 1964a, 1964b) to produce seasonal factor and trend estimates at the current end of a time series. Based on the assumption that both seasonal pattern and trend-cycle in the future contain linear trends, the design of a surrogate filter is equivalent to a linear extrapolation with minimum revision criterion to forecast the unknown future data. This design for trend-cycle estimate has been well elaborated by Doherty (2001).

5.6 Recommended practices for the reporting and presentation of different forms of time series data

127. This Section commences with a brief discussion and recommendations on the different forms of data (raw, seasonally adjusted, or trend-cycle) that should be presented, followed by discussion and recommendations on some of the more common transformations applied to seasonally adjusted figures (in particular, the different growth rates described in Section 4.4 above), and finally what information should be provided about seasonal adjustment for each of the three categories of users identified above. The discussion and recommendations use terminology and definitions provided in Sections 4.4.2 and 5.2 above.

5.6.1 Forms of time series data to be presented

128. In the main, the presentation of seasonally adjusted data in press releases, etc., concerns members of the general public. Since the most appropriate seasonal adjustment techniques are very sophisticated statistical transformations it is not reasonable to expect the general public to have the ability to perform these transformations on their own. Therefore, the general public would expect statistical agencies to seasonally adjust as appropriate the main sub-annual indicators that appear in press releases, etc.

129. A subtlety is the distinction between the adjustment for seasonal variations per se, and other adjustments such as those for trading-days and moving holidays such as Easter. Within the statistical community, it is generally understood that "seasonally adjusted" includes all these adjustments unless otherwise specified, not just those for seasonal variations. This understanding is also the most widely used by statistical agencies. This aspect is reflected in the definition of a seasonally adjusted time series provided (in Section 5.2) above.

Recommendation 1

When seasonality is present and can be identified, sub-annual indicators should be made available in seasonally adjusted form. The level of detail of indicators to be adjusted should be chosen taking into account user demand and cost-effectiveness criteria. The adjustment should be applied appropriately using the method chosen as a standard by the agency. The method used should be explicitly mentioned in metadata accompanying the series.

130. The question now arises as to whether or not the original unadjusted (or original) data should be presented together with the seasonally adjusted statistics in data disseminated to the general public, *e.g.* in press releases. Proponents for presenting the two versions generally point out that many users are interested in seeing the original series, whereas those not in favour of presenting both versions assert that there is a possibility for users to be confused about what is the correct information. The OECD task force supported both points of view. It noted however that if centre stage is given to the seasonally adjusted or trend-cycle estimates through their use in any main features text or broad analyses accompanying the statistics, the risk of confusion is greatly reduced.

131. By the same token, if any of the intermediate components of a seasonally adjusted series is presented (*e.g.* the series only adjusted for trading-days) in addition to the unadjusted and seasonally adjusted versions, then the risk of confusing the general public is very real. In addition, it is likely that the statistical agency would then have to provide some explanations about the intricacies of the seasonal adjustment process with the release, increasing the risk of burying the essential information.

132. As mentioned above in Section 5.1, the issue of the choice between the presentation of seasonally adjusted or trend-cycle estimates to the general public depends to some extent on the intended focus of the disseminated time series. If the focus is on underlying medium term movements then trend-cycle estimates would be the preferred form, if on incremental changes (including those in the most recent series) then seasonally adjusted series would be preferred. The OECD task force believed that the focus of press releases in most countries is more likely to be changes in most recent data, though it accepted that this view is not universally shared by all national statistical agencies. The following recommendation was formulated in this context.

Recommendation 2

When applicable, the focus of press releases (or similar releases to the general public) concerning the main sub-annual indicators should be on their appropriately seasonally adjusted version. Users should also be given access to the original (or raw) series, either in the publication (if space permits) or by reference to it.

Where there is a user demand, the agency may also disseminate intermediate components of the seasonal adjustment process (*e.g.* series adjusted for calendar effects) and / or trend-cycle estimates but it should be clearly indicated that the focus is on the seasonally adjusted estimate when short-term variation is of interest.

5.6.2 Analytical transformations

133. The amount statistical information reported in press releases and similar forms of data dissemination is of necessity limited, and focuses on the meaning of the results of a statistical program. In order to help the public at large assimilate this information, some simple transformations are generally presented such as the compilation of the various growth rates discussed in Section 4.4 above. If these transformations are not provided in disseminated data, users will of necessity compute them, hence the following discussion and recommendations which deal with the most common of such analytical transformations.

Recommendation 3

Press releases presenting seasonally adjusted flow series should at the minimum provide period-to-period growth rates for the latest period and, if space permits, period-to-period (*e.g.* month-on-previous-month, quarter-on-previous-quarter) change in levels.

134. Month-on-previous-month and quarter-on-previous-quarter growth rates for original series are not very informative unless seasonal effects are negligible. For this reason statistical agencies seldom use them in their releases of indicators affected by seasonal fluctuations. The growth rate on seasonally adjusted series (or for original data where seasonal factors are not significant), conveys the most recent information contained in a time series (trend-cycle and irregular movements) and is the best way of presenting short-term developments, even if the irregular component is relatively large. To deal with irregular movements that blur the trend-cycle, the rate of change based on two or three month's worth of values[21] can be utilised. This practice, which is customary in some countries, is a convenient (and transparent) way of quantifying the short-term movements averaging out a reasonable part of the irregular component.

Recommendation 4

For month-on-previous-month and quarter-on-previous-quarter rates of change, seasonally adjusted data is the best way of presenting information about a time series (trend-cycle and irregular movements) and for presenting short-term developments, even if the irregular component is relatively large. To deal with irregular movements that blur the trend the rate of change bases on two or three months' (or quarters) worth of values can be utilised.

[21] For example, $(X_t + X_{t-1}) / (X_{t-2} + X_{t-3}) * 100 - 100$ or $(X_t + X_{t-1} + X_{t-2}) / (X_{t-3} + X_{t-4} + X_{t-5}) * 100 - 100$.

135. The change from previous year (referred henceforth as year-on-year change (YoY)) can be misleading in assessing the cyclical movements of an indicator, due to the compounding of movements over a 12 month span. However, its utilisation by users and the media is very common. Where necessary, special effects contained in the base period should be highlighted when presenting YoY changes. In other words the impact of the so-called base effect[22].

136. YoY changes should be applied to raw data and to data adjusted for calendar effects if the latter are available. In this way the trading day effects are made clear. Technically, it would not be incorrect to advise against the utilisation of YoY changes on seasonally adjusted data. In particular, when the seasonal component is not deterministic, the rate of change on raw and seasonally adjusted data can be different, conveying conflicting signals, leading the general public and even some informed users to question the validity of the results. However, YoY change calculated on seasonally adjusted series is a very common practice.

Recommendation 5

For rate of change with respect to the same period of previous year the year-on-year changes should be applied to raw data and to data adjusted for calendar effects if the latter are available. Where necessary, special effects contained in the base period should be highlighted when presenting YoY (base effect).

137. In some countries the levels of some seasonally adjusted flow figures are presented at "annual rates", being multiplied by 12 (for monthly series) or 4 (for quarterly series)[23]. This practice is not very common, and is largely restricted to the presentation of sub-annual national accounts estimates by Canada, Japan, Mexico and the United States. The main stated advantage of this practice is that it facilitates the comparison between series of different periodicities (monthly, quarterly and annual). However, given its limited use, it is more of a hindrance when comparing seasonally adjusted figures from different programs.

138. Annualising the change of a single month or quarter can result in misleading signals, particularly for series displaying high volatility. Similarly, the notion that level data could be annualised on the basis of seasonally adjusted and calendar adjusted time series which contain only minor irregularities should be treated with caution as it implies that the annualised rates of change should be presented only in those cases where such conditions are considered to hold and to be suppressed in other cases. Changing data presentation this way could call into question the integrity of both the data and the agency producing them. In turn, proposing a minimum length for the period to be annualised (for instance, six months), while correct in principle, seems not very worthwhile in practice, as press releases and other dissemination formats seldom allow for such a kind of data transformation. Furthermore, annualizing semi-annual estimates may also lead to lags in identifying turning points. For these reasons the OECD task force recommended against the use of annualised level changes.

[22] A base effect occurs when the evolution of a variable's annual rate from month t to month $t+1$ varies because of the evolution of the variable's level 12 months before and not because of the variation of the variable's level between month t and month $t+1$ (Banque centrale du Luxembourg 2004). An example of a description of a base effect is provided in the context of a YoY change in the consumer price index (CPI) reported in Statistics Canada's, *The Daily*, on Friday, 20 February 2004 (refer http://www.statcan.ca/Daily/English/040220/d040220a.htm)

[23] Such series are more appropriately referred to as the "Linear approximation of the annualised growth rate". The compounded form is referred to as the "Annualised growth rate". Refer terminology in Section 5.2 above.

Recommendation 6

Because of the risk of providing misleading signals, especially where series display significant volatility, the presentation of annualised level changes is not recommended, especially as the key headline series.

Where annualised changes are used, users should be provided with information regarding the possibility of misleading signals due to series volatility.

139. The question now arises as to whether or not period-to-period growth rates should be annualized? In Canada, annualized growth rates are only presented for quarterly estimates of GDP based on the income and expenditure approaches. The monthly growth rates of GDP by industry, the other major sub-annual program that is part of the Canadian System of National Accounts, are not. Also, this practice is not widespread among OECD Member countries, and in countries presenting such rates there are differences in the focus given to them. For example, in the United States the Bureau of Economic Analysis emphasizes the annualized quarterly growth rate of GDP in its press releases[24], whereas in Canada it is the quarterly growth rate itself that is emphasized.

140. There are two main justifications for the presentation of annualised growth rates. The first is that they provide a forecast for the annual growth rate. The other is they provide a rate that is interpretable by users on an annual basis similar to, say, the unemployment rate or an interest rate. The first justification for such rates as forecasts is to be rejected as it is only applicable to the first period of the year. The second justification does reflect a genuine user need. However, annualizing has a very negative aspect in that it exaggerates the volatility of the period-to-period growth rates. For this reason, annualizing monthly growth rates is very rarely seen, and is not appropriate.

141. The task force concluded with the following recommendation.

Recommendation 7

Annualized period-to-period growth rates are not recommended for the presentation of quarterly or monthly growth rates.

Preference should be given to the use of year-on-year growth rates.

5.6.3. Information about seasonal adjustment to be provided to users

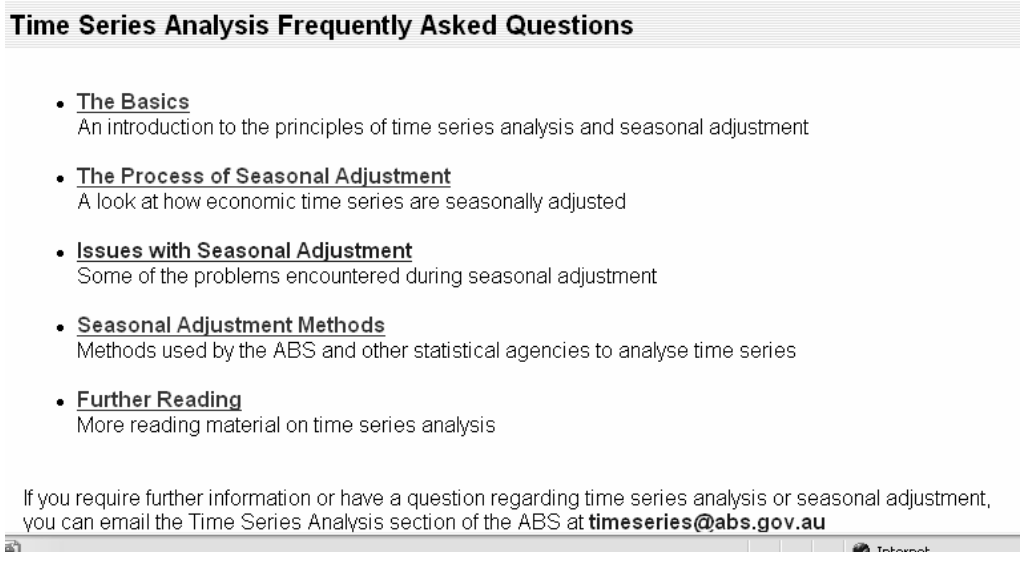
142. The general public has an interest in understanding what seasonal adjustment is all about. However, given the sophisticated nature of seasonal adjustment methods, it is not reasonable to expect such users to possess the mathematical and statistical background to understand a technical description of any particular adjustment method.

143. Accordingly, statistical agencies should provide metadata on seasonal adjustment in the form of a layperson's explanation of the seasonal adjustment process and how seasonally adjusted series should be interpreted. Two examples of such metadata are those provided by the Australian Bureau of Statistics in its *Time Series Analysis Frequently Asked Questions* (ABS 2003a) (refer Figure 4) and

[24] See http://www.bea.gov/bea/newsrel/gdp103a.pdf

Statistics New Zealand in their user paper, *Seasonal Adjustment Within New Zealand (*Statistics New Zealand 2001), the latter being more technical than the former.

Figure 4: Australian Bureau of Statistics, 2004, Time Series Analysis: Frequently asked Questions



Time Series Analysis Frequently Asked Questions

- The Basics
  An introduction to the principles of time series analysis and seasonal adjustment
- The Process of Seasonal Adjustment
  A look at how economic time series are seasonally adjusted
- Issues with Seasonal Adjustment
  Some of the problems encountered during seasonal adjustment
- Seasonal Adjustment Methods
  Methods used by the ABS and other statistical agencies to analyse time series
- Further Reading
  More reading material on time series analysis

If you require further information or have a question regarding time series analysis or seasonal adjustment, you can email the Time Series Analysis section of the ABS at **timeseries@abs.gov.au**

Source: ABS, 2004, Time Series Analysis: Frequently Asked Questions, ABS, Canberra

Recommendation 8

Statistical agencies should disseminate a non-technical explanation of seasonal adjustment and its interpretation for the benefit of, and aimed at, the general public.

144. The task force then formulated the following recommendation for informed users.

Recommendation 9

For the benefit of users requiring information about the appropriateness of the seasonal adjustment method applied, statistical agencies should provide a minimum amount of information that would enable an assessment of the reliability of each seasonally adjusted series.

145. Finally, for analytical users, the task force believed that no additional elements were required beyond those provided for informed users which are presented in the publication (whatever its format) dedicated to the statistical program. However, for analytical users, the availability of metadata is of paramount importance.

146. The main elements of this metadata could include the following: a short standardised description of the method used, all the main parameters of the adjustment (*e.g.* additive versus multiplicative decomposition model), outlier date, type and reason specification, and some of the derived information (*e.g.* the trading-day weights). The principle to be followed is that the metadata should be sufficient to enable an analytical user to seasonally adjust in a consistent way other series

from the same statistical program which may not have been adjusted, or to compare the results obtained from using different options or methods for seasonally adjusting the same series.

147. The task force noted that, to a large extent, the knowledge of which software was used and the parameters specified for the seasonal adjustment of a particular series is generally sufficient to replicate the process. However, given its limited use this information does not need to be disseminated. Nonetheless, it should be readily available upon request.

148. The task force concluded with the following recommendation.

Recommendation 10

Statistical agencies should maintain metadata on seasonal adjustment of sufficient extent to enable outside users to seasonally adjust in a consistent way other series from the same statistical program that may not have been seasonally adjusted.

6. GUIDELINES FOR THE REPORTING AND DISSEMINATION OF METADATA

149. This Section provides guidelines and recommendations for the reporting and dissemination of metadata. An overview of existing international guidelines for the reporting and presentation of statistics is provided in Section 2 above.

150. The Introduction to this Handbook emphasized that metadata is a key element of recommended reporting and presentation practice for both national agencies and international organisations, and outlined the need for statistics to be accompanied by metadata to enable users to assess the ability of those statistics to address their needs. In addition to further emphasising this need, the Introduction to this Section below also discusses the need for metadata to be structured in such a way as to not immerse users with voluminous amounts of text, and to address the needs of different types of users, ranging from the general public to the specialist analyst. Section 6.2 provides a brief overview of metadata content standards that have been developed by various initiatives in recent years, focusing on the current SDMX and METIS initiatives. The metadata guidelines and recommendations provided in Section 6.3 relate to the need for metadata, access to metadata, common metadata concepts, the adoption of standard metadata terminology and the unambiguous presentation of similar but not identical series. Finally, this Section concludes (in Section 6.4) with a brief discussion of the Data Documentation Initiative (DDI) for Micro-data.

6.1 Introduction

151. The provision of methodological information or metadata[25] with statistics outlining concepts, definitions and describing methods used in collection, compilation, transformation, revision practices and dissemination of statistics, etc., is an essential function of all agencies disseminating statistics at both the national and international levels. A distinction can be made between "structural" metadata – that act as identifiers and descriptors of the data which are needed to identify, use and process data matrixes and cubes – and "reference" metadata – that describe statistical concepts, methodologies for the collection and generation of data and information on data quality (SDMX 2006a)[26].

152. The need for such methodological information arises from a desire to lend transparency to economic, social and population statistics so that the typical end-user can make an informed assessment of their usefulness and relevance to his or her purpose. In recognition of this, methodological transparency is embodied as one of the UN *Fundamental Principles of Official Statistics* (UNSC 1994). The recommended metadata practices provided below in Section 6.3 flesh out this principle.

153. The provision of metadata is therefore an inescapable responsibility of all statistical agencies in both developed and developing countries and one that requires adequate planning and resources. In

[25] The International Organisation for Standardisation (ISO) definition of metadata is "data that defines and describes other data" (ISO/IEC 11179-1, 1999(E): Information technology – Specification and standardisation of data elements – Part 1: Framework for the specification and standardisation of data elements, First edition 1999-12-01

[26] Reference metadata, sometimes generated, collected or disseminated separately from the statistics to which they refer, can be relevant to all instances of statistics described: entire collections of data, data sets from a given country, or for a data item concerning one country and one year. For this reason, some overlap may exist between "reference" metadata – which are often disseminated separately from the statistics to which they refer – and "structural" metadata used to identify statistics.

recent years even greater emphasis has been given to the importance of ensuring that statistics published by international organisations, national statistical institutes and other agencies are accompanied by adequate metadata. Many statistical agencies have embodied their corporate policy on the provision of metadata in their dissemination standards and author guides[27].

154. Users of metadata are generally depicted as falling into two broad groups: producers of statistics responsible for designing statistical collections, collecting, processing and evaluating statistics, and disseminating data; and end-users of statistics comprising policy analysts, media, academics, students, etc. (UNSC and UNECE 2000). The statistical functions of international organisations often fall somewhere in the middle of these broad groups, in that they also perform the role of disseminators of statistics to internal or external end-users. International organisations also use metadata in evaluations and assessments of the comparability of statistics between countries.

155. In many instances the metadata requirements of users located in national government agencies, the private sector, national statistical agencies and in international agencies frequently overlap. Therefore, determining the amount of metadata to be disseminated by statistical agencies on the basis of the location of users and even the types of uses of metadata may not be all that helpful in that metadata are more often than not presented to an unknown audience of users. The approach used in this Handbook is to differentiate between the amount of metadata detail required for data interpretation by different users and how varying amounts of metadata detail are best presented.

156. An approach commonly used by national and international agencies entails the presentation of metadata as layers within a pyramid. Using this approach, for any specific statistical domain (*e.g.* prices, production, education, health) methodological information describing statistics becomes more detailed as one moves down from the apex of the pyramid. For example:

- at the apex of the pyramid are table headings and footnotes that are generally immediately adjacent to the statistics and which are an integral part of each statistical table. Such metadata are essential for an understanding of the statistics and includes information on key issues such as the status of the statistics with respect to revisions (*e.g.* preliminary, final, etc.);

- then there are explanatory notes generally located in the same "publication" and which provide a brief general description of the statistics, definitions, key issues, limitations, etc., that can impact on the use of the data. In an international context, in the main, explanatory notes do not necessarily provide much detail on individual country methodology / practices;

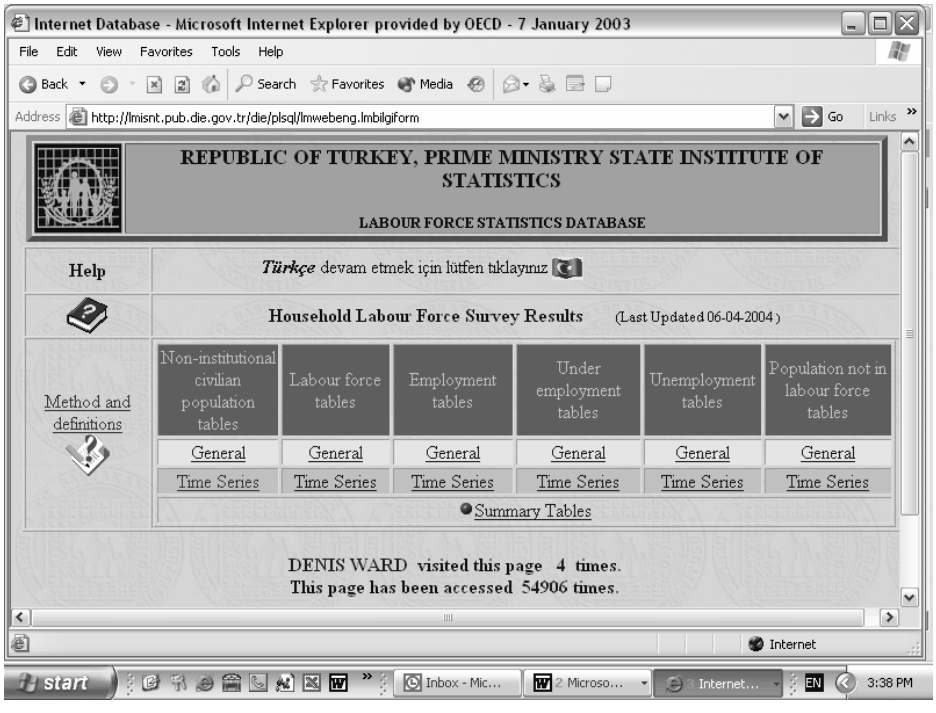
- finally, at the base of the metadata pyramid are detailed methodological information disseminated by national statistical agencies and international organisations in publications and / or on websites. These are potentially the source of the most detailed methodological information available. Such information includes the revisions policy for the series and whether the series are benchmarked with other series either over time (*e.g.* monthly / quarterly to annual) or when used in combination / integrated with other series (*e.g.* in the compilation of volume production indices, quarterly national accounts (Algera 2005, p. 2)). Some (though not all) statistical agencies publish very detailed concepts, sources and methods for a number of their key annual and infra-annual statistics.

157. The need for the provision of more extensive methodological information, and its accessibility to users through dissemination on the web, is now receiving greater recognition.

[27] An example of such standards are metadata requirements embodied in the UK Office for National Statistics, *National Statistics Code of Practice: Protocol on Data Management, Documentation and Preservation* (ONS 2004, p. 10)

However, practices in this area vary considerably in the statistical systems of both developed and developing countries with regard to the amount of methodological detail provided on their websites and in other dissemination media (even in the national language), frequency of updating, its proximity to the statistics it describes and ease of access by users[28]. The State Institute of Statistics of Turkey labour force statistics database is an example of an on-line database where statistics are in close proximity to metadata – see Figure 5.

Figure 5: State Institute of Statistics of Turkey, Labour Force Statistics Database



Source: State Institute of Statistics of Turkey, *Labour Force Statistics Database*, available at http://lmisnt.pub.die.gov.tr/die/plsql/lmwebeng.lmwebform_eng

158. Metadata disseminated by statistical agencies can therefore be usefully categorised on the basis of both the amount of information provided and its proximity to the statistics it describes. In reality, the typical end-user of statistics seldom requires or uses detailed metadata. Most users of methodological information disseminated by statistical agencies in the context of the dissemination model outlined above, merely access the top layer. If they require more detailed information on specific methodological aspects to determine the relevance of the statistics to their requirements, they may have to search through succeeding layers where more detailed methodological information is provided. In this context, in addition to the compilation and dissemination of metadata, a key role of the statistician involves the organisation and structuring of metadata that allows users to dig as deeply as necessary into issues of concepts and compilation practices, etc., without being buried in enormous amounts of text.

159. The primary responsibilities of national and international agencies regarding metadata are therefore to:

[28] A very detailed comparison on Internet metadata availability and website practices for all EU Member States and Iceland, Norway and Switzerland is provided in a 2006 Eurostat Metadata Working Group paper, *Metadata Availability from National Web Sites* (Eurostat 2006c)

- ensure that statistics disseminated are accompanied by appropriate metadata; and to

- provide efficient facilities for the dissemination of appropriate metadata detail to users.

160. International organisations have a specific additional responsibility to minimise the reporting burden of national agencies supplying both metadata and statistical data.

6.2 Brief overview of relevant existing metadata standards

161. As stated above, there are significant differences between statistical agencies when it comes to the organisation and structure of metadata for statistics which are becoming increasingly accessible via a wider range of dissemination media, in particular, on-line dissemination on the web (in html or databases). There are two broad sets of issues with respect to the evolution of statistical metadata "content" standards, *i.e.* the development of an agreed list of common metadata items and the standardisation of terminology and definitions for these items, namely the:

- accessibility of the metadata. In the context of Internet, dissemination issues here involve the actual availability of metadata on websites, organisation on the web, provision of search facilities, linkage to data and the financial cost to the user to access the required metadata; and

- significant differences between countries in the actual statistical methodological elements described in metadata for the same statistical domain. In some instances the problem is merely one of terminology where the same term can have different meanings or different terms can have the same meaning. In other cases, the actual metadata is different. From the viewpoint of an international organisation, where there is a frequent need to compare practices used by a number of countries, different metadata content posted on websites or published elsewhere makes any meaningful methodological comparisons a time consuming and costly exercise. The need to compare statistics across countries is by no means restricted to users working in international organisations.

162. Over the last few years a number of initiatives and forums have been involved in the development of metadata standards, some of which are summarised below:

- *ISO/IEC 11179 - Metadata registries:* This International Organisation for Standardisation (ISO) standard comprises six parts describing the content and management of descriptions of data. These descriptions comprise a representation of the semantics of data. Commercial software exists based on this standard and many statistical agencies around the world are using 11179 in their metadata implementations (ISO/IEC n.d.).

- *Data Documentation Initiative (DDI):* As part of the DDI (refer also Section 6.4 below), an XML DTD for describing the content of social science data sets has been established. It is used throughout the world in university and government social science data archives and commercial software exists based on this content standard (ICPSR n.d.).

- *Object Management Group (OMG) Meta-Object Facility (MOF) and Common Warehouse Model (CWM):* Both specifications are now ISO standards. MOF is a high level framework for describing CWM and the Unified Modeling Language. CWM allows one to map columns of disparate databases together and keep track of those mappings (OMG n.d.).

- *World Wide Web Consortium (W3C):* There are many standards developed in W3C that are relevant to statistical agencies (*e.g.* , XML - eXtensible Mark-up Language) and others that

should be (*e.g.* , RDF – Resource Description Framework - and OWL - Web Ontology Language) (W3C n.d.).

- *Dublin Core Metadata Initiative*: Is a subject matter independent high level list of descriptive elements for any resource, *e.g.* , web, library, or museum. Many organisations involved with metadata systems claim conformance to the Dublin Core. There is software and a registry for managing Dublin Core metadata (Dublin Core n.d.) .

- *Neuchâtel Group:* Is an informal group of representatives from the statistical agencies of Denmark, Netherlands, Norway, Sweden, Switzerland and the US Bureau of Labor Statistics, and a small software company in Germany. The work includes models to describe and manage statistical classifications and variables. The variables work follows ISO/IEC 11179. All agencies except the Bureau of Labor Statistics have an implementation of the classification server developed in Germany.

163. Two other key forums working in this area are the SDMX initiative discussed in Section 2.3 above and the UNECE-Eurostat-OECD Workshop on Statistical Metadata (METIS). SDMX work related to the development of content-orientated guidelines for the exchange of metadata, in particular, for cross-domain metadata concepts, is discussed below in Sections 6.3.3 and 6.3.4 in the context of the development of the *Metadata Common Vocabulary* (MCV).

164. The METIS forum on statistical metadata, organised jointly by UNECE, Eurostat and the OECD, has met around every 18 months since 1995. The major objectives of the forum, normally attended by delegates from around ten international organisations and 30 countries, are to exchange experiences on the development of corporate statistical metadata environments and to develop international standards in this area. Discussion at METIS covers a combination of ITC and metadata "content" issues, the latter comprising terminology, metadata models and corporate metadata governance.

165. Metadata guidelines and recommendations flowing from the work of METIS to date, primarily touch on issues relating to best practices for disseminating metadata on the Internet, terminology on statistical metadata and guidelines for the modelling of statistical data and metadata. All of these standards may be downloaded from a UNECE website[29].

166. The February 2004 meeting of METIS noted the existing wide variation in metadata practices in both international organisations and national agencies. It also noted the proliferation of standards and products for metadata in many areas and that, whilst these standards are in the main complementary, the forum felt the need to bring them together within a framework. METIS undertook to draft and publish a framework that would provide links and context to current and previous metadata standards initiatives together with comparisons of selected examples of current best practice at the national and international levels (UNECE, Eurostat and OECD 2004, para. 7). The April 2006 METIS meeting reviewed the recommendations for future work put forward by the Task Force on Common Metadata Framework. The Framework and links to recommended practices would be developed along a number of key themes such as:

- processes for metadata collection;

- terminology;

[29] Available at http://www.unece.org/stats/publ.htm

- metadata and data interchange entailing identification of common models between international organisations to which national agencies could map metadata maintained in their own corporate metadata repositories;

- migration strategy from existing fragmented metadata environments;

- metadata dissemination and its relation to the dissemination of statistics;

- metadata governance and corporate management issues;

- incorporation of usability concerns in metadata management.

These themes touch on some aspects of the guidelines for the reporting and dissemination of metadata outlined below in Section 6.3.

167. The following general recommendations were also made by the Task Force:

a. The Framework will be a living/evolving reference to standards, concepts, and recommended practices. An editorial board will be created to ensure future maintenance of the Framework.

b. The Framework will be published in an electronic form on the UNECE website, with some parts published in print (after public and editorial group review).

c. The Framework shall comprise two types of information:

   - text written specifically as an integral part of the Framework;

   - selected and edited contributions by countries (recommended practices).

In order to attract broader readership, each part of the Framework will comprise a general overview, avoiding overly detailed technical information, with links to more technical and detailed papers. Linked contributions may relate to multiple parts of the Framework.

All material included in the Framework should be accessible without restriction. Drafts will be made available for public review. After two rounds of review they will be left stable within the Framework for some (reasonable) time.

The draft Framework will be updated using contributions from METIS meetings.

The editorial board will be open to all inputs within and outside the framework of METIS and ensure collaboration with other relevant groups.

6.3 Recommended practices for the reporting and dissemination of metadata

168. This Section outlines four key elements of recommended practice in the compilation and dissemination of metadata which specifically relate: to the need for the compilation of up-to-date metadata by international organisations and national agencies; providing access to metadata; the methodological items (or metadata elements) that should be incorporated in metadata disseminated; and the use of a common set of terminology. Each of these elements of recommended practice is discussed below. Other Sections of this Handbook outline recommended practice for ensuring

methodological transparency through the provision of metadata in specific areas such as describing methodology used in seasonal adjustment (Section 5.6), the provision of information on data revisions (Section 7.1), series breaks (Section 7.2) and sampling and non-sampling errors (Section 7.3).

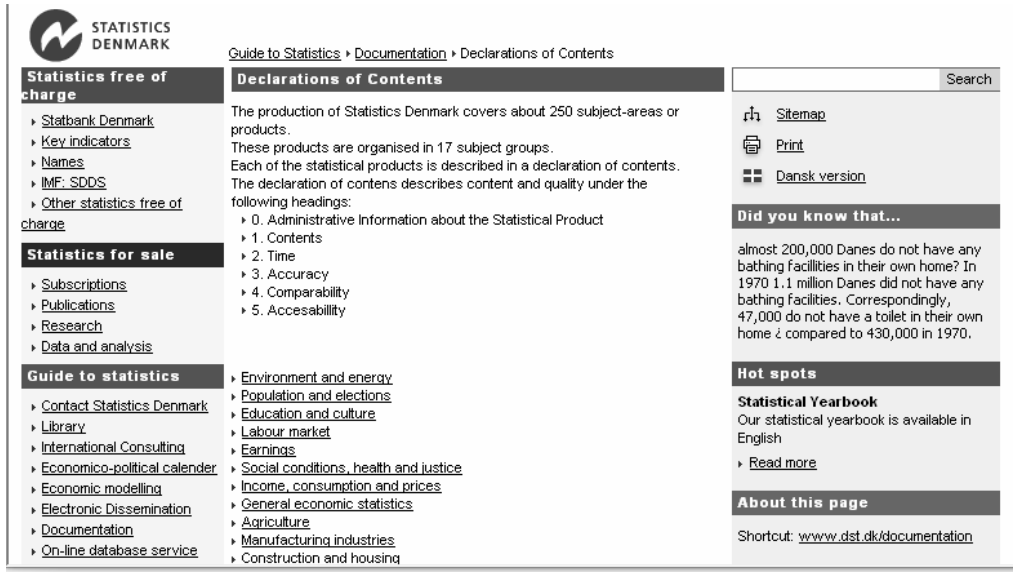
6.3.1 The need for metadata

169. All statistical agencies should:

- compile metadata required for users to understand the strengths and limitations of the statistics it describes (refer Figure 6 for Statistics Denmark's on-line quality reporting); and

- keep their metadata up-to-date, incorporating the latest changes in definitions, classifications and methodology, etc.

Figure 6: Example of on-line quality reporting – "Guide to Statistics", Statistics Denmark



Source: Statistics Denmark, 2004, *Guide to Statistics*, Statistics Denmark, Copenhagen, available at http://www.dst.dk/HomeUK/Guide/documentation/Varedeklarationer.aspx

6.3.2 Access to metadata

170. National agency and international organisation practices vary significantly with respect to the visibility of metadata they disseminate, in particular, for metadata located on websites. In some instances metadata is easily located by users unfamiliar with the site and in others considerable time and effort is required to navigate through the website to obtain the required information, particularly where metadata for a number of different statistical domains are sought. Key recommendations in this area include:

- ensuring that users have ready access to such metadata through its dissemination via a range of different media – paper publications, CD-ROMs, etc. However, it is important for all metadata to be available to users on the Internet, given that it provides the most accessible medium for obtaining the most up-to-date metadata. It is also recommended practice for metadata to be structured in such a way as to meet the needs of a range of users with different requirements

and/or statistical expertise. This does not necessarily entail the physical presentation of different metadata to each group of users with different statistical expertise. However, a layered presentation of metadata is recommended, progressing from summary metadata to more detailed metadata. Each layer should use clear and precise text;

- dissemination of metadata free of charge on the Internet. There is strong support for the notion that metadata describing statistics has a high public good component and should therefore be disseminated free of charge on the Internet even if the actual economic and social statistics they describe and paper publication versions of the metadata are subject to an organisation's price regime;

- active linkage of metadata to the statistical tables and graphs they describe and vice versa;

- the availability of metadata not only in the national language but also, where resources permit, in one of the languages commonly used internationally, such as English;

- structuring the metadata for different statistical domains on the basis of some hierarchic classification. Consideration could be given to the adoption of the UNECE *Classification of International Statistical Activities* as the international standard for metadata. The September 2005 version is available at http://www.unece.org/stats/documents/ece/ces/bur/2005/5.e.pdf;

- provision of a local search engine based on free text search;

- implementing recommended practice for ensuring either the stability of URLs (Uniform Resource Locators) or providing links between the old and new URLs that will redirect users to the new address. This is a key issue given the importance of links between websites[30];

- providing the names of contact persons or email addresses where further information about concepts, definitions and statistical methodologies may be obtained. In some organisations the "contact" would be a generic corporate contact point or referral service for all client enquiries.

6.3.3 Adoption of a set of common metadata items

171. This issue, together with the adoption of common terminology, is at the heart of current problems and difficulties of comparing methodologies used by different countries in the compilation of the statistics they disseminate. The issue is also associated with the need for international organisations to minimise the metadata reporting burden of national agencies.

172. In addition to a perceived lack of co-ordination between international agencies, national agencies faced with the task of providing metadata to different international agencies, often comment on their use of different lists of metadata items to describe methodologies for the same statistical domains. They also comment on how much easier life would be if different international organisations used either:

- the same common list of metadata items (or at least a common core set) so that one set of metadata compiled by the national agency would meet the needs of most international organisations; or

[30] The World Wide Web Consortium (W3C) document "Cool URIs don't change" (available at http://www.w3.org/Provider/Style/URI) outlines the case for maintaining stable URLs and best practice for designing URLs.

- at the minimum, a consistent set of individual metadata items that would enable national agencies to map metadata maintained in their corporate metadata facilities to repositories maintained by various international organisations in lieu of direct collection and / or duplicate storage on different databases.

173. Achieving complete agreement on a common set of metadata items across all national statistical agencies (and international organisations) has been a difficult task given the special issues, circumstances, etc., related to individual statistical systems which require formulation of their own documentation standards. The notion of a minimum core set of metadata required for the correct interpretation of statistics has been discussed at numerous forums on metadata and indeed such a list is included in the UNSC/UNECE guidelines (UNSC/UNECE 2000, p. 5). Similarly, a comprehensive set of standard metadata items (or metadata "prompt points") is provided in both the IMF's SDDS (IMF 2003f) and GDDS (IMF 2004a, p. 113) referred to above in Section 2.1. The SDDS primarily covers economic statistics (real, fiscal, financial and external statistics) though also includes population data. The GDDS covers the same domains in economic statistics but a broader range of socio-demographic data (population, health, education and poverty).

174. There have also been a number of national initiatives in this area, but one example is Statistics Canada's metadata initiative, the Integrated Metadatabase (IMDB) (Statistics Canada 2006). This facility follows and expands on the ISO 11179 standard and provides detailed metadata across a range of statistical programmes and subjects using a consistent set of metadata items with links to data tables, surveys and statistical programs and various statistical outputs, which are accessible to users on Statistics Canada's website. The IMDB metadata model also allows users to view changes to variable definitions, classifications, data sources and methodology over time (refer also Section 7.2.3 below outlining recommended practices for the presentation and reporting of information about series breaks). The metadata content standards are based on Statistics Canada's Policy on Informing Users on Data Quality and Methodology (Statistics Canada 2000).

175. The SDMX initiative is currently developing a limited set of common metadata items or categories (referred to as "cross-domain concepts") as part of the SDMX Content-oriented Guidelines which were released for public comment in March 2006 (SDMX 2006). These cover concepts used principally in data structure and metadata structure definitions. If adopted by national and international organisations, the widespread use of the SDMX cross-domain concepts will enhance the possibility of more efficient metadata interchange. Examples of the SDMX cross-domain concepts are "scope / coverage", "statistical concept", "statistical processing", "currency", "decimals"[31]. The cross-domain concepts being developed are to a large extent based on existing template(s) such as those developed by the Eurostat, IMF and the OECD and the adoption of a common set by these organisations is a step in the direction in the use of consistent if not common metadata items. All three organisations have agreed to adopt the standard set of metadata terminology embodied in the SDMX *Metadata Common Vocabulary* (see following Section).

176. Much of the above discussion has been in the context of the provision of metadata for aggregated statistics. There is a similar need to provide users of micro-data with comprehensive information to ensure that they will use them effectively, efficiently and accurately. As discussed in more detail below in Section 6.4, the Data Documentation Initiative (DDI) was set up to establish a common system to document key aspects of micro-datasets such as their content, presentation, transport and preservation.

[31] Given that the list of SDMX cross-domain concepts is still evolving at the time this Handbook was prepared, no attempt is made to provide a complete list of these concepts. Readers are therefore urged to refer to the SDMX initiative website (www.sdmx.org) for the current complete set of cross-domain concepts.

6.3.4 Adoption of a common set of terminology for metadata preparation

177. Considerable resources are often expended by international organisations in verifying text, etc., to ensure that methodological descriptions are as consistent as possible between countries. Not only does the process of metadata verification entail a duplication of effort, it also results in the dissemination of different methodological terminology, especially where translation of methodological text into another language is necessary. Ideally, methodological descriptions of the same national statistical collections published by different international organisations should be identical with regards to terminology. Mechanisms for achieving this comprise:

- the rigorous use of terminology imbedded in the various international statistical guidelines and recommendations. This could be facilitated by the use of glossaries published by international organisations which contain definitions derived from those standards. Examples of such glossaries are those maintained by the OECD, Eurostat and UNSD referred to in Section 3.2 above;

- use of existing standards for the development of a corporate thesaurus – refer para. 69 above.

178. The *Metadata Common Vocabulary* (MCV) developed under the umbrella of the SDMX initiative is specifically aimed at identifying commonly used terms to describe the different types of metadata (SDMX 2006a). It is intended to be used by international organisations and national statistical agencies. The MCV contains a core set of metadata items (for both structural and reference metadata) and their related definitions and is designed to improve the standardization of metadata content for the purposes of data exchange and to promote the use of common nomenclatures that can foster international comparability of international data. The current version of the MCV (available on the SDMX website at www.sdmx.org) contains several fields – term title, definition, source, hyperlink to definition source where available, related terms and context – refer Figure 7.

Figure 7: SDMX Metadata Common Vocabulary (MCV)

Data processing

The operation performed on data in order to derive new information according to a given set of rules.

Source

Economic Commission for Europe of the United Nations (UNECE), "Terminology on Statistical Metadata", Conference of European Statisticians Statistical Standards and Studies, No. 53, Geneva, 2000

Context

The processing site refers to the organisation, institute, agency, etc, responsible for undertaking the collection, tabulation, manipulation and preparation of data and metadata output. The processing site may or may not also refer to the physical location(s) at which such activities are carried out.

A processing system embodies both manual and automated systems used by agencies to despatch questionnaires, collect, compile, manipulate, analyse and disseminate data and metadata output. Such systems therefore cover all stages of the statistical processing cycle.

Hyperlink

http://www.unece.org/stats/publications/53metadaterminology.pdf

Related terms

Compilation practices
Processing error

Source: SDMX, 2006a, *Metadata Common Vocabulary*, available at www.sdmx.org

6.3.5 Unambiguous presentation of similar but not identical statistical data

179. There are numerous examples of situations where users are confronted by several different versions of seemingly the same statistical data published by different national agencies and international organisations. For example:

- Series for individual countries that have been transformed by either national agencies or international organisations to improve their comparability. Examples here are: Eurostat's Harmonised Consumer Price Index (HICP) and the OECD's Standardised Unemployment Rates (SURs) that are frequently published alongside similar, but different national series. Similarly, at the national level, there are estimates of employment obtained directly from labour force surveys and labour force series that have been adjusted for SNA labour input purposes.

- Other national series that have been transformed and published by international organisations in some way to improve comparability. In some instances the same national data has been transformed differently by different international organisations resulting in inconsistent statistics both between themselves and with data published at the national level.

  An example of different transformation processes resulting in different series at the national and international levels is the use of different seasonal adjustment applications by national institutes and the European Commission for business tendency survey data. Other examples are series transformed at the national level specifically to meet the requirements of an international organisation which again results in different data for seemingly the same series being released at the national and international levels.

- The use of different terminology or label for the same concept by different agencies, *e.g.* "industrial manufacturing" and the heading "intermediate goods".

180. Recent investigations by the OECD Short-term Economic Statistics Working Party (STESWP) task force on data presentation and seasonal adjustment sought to formulate a small set of recommendations on practices and processes that would alleviate, in the short term at least, the impact of such inconsistencies by making users more aware of the differences, and the reasons, between similar but non-identical series. In the longer term, international initiatives to develop standards for the exchange of data and metadata and improved co-ordination between international organisations on the collection of such information from national agencies outlined in Section 2.3 above aim to eliminate most of these differences altogether.

181. Five broad recommendations of good practice in this area comprise (Friez 2003):

- Similar but different series should be given different titles to facilitate clear differentiation by users.

- International organisations that disseminate national data should always be aware of and clearly state in their metadata whether or not the precise series they disseminate that are derived from national sources are also disseminated in the country of origin, or compiled and / or transformed by national agencies specifically to meet the requirements of international organisations.

- International organisations should clearly describe in their metadata, specific details of any transformation of national data they perform to make the series more internationally comparable. Data transformed by international organisations should be clearly indicated as such, particularly,

but not only where, published alongside different national series for the same statistical domain. The two sets of series must be clearly differentiated in the mind of the user.

- The precise name of the classification used in statistics disseminated by national agencies and international organisations (especially when transformed to an international classification to enhance international comparability) should always be clearly indicated (for instance, NACE Rev. 1, CITI, Main Industrial Grouping (MIG) or national classification) so that when the same denomination is used in various classifications such as intermediate goods, the user clearly knows which classification has been used.

- When a field of activity is only partially covered (such as MIG-intermediate goods or MIG-consumer goods in the new orders indicators of the European Commission's Short-term Statistics Regulation), it should be clearly indicated for instance with an asterisk or a footnote (for example, in the Eurostat's short-term statistics new orders series, MIG-non durable goods (1) - *(1) Partial ; does not include NACE 151-155, 158, 159, 16, 19, 22, 364-366*).

6.4 Data Documentation Initiative for Micro-data

182. Data producers are increasingly expected to provide the research community with access to micro-level data (*e.g.* survey datasets). The availability of detailed documentation for those datasets is crucial to provide secondary users with a full understanding of these data to enable them to use them effectively, efficiently, and accurately. However, experience shows that metadata provided with micro-datasets is often inadequate, making their exchange and use complex and problematic.

183. The Data Documentation Initiative (DDI) was set up to respond to the need for a common system to describe and catalogue survey datasets that underlie much social science research. It has established a consensus for the content, presentation, transport, and preservation of micro-data documentation. The DDI metadata specification originated in the Inter-university Consortium for Political and Social Research (ICPSR) and is now the project of an alliance of about 25 institutions in North America and Europe.

184. The DDI specification was designed to encompass various kinds of micro-datasets. It provides a comprehensive set of elements to be used to record and communicate in detail the characteristics of statistical data obtained from sample surveys, censuses, administrative records and other systematic methodologies for generating empirical measurements. These elements—some of them mandatory, most of them optional — are structured into five sections:

- Section 1.0 - *Document Description* consists of bibliographic information that can be considered as the header whose elements uniquely describe the full contents of the compliant DDI file.

- Section 2.0 - *Study Description* consists of information about the data collection. This section includes information about who collected and who distributes the data, about the scope and coverage, sampling (if relevant), data collection methods and processing, citation requirements, etc.

- Section 3.0 - *Data Files Description* provides information about the data file(s).

- Section 4.0 - *Variable Description* provides a detailed description of variables, including (when relevant) the variable type, variable and value labels, literal questions, computation or imputation methods, instructions to interviewers, universe, descriptive statistics, etc.

- Section 5.0 - *Other Study-Related Materials* allows for the inclusion of other materials related to the study such as questionnaires, user manuals, computer programs, interviewer manuals, maps, coding information, etc.

185. To maximize exchangeability and take advantage of Internet technology to share data and metadata, the DDI is expressed as an XML Document Type Definition, or DTD. In other words, the DDI encodes the metadata elements into a database following a standard structure and specification language. The DDI therefore facilitates interoperability as codebooks marked up using the DDI specification can be exchanged and transported seamlessly, and applications can be written to work with these homogeneous documents.

186. Version 1.0 of the DTD was published in March 2000. Since that time, several enhancements have been made. The most recent stable version of the DTD is Version 2.0, which is expressed as both a DTD and as an XML Schema.

187. The DDI is thus a relatively recent endeavour, which aims to be the foundation for the collection, distribution, use, and archiving of many future data collection projects in the social and behavioural sciences, across institutions, countries, and disciplines. Tools are being developed to assist data producers and archivists in fully exploiting it. Detailed information on the DDI and its associated tools are available at the DDI Alliance website: www.icpsr.umich.edu/DDI.

7. GUIDELINES ON KEY REPORTING PRACTICES

188. This Section provides guidelines on a small number of key reporting practices that have significant impact on the interpretability of data disseminated by both national agencies and international organisations. The six reporting practices covered in this Handbook are: data revision (Section 7.1); presentation of series breaks (Section 7.2); the presentation of information on sampling and non-sampling errors (Section 7.3); the presentation of information on the rebasing of indices (Section 7.4); the adoption of recommended citation practices (Section 7.5); and the presentation of information relating to administrative data (Section 7.6).

189. As mentioned in the Introduction to this Handbook (in Section 1.2), the different approaches used by national agencies and international organisations for each of these key reporting practices can and do complicate the process of comparing data, both between countries and within an individual series over time. The discussion of each key practice below commences with background information and an outline of main issues relating to each practice, existing international standards (if any), and concludes with recommended practices for implementation by both national agencies and international organisations.

7.1 DATA REVISION

190. The following discussion on data revision and the need for the formulation by national agencies and international organisations of a comprehensive and transparent revisions policy draws directly and extensively from an IMF Working Paper, *Revisions Policy for Official Statistics: A Matter of Governance* first presented at the August 2003 International Statistical Institute (ISI) and subsequently revised the following year (IMF 2004). The discussion also uses material from an OECD-ONS workshop on assessing and improving statistical quality revision analysis for national accounts held in Paris on 7-8 October 2004[32]. Although the IMF working paper was written primarily in the context of economic statistics the terminology, context of revisions and recommended practices are just as relevant for social and population statistics, irrespective of whether or not the statistics are published in developed or developing countries.

191. The basic premise of the IMF working paper is that a sound revisions policy contributes inter alia to good governance in official statistics. It notes that many countries have not yet set out a well-articulated revisions policy. In recent years, however, revisions policy is receiving more emphasis. For example, the Fund's *Quarterly National Accounts Manual*, Chapter XI (IMF 2001a) provides a discussion of revisions policy. The Ecofin Council of the European Union, in February 2003, included a section on revisions in its "Code of Best Practices on the Compilation and Reporting of Data in the Context of the Excessive Deficit Procedure." In addition, the IMF's Data Quality Assessment Framework specifies recommended revision practices.

192. The need for the development of a set of recommended practices with regard to data revision, and their application by national agencies is also important at the international level where international organisations such as the IMF, OECD, Eurostat and other regional bodies require consistent data. However, the absence of common policy action in this area among member countries is one of the causes of inconsistency of data at the national and international levels, necessitating constant change due to variations in the timing of revisions.

193. The purpose of the IMF working paper is to gain widespread acceptance of the importance of a revisions policy, to work towards the development of a comprehensive and internationally accepted set of recommended practices that together would constitute a sound revisions policy which individual developed and developing countries could fit to their own individual circumstances. The practices outlined below are derived from a discussion of user needs, resource issues, and maintenance of credibility. More specifically, they derive from a selection of examples of recommended practices in place in various countries that are included in an extensive set of appendices attached to the IMF working paper. These are drawn from national accounts, prices, government finance statistics, monetary statistics, and balance of payments statistics, though again, most are relevant to the social and population statistical domains.

7.1.1 Typology and terminology

194. Revisions are defined broadly as any change in a value of a statistic released to the public by an official national statistical agency. The statistic may be a level, such as the value of a flow (for

[32] Papers presented at this workshop are available at http://www.oecd.org/document/23/0,2340,en_2825_293564_33729303_1_1_1_1,00.html

example, GDP) or of a stock (for example, of financial assets), or a change in level, such as the rate of price increase. Revisions can be classified in at least two ways. One way is by the reason for the revision, another is by the timing of the revision. It is especially useful to catalogue these in order to establish a common language.

Revisions classified by reason

195. Revisions may take place for at least eight reasons – see below. In reality, some of the distinctions are blurred because two or more kinds of revisions may be made at the same time. Aside from correction of mistakes, the last item in the list, the reasons tend to fall into three groups. The first group is the incorporation of more complete or otherwise better source data, encompassing the first three reasons. The second is routine recalculation, encompassing the next two reasons, and the third is improvements in methodology, encompassing the next two reasons.

Summary of main reasons for revision of data

- Incorporation of source data with more complete or otherwise better reporting.
- Incorporation of source data that more closely match the concepts.
- Replacement of first estimates derived from judgmental or statistical techniques when data become available or as a result of benchmarking.

- Incorporation of updated seasonal factors.
- Updating of the base period.

- Changes in statistical methods.
- Changes in concepts, definitions, and classifications.

- Correction of errors in source data and computations.

196. The first reason, the incorporation of source data with more complete reporting, cause revisions across a wide spectrum of statistics. At one end of the spectrum, a first report on credit aggregates may be based on the largest financial institutions and then the aggregate is revised when reports from all institutions, including the slower ones that have less sophisticated reporting or are from outside major cities, become available. At the other end of the spectrum, data from monthly samples may be replaced in national accounts components with data from more comprehensive annual samples. Two other reasons for revisions are related. Updating of weights, as for price indexes, brings in information from more recent surveys. Incorporation of audited results, as for budgetary figures and data from financial reports, to replace early results in effect brings in "better" data.

197. The second reason, the incorporation of source data that more closely match the concept, is most likely to occur in datasets that piece together many data sources in a mosaic that represents a comprehensive picture of some aspect of the economy. The national accounts and balance of payments are prime examples of such datasets. For example, if production is to be measured, source data that represent sales (plus some adjustments) may provide a first estimate and then the estimate is subject to revision as data more closely matching production become available.

198. In some situations no current data may be available, and a first estimate is based on judgmental or statistical techniques. A revision may then occur when data become available. Such situations may arise for quarterly national accounts. The United States uses judgmental extrapolation

for the first quarterly estimate for several components, including domestic services and improvements on owner-occupied housing. Subsequently, data become available that can be incorporated. Another example is Netherlands benchmarking of their monthly index of industrial production (IIP) to quarterly and annual national accounts. The monthly IIP is adjusted when new and more accurate quarterly information becomes available. As a result the monthly statistics and quarterly / annual national accounts are fully consistent (Algera 2005, p. 9).

199. These first three reasons often appear together, for example, in national accounts and balance of payments. In monetary and government finance statistics, the reasons often boil down to completing institutional coverage and incorporating the outcomes of audited reports.

200. Incorporation of updated seasonal factors relates closely to the incorporation of additional source data, and some lists of reasons for revisions do not list the two separately. Seasonal factors, such as those that are derived from a moving average of experience or from the most recent year (concurrent seasonal factors), can change as the new experience comes into, and older experience drops out of, the calculations. Some countries rarely revise the consumer price index to bring in new or additional price observations, but do revise once a year to incorporate updated seasonal factors. For example, the U.S. Bureau of Labor Statistics, with the release of the January index, each year recalculates the seasonal adjustment factors to reflect price movements in the just-completed year. This routine annual recalculation may result in revisions to seasonally adjusted indexes for the previous five years.

201. Updating of the base year of an index - that is, the year set equal to 100, is also often a routine reason for revision. This may be carried out as a separate step, but usually it is done when new data underlying the weights for the index are introduced.

202. Incorporation of changes in statistical methods is sometimes not listed separately because such changes often go hand in hand with changes in source data. However, they can also occur independently. For example, revision studies or analyses may reveal that a particular method can be improved or replaced by another to achieve greater accuracy or timeliness. In the last few years, this source of revision has become more prominent as countries moved from fixed-weighted volume and price measures to chain-weighted measures. Changes in concept, definitions, and classifications, often stimulated by the adoption of new international guidelines, are yet another source of revision, for example, when a country moved from following the fourth to the fifth edition of the *Balance of Payments Manual*. Major efforts have been devoted to reaching internationally agreed classifications in recent years. The Classification of the Functions of Government (COFOG) and the Classification of Individual Consumption by Purpose (COICOP) are cases in point. The introduction of new classifications is often undertaken when new concepts and definitions are introduced, but sometimes on its own.

203. In addition, changes in presentation of statistics should be mentioned. They do not, strictly speaking, fit the definition of revision as a change in a value of a statistic. However, they often take place at the same time as revisions, especially revisions caused by changes in concept, definitions, and classifications. Changes in presentation are also often implemented to respond to the analytical needs of users, for example, the experience of Australia reporting financial derivative asset and liability positions on a gross basis rather than on a net basis.

204. Finally, revisions occur as errors are corrected. Errors may occur in source data or in processing. For example, reporting institutions may discover after submitting the data that some components are missing or outdated seasonal adjustments may have been inadvertently applied.

205. A key aspect that distinguishes the first five reasons listed above from the remaining three is the possibility of their being predictable to users in terms of timing. For example, the use of more complete source data as estimates progress from preliminary to final can be undertaken on the basis of a scheduled set of releases. Similarly, the incorporation of updated seasonal factors and base periods are also predictable, regular (albeit with a longer cycle) and known well in advance by the statistical agency with the possibility of their being signaled to users well before implementation. On the other hand, the last three reasons tend to be less predictable though are generally (with the exception of errors) implemented with sufficient lead time to advise users well in advance.

Revisions Classified by Timing

206. With regard to timing, some revisions are made in the weeks or months shortly after a first release. These are "current revisions" because they affect the current weekly, monthly, or quarterly data. "Annual revisions" are made after data for all the months or quarters of a year become available. Audits are usually undertaken for a calendar or fiscal year's data, although the results may not be available for some time after the close of the year. Both current and annual revisions usually stem from the first four reasons: incorporating source data with more complete reporting; incorporating source data that more closely match concepts; replacing data initially compiled using judgmental and statistical techniques, or as a result of benchmarking; and incorporating updated seasonal factors. Annual revisions often affect several years of data - perhaps three or four years, so an annual estimate may be subject to revision more than once. For example, in the U.S. national accounts, there are three such revisions, as important additional annual source data arrive in each of three years.

207. Less frequent revisions, often four or more years apart, may be called "comprehensive," "major," or "historical" revisions. Typically they are occasions for major changes in statistical methods and changes in concepts, definitions, and classifications. Often these revisions are carried back, or backcast, for a number of years. Revisions that correct error, of course, have no predictable timing.

208. Another aspect of timing that impact on international organisations is the absence synchronization of revisions and their implementation between member states. The receipt of data released by member states at different points in time can have a significant impact on the compilation of zone aggregates or derived statistics (such as purchasing power parities (PPPs)) by international agencies, especially where data for larger economies are involved. The "solution" to this issue involves negotiation and agreement between the international organisation and their member states to achieve greater synchronization of both initial releases and revisions, again, especially for the larger economies. Although complete synchronization may not be achievable, the result could be greater coalescing of releases and a narrowing of the band of release dates.

7.1.2 Context of revisions

209. The context of revisions can be analyzed from three main points of view: user needs, resource issues, and maintenance of credibility.

User Needs

210. User needs with respect to revisions fall into the following five categories, the:

- *timeliness* of first release of data and timing of subsequent revisions;
- *accuracy* of first release of data and subsequent revisions;
- *consistency* of data over time;

- *coherence* with other series;
- *documentation* for the revisions that is provided to users.

Timeliness

211. Some users, such as policymakers, investors, international organisations, and the media, put strong emphasis on the timeliness of statistics. A key aspect of timeliness is the early release of economic data for them to be relevant to users' particular needs. For a central bank to conduct monetary policy effectively, it will need to analyze data on inflation and growth of monetary aggregates that are as up-to-date as possible. For investors and financial markets to make informed decisions, they also need timely data. For international organisations to monitor adequately economic developments and their funded programs in member countries, it requires the latest data at the earliest possible date.

212. Another aspect of timeliness that concerns users is that the timing of first release of data and subsequent revisions is predictable and relatively stable from year to year. In addition, the timing of the release may need to be coordinated with the preparation of important official policy documents, such as government budgets.

Accuracy

213. While policymakers place a high premium on timely data, they also need a degree of accuracy. The consequences of inaccurate data can be just as serious as late or delayed data, because inaccurate data can cause policymakers to make wrong decisions. Similarly, although investors want timely data on which to base their investment decisions, they do not want to take a decision based on data that are likely to change substantially in the next month or next quarter. Among users, researchers and the academic community place perhaps the highest priority on accuracy, as timely data are less important to them than an accurate and comprehensive time series of data. The needs of researchers and policymakers are related, as researchers use economic data to test empirically and validate economic theory, which is at the basis of policymakers' decisions.

214. The importance placed by users on accuracy clearly requires that they be able to judge the accuracy of preliminary data and subsequently revised data. To make informed judgments, revised data must be clearly identified and documentation provided. The documentation should include information on the sources and methods used to prepare data, on changes to be incorporated in upcoming major revisions, and, post-revision, on the sources of the revision. Some indication from statistical agencies of how accurate preliminary or provisional data are would also be useful to researchers, as they may decide not to use these data in their time series if they are outside a certain degree of accuracy.

Consistency

215. Many users, particularly those engaged in research and forecasting, require consistency of data over time. While they realize that revisions will yield more accurate data, they are concerned that revisions that are frequent or large may disrupt their databases and cause inconsistencies unless the revisions are backcast over a sufficient number of years. As well, users who work with several datasets will be concerned that revisions be carried out in a coordinated way to avoid lengthy periods when one dataset is revised and others are still on the old basis.

Coherence

216. There is also a growing user requirement for the dissemination of "related" statistics that are coherent. The coherence of statistics reflects the degree to which series derived from a single statistical program are logically consistent with related statistics, both over time (*e.g.* monthly, quarterly, annual series) and conceptually (*e.g.* indices of industrial production and quarterly national accounts). Fully coherent data are logically consistent – internally, over time, and across products and programs.

217. Benchmarking techniques are designed to address coherence both over time and between statistics series that are the outcome of combining different statistics (*e.g.* deflation of turnover with a price index) or the integration of a number of series (*e.g.* quarterly national accounts). The various aspects of revisions in the context of benchmarking have been presented by Statistics Netherlands (Algera 2005) in the form of a matrix with the time column relating to future, monthly, quarterly and annual data and degree of integration (single series, combined series, integrated series) forming rows.

Documentation

218. To lessen the trauma caused by the revisions, users would want clear documentation. Basic documentation should include identifying in statistical publications data that are preliminary (or provisional) and revised data, explaining the sources of revisions (including those arising from benchmarking), and explaining breaks in series when consistent series cannot be constructed.

219. Documentation is particularly important when changes in concepts and definitions are involved because such changes can seriously affect the interpretation of various statistical applications (for example, forecasts) and empirical tests of the validity of economic theory. Meetings and consultations with users arranged by the statistical agency can also be helpful in explaining the reasons for and content of revisions, particularly in advance of the revisions so that users can prepare better to deal with them. It is also important for users that the revised data are as easily accessible as possible, preferably with electronic release of the complete revised time series with explanatory documentation attached.

Resource Issues

220. Resources affect countries' revisions policies in several ways. On the one hand, there are specific issues of cost effectiveness (that is, is the increased accuracy gained from a revision worth the cost?). On the other hand, there are questions about the basic design of the statistical compilation system itself, which has fundamental implications for the costs of revisions. How effectively a statistical agency addresses the resource issues that it faces will depend in large part on the quality of its management. Effective management of resources is a critical element of the good governance of statistical agencies.

221. As described in Section 7.1.1 above, revisions are driven primarily by the arrival of source data. Typically a core set of source data are available for the first estimates that are released to satisfy the timeliness needs of users. Then, as more detailed and comprehensive source data arrive, the first estimates are revised to improve the accuracy of the statistics. In designing the statistical compilation system and defining the surveys and administrative data to be used as source data, it is important to bear in mind the cost implications of alternative designs and definitions. A developing country that tries to implement surveys and administrative data in as much detail and breadth as developed countries may well find that it does not have the means to compile and revise these data in a timely manner. It is not uncommon for developing countries to have compilation systems and sample surveys based on industrial country models that result in piles of collected data sitting unused or never

finalized for months and even years. In such countries, an appropriate balance may well require that official statistics rely on less detailed and comprehensive source data that are as representative and timely as the resources of the country will allow.

222. Statistical agencies of all countries, both developed and developing, must operate within limited budgets and make efforts to ensure the cost effectiveness of their programs, including revisions. Again, it is a matter of balancing, balancing not only timeliness against the accuracy needs of users, but also balancing both timeliness and accuracy needs against the marginal costs of achieving improvements in both areas. Costs are incurred not only by the statistical agencies, but also by the respondents who must take the time and effort to complete the questionnaires and data submissions necessary to comply with data release and revisions policies. A kind of "cost benefit analysis" must be done in order to take realistic and sustainable decisions with respect to the timeliness and frequency of data releases and revisions. It should be conducted in a way that balances needs and costs across different types of data users and different data sets. Unfortunately, no mathematical formula exists to conduct this type of analysis. It must, in effect, be must be accomplished in a less precise way through the difficult process of consultation and coordination among statistical agencies and users, as well as with the political authorities who control the agencies' funding.

223. In many countries, particularly developing countries, statistical agencies are often seriously under-resourced both in absolute terms and relative to other government agencies. In these circumstances, it will be important that statistical agencies undertake efforts to raise the consciousness of the political authorities to the serious consequences of neglecting to build adequate statistical capacity. International organisations have an important role to play in this arena. With respect to revisions, both statistical agencies and international organisations must impress on the political authorities of countries the critical importance of adequate resources to allow for the timely release and revision of official statistics.

Maintenance of Credibility

224. Confidence in the figures effectively must be built on confidence in the statistical agency disseminating them. Fundamental to achieving trust in, or credibility of, statistical agencies is *integrity*. Integrity is a central element in the IMF's Data Quality Assessment Framework and is also prominent in the *U.N. Fundamental Principles of Official Statistics* (UNSC 1994). Providing assurances of integrity involves, at the broadest level, enacting effective statistical legislation and ensuring the professional autonomy of statistical agencies. But establishing a sound revisions policy is also a key element necessary to gain the trust of users.

225. It is not unusual, even in industrialized countries, for a distrust of government (or the political party in power) to be translated into distrust of official statistics, or at least a healthy degree of skepticism. Revisions can be particularly sensitive if statistical agencies handle them in an unprofessional manner. At the extreme, users may even suspect the government is intentionally misreporting for its own political or financial motives. For example, investors might suspect the government is intentionally delaying or misreporting data on international reserves to prevent capital flight. Or the media may suspect the government is manipulating statistics to avoid criticism of its policy record. Or an international organisation may worry that a government is misreporting to comply with a policy target.

226. What are the needs of users with respect to revisions and the credibility of official statistics? With respect to the release of first estimates, users need to be able to make informed judgments about the quality of these estimates. How accurate are they? What is the likelihood of further revision, and by how much and in what direction? When will the data be "final"? For the revisions themselves,

users need to be informed about the causes of the revisions, as well as have access to complete documentation on methodology and procedures.

227. Users will also be reassured if they see that revisions take place within the framework of an overall policy and according to a predetermined schedule. If the policy, procedures, and schedule are published, it will be evident that revisions are not ad hoc and for political interests, and that adequate safeguards exist to prevent abuses in this area. Finally, when mistakes are discovered, it is critical that the statistical agency report them to the public as soon as possible and provide satisfactory explanations to reassure users and enable them to distinguish honest mistakes from cases of "misreporting."

7.1.3 Recommended practices for data revision

228. This Section identifies eight main recommended revisions practices. They are consistent with the general principles of good governance in statistics, such as they appear in the Fundamental Principles of Official Statistics and in the *Handbook on the Operation and Organization of a Statistical Agency* (UNSD 2001). In fact, the revision practices identified can be seen as making explicit the application of these principles about, for example, integrity, responsiveness to users' needs, and professionalism in the context of revisions.

7.1.3.1 Consultations with users elicit views about revisions practices

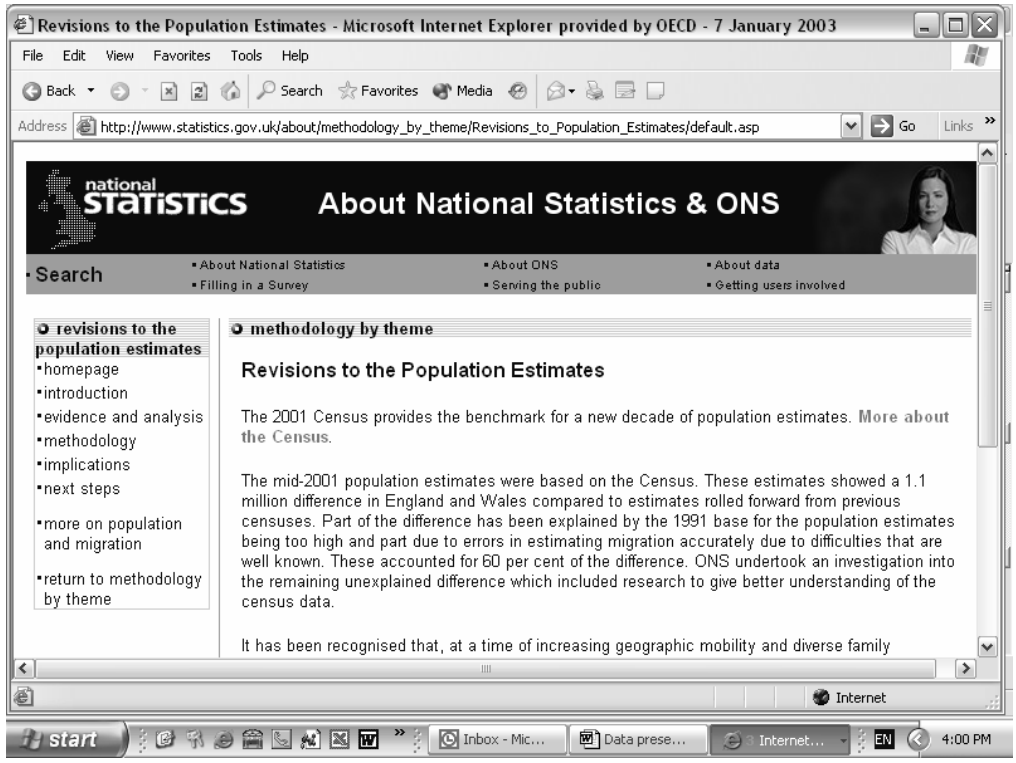
229. Preliminary to elaborating a country's revisions policy, it is important to consult the main users of official statistics to identify needs and priorities specific to individual countries. Their views could be sought, for example, about their particular needs for timeliness of data, problems they experience because of revisions, and their priorities about balancing timeliness with accuracy and consistency.

7.1.3.2 A clear, short summary statement of when to expect revisions and why is readily accessible to users

230. Most revisions fall within a "revisions cycle". Cycles typically incorporate current (for example, quarterly) and annual revisions as defined in Section 7.1.1 above and less frequent comprehensive or benchmark revisions that usually relate more to the two "improvements" reasons listed in Section 7.1.1.

231. The UK Office for National Statistics National Statistics *Code of Practice: Protocol on Revisions* (ONS 2004a, p. 8) extends this further by stating that each organisation responsible for producing national statistics should publish and maintain a general statement describing its practice on revisions which identifies those outputs subject to scheduled revisions and a separate list of those which are deliberately not revised. The Protocol includes all of the recommended practice for revisions outlined in this Section of the Handbook – refer Figure 8 for ONS revisions policy for population estimates.

Figure 8: Revisions policy for population statistics – UK Office for National Statistics



Source: United Kingdom Office for National Statistics, *Revisions to the population estimates*, available at http://www.statistics.gov.uk/about/methodology_by_theme/Revisions_to_Population_Estimates/default.asp

7.1.3.3 The current revision cycle is relatively stable from year to year

232. Current and annual revisions are undertaken broadly to incorporate more complete or otherwise better source data. The following practices relate to the timing of current and annual revisions, the:

- revisions are timed to incorporate new source data;
- revision schedule takes into account the timing for preparing important official economic policy documents;
- revision schedule takes into account the timing of revisions in other datasets.

233. Stability of the revision cycle from year to year is at the heart of recommended revisions policy. Users place great importance on a revision schedule that is regular. Fortunately, for countries that decide to establish a revisions policy, it is not difficult to ensure that its timing is stable over time. Indeed, it is a logical outcome and one that promotes efficient implementation. The most common basis for stability is the timing of arrival of source data, which then triggers their incorporation into revised data. Occasionally, a balance must be struck between maintaining the stability of the cycle and making unpredictable but important revisions outside the cycle. Coordinating timing with important official economic policy events can also be useful. For example, Italy times the release of national accounts to coincide with the annual presentations to their parliaments on the economic situation. It is also important to coordinate with other macroeconomic sectors to ensure consistency, for example, coordinating revisions of balance of payments statis tics with national accounts.

7.1.3.4 Major conceptual and methodological revisions are usually introduced every four to six years, balancing need for change and users' concerns

234. Major conceptual and methodological revisions relate mainly to the two "improvements" reasons for revisions outlined in Section 7.1.1 above —to incorporate new statistical methods and new concepts, definitions, and classifications—all super-imposed on changes in the structure of the economy. These revisions are typically more far-reaching and complex than current revisions, and can be disruptive and problematic for users if they occur too often or take place in a confusing or unpredictable manner. A reasonable guideline for regular timing would be every four to six years. Timing such as this balances the need to avoid unnecessary disruptions to time series with the need to maintain the quality of statistics in line with international best practices and the changing institutions and structure of the economy.

235. Although individual countries do not control the timing of major changes in international statistical methodologies (for example, the appearance of *1993 SNA* and the *BPM5*), a four-to-six-year cycle can generally accommodate these changes without undue delays and disruptions. Incidentally, it is also possible and can be helpful to users to coordinate the timing of methodological improvements with the current cycle of revisions timed for the arrival of better source data. Countries do have control, however, over the timing of methodological and classification changes that they undertake to reflect institutional and structural changes in their own economies. These kinds of changes can be accumulated, studied, and prepared for during the four-to-six-year intervals before they are finally published.

7.1.3.5 Revisions are carried back several years to give consistent time series

236. To maintain the serviceability of data following major revisions, data should be revised back as far as is reasonable based on a balancing of user needs, costs, and availability of source data. The revised time series should be released simultaneously with the revised current data or soon thereafter, preferably in easily accessible electronic format. The revised series should be of sufficient detail and not so aggregated that users are not able to detect the sources of the changes.

237. Clearly, some revisions are more difficult than others to revise backwards. Among these are data from surveys that have changed, data affected by legal constraints, and data constrained by accounting principles (for example, government finance statistics). Lack of resources also constrains the extent of backward revisions for both developed and developing countries. Various second-best approaches are possible, such as the U.S. practice described where GDP series are revised back to the last benchmark (usually five years) and further back for selected series that are particularly important.

7.1.3.6 Documentation on revisions is readily available to users

238. It is important to provide documentation to users outlining the following information. This could accompany the statistics in question, perhaps in an abbreviated form with links or references to more detailed information in quality or methods manuals, etc.

Preliminary (or provisional) data and revised data are identified as such

239. While this practice may seem obvious, it is not uncommon to find in many countries that preliminary and revised data are not clearly identified. This is especially likely in countries where revisions are not made according to a consistent or clearly stated revisions policy. It also occurs more often for government finance statistics and monetary statistics, where statistical principles may not be as much at the forefront as in national statistical offices. Serious confusion and misunderstandings by users could easily arise from neglect to identify changes in data.

Data revision terminology	
Recommended terminology	**Definition**
Data revisions	Data revisions are defined broadly as any change in a value of a statistic released to the public by an official national statistical agency.
Preliminary data / Provisional data	Some statistical agencies use the term "Preliminary data" to describe the first released version of a series and "Provisional data" to describe subsequent versions prior to final amendment. However, the two terms are often used interchangeably though users in general should have no great problem in understanding that data labelled either "preliminary" or "provisional" are subject to revision provided this is clearly highlighted by the agency in the release. Clearly informing the use that the data is subject to revision is more important than the precise term used to describe such data.

240. The actual notation used by national agencies and international organisations for identifying statistics in tables or graphs that are either preliminary/provisional or which have been revised varies, though many agencies use "p" or "r" respectively. The main issue is that whichever notation or practice is used (in paper publications, on-line databases or on the Internet) it must be unambiguous in meaning and used consistently for a disseminated series and in different publications disseminated by the organisation.

Advance notice is given of major changes in concepts, definitions, and classification and in statistical methods

241. Users should be alerted in advance of major conceptual and methodological revisions to help them prepare for and understand better the reasons for and nature of the changes. An example is the Australian Bureau of Statistics efforts to prepare users for revised balance of payments statistics according to *BPM5*. The Bureau provided a description of the new standard and its benefits in advance, including illustrations of sample draft data tables to begin to acquaint users with the changes. Consultations with key users dealt with the implementation of the new standard, and a number of changes were made in the implementation strategy and schedule as a result. Various reports and discussion papers published in advance of the revision analyzed and described the effects on Australia's statistics.

The sources of revision are explained when the revised series are released

242. An example includes documentation on revisions that occur as a result of the benchmarking of monthly and annual series or of related series. Such documentation would contain a description of the benchmarking techniques used, timing of their application, etc.

Breaks in series are documented when consistent series cannot be constructed

243. Complete and transparent documentation of revisions allows users to understand the sources of revisions and, if needed, adjust their analysis of the data. Perhaps even more importantly, complete documentation serves to promote trust in the credibility and integrity of the data and the institutions responsible for compilation and dissemination. Key parts of the documentation are about the sources of the revisions, including the main flows of source data from the preliminary estimates to the revised data. It is also important that breaks in the series be clearly identified when consistent time series cannot be constructed. Documentation can be made available to users in hard copy publications, websites, press releases, and dedicated seminars.

7.1.3.7 Users are reminded of the size of the likely revisions based on past history

244. It is particularly important for users who make decisions on the basis of preliminary estimates, such as policymakers and investors, to be able to make an informed judgment about the reliability and accuracy of the preliminary or provisional data. How much confidence should they have in the first estimates? Accordingly, it is recommended practice for statistical agencies to conduct periodic analyses of revisions (or "revision studies") and to make them available to users. Today's ITC environment makes such studies less demanding than in the past. The following two recommended practices for revision studies have been identified:

- periodic analyses of revisions investigate the sources of revision from earlier estimates and statistical measures of the revisions;

- the analyses are published for major aggregates to facilitate assessment of the reliability of the preliminary estimates.

245. Measures of the direction and dispersion of revisions are the main topics of most revision studies. If revisions have a tendency to be in one direction users can adjust appropriately their interpretation of the preliminary estimates. Alternatively, the discovery of such a tendency could indicate flaws in methodology that may necessitate changes in procedures, and these can be announced with the study results. Revision studies can also be used to fine tune the timing of revisions within the cycle. Measures of dispersion of the revisions provide users with an indication of the accuracy of the preliminary estimates and enable them to assess the likely size of future revisions.

246. It is important to report to users not only the statistical analysis carried out in the revision studies, but also the basic data flows from the first estimates through all the revisions. The main conclusions of the studies should be clearly stated. Providing the basic data to users allows them to conduct their own studies of revisions if they wish.

247. A joint OECD - UK Office for National Statistics (ONS) workshop on revisions analysis held in Paris in October 2004 (OECD and ONS 2004) identified marked differences between countries in the degree to which revision analysis is a regular feature of revisions policy, especially in the context of quarterly estimates of GDP. Some countries do not conduct any such analyses, others have conducted them as one-off projects whilst some conduct such analyses on a regular basis. There was broad consensus at the workshop on the core set of summary indicators that are found in most revision studies.[33] In addition to a number of numerical summary measures, the workshop recommended the use of graphical presentation to supplement the revision analysis.

248. In terms of the dissemination of the results of revisions analysis the OECD-ONS workshop recommended that:

- the presentation of summary measures of revisions should have a fairly low profile in short-term publications and press releases. However, it strongly recommended the inclusion of a prominent statement making it clear that the estimates presented are nonetheless subject to revision – refer Figure 9 for example of such statement by Statistics Canada;

[33] Available from http://www.oecd.org/document/23/0,2340,en_2825_293564_33729303_1_1_1_1,00.html

Figure 9: Example of provision of warning statement that statistics are subject to revision, Statistics Canada,2006

Investment in Non-residential Building Construction - Microsoft Internet Explorer provided by OECD - 7 January 2003

File Edit View Favorites Tools Help

Back Search Favorites

Address http://www.statcan.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=5014&lang=en&db=IMDB&dbg=f&adm=8&dis=2#3 Go

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STATISTICS CANADA

CANADA'S NATIONAL STATISTICAL AGENCY

Investment in Non-residential Building Construction

Status: Active
Frequency: Quarterly
Record number: 5014

The investment in non-residential building construction represents the spending value for enterprises and governments, for industrial, commercial and institutional buildings.

Detailed information for second quarter 2006
Data release – July 11, 2006

- Description
- Data sources and methodology
- Data accuracy

Revisions and seasonal adjustment

Estimates for each quarter are revised when those for subsequent quarters of the same year are published. On an annual basis, when the first quarter is released, revisions are made back four years in accordance to the National Account revision policy. Usually, once every ten years an historical revision is carried out.

Seasonal adjustment is performed by the X11-ARIMA method, version 2000. Seasonally adjusted data for the total investment in non-residential building are obtained indirectly, i.e., by adding up their seasonally adjusted components. These components are the Census Metropolitan Area (CMA) and other regions at the provincial level for each category of non residential building -- industrial, commercial and institutional. Some series contain no apparent seasonality, and in these cases, unadjusted values have been tabulated and aggregated to the adjusted values of the other series.

Data accuracy

No direct measures of the margin of error in the estimates can be calculated. The quality of the estimates can be inferred from analysis of revisions and from a subjective assessment of the data sources and methodology used in the preparation of the estimates.

Date modified: 2006-07-10

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Internet

start | Hankbook on Data ... | CANADA : CSTAT ... | Data presentation ... | STC response Jan ... | Investment in Non-... | EN | 9:50 AM Friday 04-Aug-2006

Source: Statistics Canada, 2006, *Investment in Non-residential Building Construction*, second quarter 2006, Ottawa, Statistics Canada, available at http://www.statcan.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=5014&lang=en&db=IMDB&dbg=f&adm=8&dis=2#3

- information in press releases, etc., should be simple and complemented by links to more comprehensive analyses;

- a two-handed approach is useful: concise and unsophisticated information in short-term publications such as press releases; more comprehensive and worked-out analyses in longer term (annual or more) publications.

249. Finally, the workshop outlined necessary conditions for the availability of data to enable regular revisions analyses. These comprised the:

- systematic archiving of all vintages of data including the original (initially disseminated) series and each subsequent revised version;

- formulation of an archiving strategy when new data are developed, ideally, archiving should be organized at the inception of the work. To define documentation and archiving, the ultimate use of this information should be clearly identified;

- inclusion of revision analysis as an integral part of the production process – refer Figure 10 for an example of such an analysis for the UK ONS Index of Services. In this sense such analyses serve a dual purpose: to provide information to users and a tool for the systematic on-going review of the data collection to identify possible causes of revisions with a view to their possible reduction, etc.

Figure 10: Example of on-going revisions analysis – UK ONS Index of Services, 2004

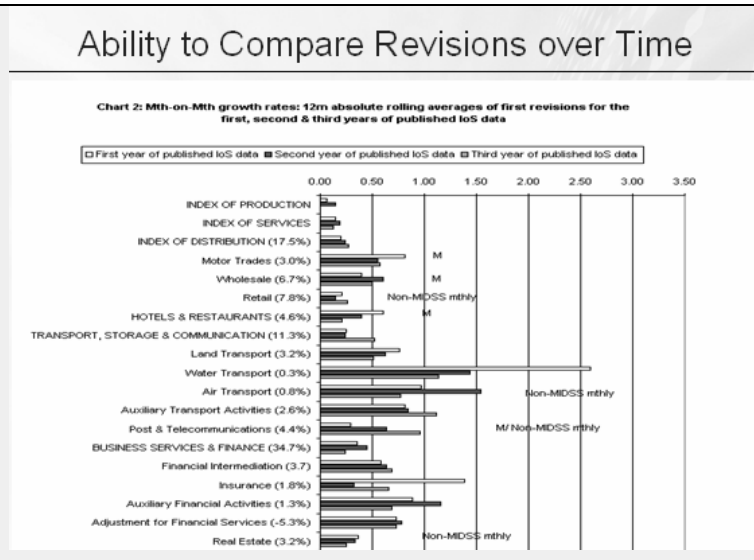
Building revisions analysis into the survey processing system: UK experience with the Index of Services

An example of how revisions analysis can be built into the survey production process is provided by the United Kingdom Office for National Statistics (ONS) experimental Index of Services.

The Index was set up by the ONS in 2002 and revisions analysis was used as an on-going measure of the reliability of survey output. Because it was a new collection, statisticians at the ONS had the luxury of being able to build the necessary requirements for such analysis into the overall operational survey design, especially with regard to the archiving of series as they are disseminated each month. This required around three staff months to undertake. The revisions analysis system has been designed to produce a range of statistics in both tabular and graphical form for component activities that comprise the service sector. These comprise:

- different lags analysis
- 12 month rolling average of revisions
- 12 month rolling variance of revisions
- 12 month rolling mean square error of revisions
- 12 month absolute rolling average of revisions
- T statistics

The system also has the ability to compare revisions over time.



Data from the revisions analysis are used by the ONS to monitor quality on an ongoing basis, to assess the impact of benchmarking on revisions, to assess how revisions performance changes over time and to identify component series where improvements in quality are required.

Source: Morgan, D., 2004, *Revisions analysis in the experimental Index of Services*, paper presented at OECD-ONS Workshop: Assessing and Improving Statistical Quality – Revisions Analysis for the National Accounts, 7-8 October 2004, Paris. Available at http://www.oecd.org/dataoecd/42/31/33850833.pps

250. The importance of such analyses at the international level prompted the OECD to develop the *Main Economic Indicators Original Release Data and Revisions Database* to study the magnitude and direction of revisions to official statistics for 21 key series published in the Organisation's monthly *Main Economic Indicators*. This database provides access to a range of information for OECD Member countries, the Euro area and five large emerging non-member economies. Further information on the database is provided below in the following information box.

OECD Main Economic Indicators Original Release Data and Revisions Database

First releases of official statistics are often revised in subsequent releases, sometimes substantially. Such revisions can impact on policy decisions, as revisions to first published data may alter the previous assessment of the state of the economy. This may occur through a changed interpretation based on the revised data itself or the impact the revision may have on econometric models which may incorporate several statistics, each subject to revision. Whilst this is a recognised issue of key importance, most producers of official statistics do not quantify expected revisions to their data and economists do not have the required data to test the sensitivity of their econometric models to revisions in input data. This important gap in knowledge required to effectively use official statistics and demands from central banks motivated the OECD to develop the *Main Economic Indicators Original Release Data and Revisions Database*, freely available at: http://stats.oecd.org/mei/default.asp?rev=1 .

This facility allows both users and producers of official statistic to study the magnitude and direction of subsequent revisions to official statistics and for economists to test the likely effectiveness of econometric models in simulated real-time. The above link provides access to an interface containing the following data and information.

- Full time series as far back as 1960 in some cases for 21 key economic variables as originally published in each monthly edition of the OECD *Main Economic Indicators* (MEI) CD-ROM from February 1999 onwards for OECD countries, the Euro area, Brazil, China, India, Russian Federation, and South Africa. This database is updated on a monthly basis and provides the raw data needed by economists to test the performance of their econometric models in simulated real time.

- Access to comprehensive revisions analysis studies performed by the OECD for Gross domestic product, Index of industrial production and Retail trade volume.

- Automated programs and a detailed user guide allowing both producers and users of official statistics to perform their own revisions analysis based on the OECD methodology for any country and variable combination available in the database.

- Information on reasons for revisions, together with recommended practices to aid producers of official statistics in establishing a transparent revisions policy for economic statistics.

The following variables are included in the database: GDP and its expenditure components; Industrial production and Production in construction; OECD Composite leading indicators; Retail trade, Consumer price index; Standardised unemployment rate; Civilian employment; Hourly earnings in manufacturing; Monetary aggregates; International trade in goods and Current account balance. This list of variables was based on feedback from a survey of central bank contacts to determine which economic variables were the most important to include in such a database – based on the restriction that they had been published in the MEI. Market based financial variables also published in the MEI (*e.g.* interest rates, exchange rates) which are often part of econometric models were not included in the database as they not revised – and thus originally released data will be the same as that in currently available MEI time series.

7.1.3.8 When a mistake in reporting or processing is made, the revision is made in a transparent and timely manner

251. Many different types of mistakes occur in official statistics, from simple mathematical and recording errors to misclassifications and mistakes in coverage. The mistakes may be by the statistical agency, or by the reporters of source data. It is critical for the integrity of a country's statistical system that any errors are not only reported to users as soon as possible, but also explained in a way that gives assurance that the mistakes were not politically motivated. Explanations for mistakes are much easier when users are already well informed by complete metadata and related documentation on the compilation procedures and sources and flows of data used by the statistical agency. In such a transparent environment, it is just as likely that users will detect errors as the statistical agency, or will at least quickly understand the source of the error.

7.2 PRESENTATION OF SERIES BREAKS

7.2.1 Introduction

252. A time series is a set of regular time-ordered observations of a quantitative characteristic of an individual or collective phenomenon taken at successive periods / points of time. Normally, though not always, time series are a set of observations, at constant intervals (months, quarters, years, etc.). The continuity of a time series not only implies that the observations are continuous over time but also that the same definitions, classifications, processes, etc., have been applied in the collection and compilation of each observation.

253. The application of inconsistent definitions and classifications, etc., for each observation over time, in theory, constitutes a measurement break in a time series (referred to as a "series break" hereafter). There are two different reasons for a time series break:

- measurement changes such as changes to classifications, estimation methodology, survey scope, etc.;

- real world changes induced by real events such as government policy (*e.g.* the introduction of a new tax), war and natural disaster, etc.

It is necessary to distinguish these two types of time series break. In this Handbook the term "series break" is used in the context of a measurement change induced time series break.

254. However, in reality not all changes to concepts, etc., constitute a series break that has a significant impact on the use of the time series. Statistical agencies responsible for the collection of data frequently apply changes to questionnaires, registers, concepts, to their monthly, quarterly and annual collections, many of which have no appreciable impact on the continuity of the series. Changes to annual collections, in particular, are a fact of life.

255. Statistical agencies, analysts and government agencies use time series data for economic and social research, and business cycle analysis to interpret current economic events. Statistical agencies require long time series to carry out seasonal adjustment and calendar effect correction. Time series are also fed into models to produce projections and forecasts about future economic and social conditions. For these reasons, users in national agencies and international organisations attach very high importance to time series continuity. In fact, such continuity within a series is often considered of greater importance than comparability between countries.

256. However, the uses of time series statistics outlined above are frequently hampered by series breaks or shortness of the series length. The main causes of series breaks are similar to some of the reasons for revising data described in Section 7.1.1 above, such as:

- changes to the base year which may co-incide with updating of the weighting system which in turn may involve changes in the sample of respondents and the sample of products; and

- the implementation of changes in concepts, definitions and classifications, methodology, sampling, estimation.

257. To a large extent, these factors derive from within the statistical agency responsible for the initial compilation of the data and are usually intentional (US Bureau of Labor Statistics 1996). However, some changes stem from external influences that may be outside the control of the statistical agency, in particular, where the data are derived from administrative sources. These include changes in

laws or administrative procedures, changes in the organisational structure of business through mergers, etc.

7.2.2 Approaches to minimising the impact of time series breaks

258. National statistical agencies normally attempt to minimise the frequency of series breaks, and when they occur, use a number of approaches to reconstruct series based on the new concepts, classification, etc.

- The most commonly used approach involves the compilation of the series using both the old and new methods, classifications, etc., for a specified period around the time of implementation. However, the high cost of compiling dual series severely restricts their availability and length.

  The availability of dual information enables an objective measure of the impact of change to be assessed and perhaps a concordance between the new and old series at the time of the series break. The concordance "coefficient" so calculated may be used to splice or link the series break. Caution is required in the application of such coefficients to the historic time series as it is only really applicable over the time dual series were compiled. It may not reflect the economic or social reality of the entire historical series (BEA 1993). The difficulty is determining when or how far back the conversion coefficient ceases being accurate.

- Alternatively, agencies may refer back to highly disaggregated data (or even unit record information) and recompile the series based on the new methodology, etc. In practice however this approach is also very labour-intensive and may only be possible for key highly aggregated series (OECD 2000). Finally, historical estimates may be made on the basis of a related indicator that exhibits the same or similar changes over time as the series where the series break occurred.

7.2.3 Recommended practices for the presentation and reporting of information about series breaks

259. Recommended practice with regards to time series breaks entails:

- The compiling agency taking all possible steps to avoid and minimise changes to questionnaires, definitions and classifications used to collect and compile data. Methodologies should be developed to reduce the frequency of revisions.

  However, there comes a time when the time series may be disrupted even when outdated classifications, concepts and questionnaires are maintained. In such instances a complete break in series may be preferred to series that continue to be collected on the basis of outmoded classifications and concepts that do not approximate reality. There is clearly a tradeoff between costs imposed by breaking a time series on one hand and the benefits from improving the relevance of the time series on the other (BEA 1993).

- Where significant breaks in a time series are unavoidable, users should be given warning well in advance of the implementation of the series break outlining the timing of implementation and a detailed explanation of the reason(s) for the change. "In advance" is taken to mean not just the time of implemention but sufficient time to enable users to implement modifications to their systems, programmes or databases and to seek further clarification if necessary. A common practice adopted by many statistical agencies is to issue a detailed discussion paper many months in advance of the change.

- Actual breaks in the series should be clearly identified in both the statistical table and any accompanying graphs. A variety of methods are commonly used by national agencies and international organisations to highlight in tables that a series break has actually ocurred. These include the insertion of a line in the table at the break point, inclusion of a footnote or tabular presentation as an entirely new series. Whichever method is adopted, the main point is that the break is completely clear to users. Consideration will also need to be given to the identification of series breaks (together with appropriate explanatory information) in data disseminated electronically such as via on-line databases, etc.

The following information drawn directly from Eurostat guidelines should also be provided (Eurostat 2003c, p. 16):

  - the reference period of the survey where the break occurred;
  - whether or not the difference reported is one-off with limited implications for the time series and / or if the reported change led to harmonisation with any standards;
  - a precise outline of the difference in concepts and methods of measurement before and after the series break;
  - a description of the cause(s) of the difference, *e.g.* changes in classification, in statistical methodology, statistical population, methods of data transformation, concepts, administrative procedures with regard data from administrative sources;
  - an assessment of the magnitude of the effect of the change, where possible, with a quantitative measure.

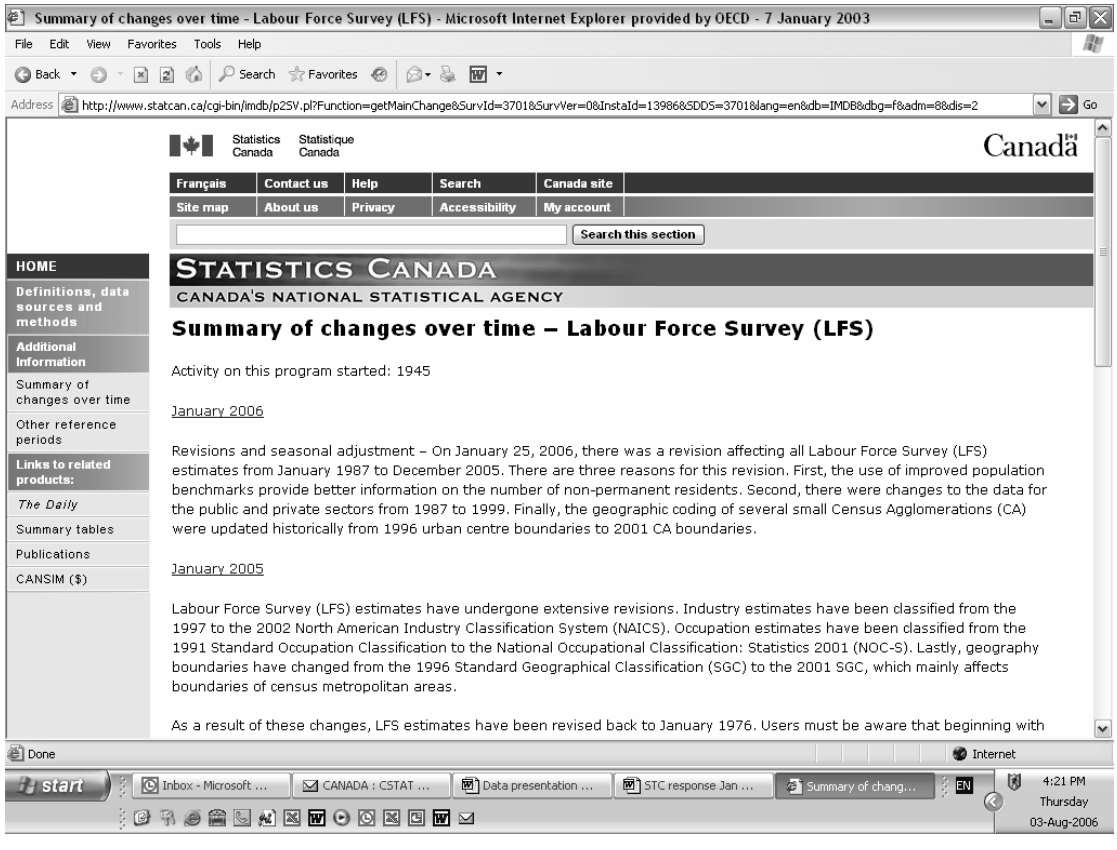
Links and references to more detailed information should also be provided.

- Points in line graphs should not be joined across discontinuities in data. The reason for the series break should be explained in a footnote accompanying the graph with appropriate links or references to more detailed explanations of the causes of the breaks.

- When methodological changes are introduced, an attempt should be made to revise the historical series as far back as data and available resources permit. Ideally, such backcasting should extend back 2-3 years to reflect the new methodology, etc.

260. An example of recommended practice of the systematic presentation of metadata on changes over time is provided by Statistics Canada's Integrated Metadatabase (IMDB) referred to in para. 174 above. That NSI's corporate metadata repository incorporates the time dimension in the metadata model used which allows users to systematically view changes to variable definitions, classifications, methodology, etc., both in summary form and with links to very detailed information regarding each change. An example of a summary of changes over time to the Canadian Labour Force Survey is provided below in Figure 11.

Figure 11: Example of provision of metadata on changes over time: Statistics Canada's Integrated Metadatabase (IMDB)



Source: Statistics Canada, *Integrated Metadatabase* (IMDB), available at http://www.statcan.ca/cgi-bin/imdb/p2SV.pl?Function=getMainChange&SurvId=3701&SurvVer=0&InstaId=13986&SDDS=3701&lang=en&db=IMDB&dbg=f&adm=8&dis=2

7.3 SAMPLING AND NON-SAMPLING ERRORS

261. The aim of any statistical agency is to compile and disseminate statistics appropriate to user needs in terms of quality. Quality is commonly defined as "fitness for use" (Statistics Canada 2003, p. 6)[34] and comprises a number of dimensions described in quality frameworks developed over the last few years by both national agencies and international organisations (referred to briefly above in Section 1.1.1). One of the quality dimensions frequently referred to is "accuracy" which is the degree to which the data correctly estimate or describe the quantities or characteristics they are designed to measure. Accuracy refers to the closeness between the values provided and (unknown) true values. Accuracy has many attributes, and in practical terms there is no single aggregate or overall measure of it. Of necessity these attributes are typically measured or described in terms of the error, or the potential significance of error, introduced through individual major sources of error.

262. An aspect of accuracy is the closeness of the initially released value(s) to the subsequent value(s) of estimates. In light of the policy and media attention given to first estimates, a key point of interest is how close a preliminary value is to subsequent estimates. In this context it useful to consider the sources of revision referred to in Section 7.1.1. in the discussion on data revision. Smaller and fewer revisions are aims, however, the absence of revisions does not necessarily mean that the data are accurate.

263. The focus of this Section are recommendations on the presentation of information to users on the several types of errors that originate from processes and methodologies used to collect data. The dissemination of such information to users is an aspect of recommended metadata reporting referred to above in Section 6 of this Handbook. The most widely used typology of such errors involves the distinction between sampling errors and non-sampling errors.

7.3.1 Sampling errors

Background

264. Sampling errors occur because not all units in a target population are enumerated in a sample survey. As a result, the information collected on the units in the sample may not perfectly reflect the information that could have been collected had the entire population of units been counted. There are various formulae for estimating the sampling error when probability sampling is applied (Eurostat 2002b). A commonly used measure of sampling error is the standard error, which indicates the degree to which an estimate may vary from the value that would have been obtained from a full enumeration of the entire population (which would represent the "true value").

265. The relative magnitude of sampling error in relation to non-sampling errors increase as more detailed or disaggregated estimates are compiled. Information on the magnitude of sampling error is an essential factor in determining the level to which data may be meaningfully disaggregated and analysed (UNSD 1993 p. 9).

266. The provision of information on sampling errors is essential in ensuring the appropriate use of data subject to such error in analyses by users with widely differing levels of statistical expertise. Its availability also facilitates evaluation and improvements to statistical design and procedures (UNSD

[34] The International Organisation for Standardisation (ISO) defines quality as "the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs." (ISO 8402, 1986, 3.7)

1993, p. 9). Particular care is required in the publication of data subject to very high sampling error, and appropriate balance is required in deciding whether such information should be disseminated at all, or presented in such a way as to make limitations in use apparent to users with only minimal knowledge of statistics. There is a need for agencies disseminating data subject to sampling error to prepare a strategy for estimating and publishing such errors. The current practice in many national statistical institutes is in fact to disseminate data subject to high sampling error on the assumption of user responsibility to use the data wisely. In this context the statistical agency does not accept this responsibility though it does have the professional obligation to attach appropriate warnings and caveats about its use (ABS 2004, Section 11:04:01).

267. Investigations into national practices regarding the presentation of sampling error estimates carried out by the OECD Short-term Economic Statistics Working Party (STESWP) task force on data presentation and seasonal adjustment in 2003 (Graf 2003) showed that much research has been done on the subject but that often no actual estimates of variance or covariance tend to be published for either annual or short-term statistics, particularly for the latter. A review of relevant national data sources showed wide variation in national practices, with respect to:

- the amount of information provided about standard errors;
- their presentation in technical notes accompanying statistical data; and
- ease of access and proximity to statistical data.

268. A detailed study of United States agency reporting practices on sampling error published by the US Office of Management and Budget in 2001 (OMB 2001) further highlighted this variation in practice, not only across statistical agencies but also within the same agency for different surveys. The adoption of different practices even for the same survey published in different dissemination media is largely a reflection of the different audiences addressed by each medium with varying degrees of statistical expertise and need for detailed information on sampling error. The recommended presentation practice outlined in the US study were highly dependent on the type of dissemination media, though the study emphasized that irrespective of the medium used it was not a question of whether or not information on sampling error should be provided but rather how essential information is to be conveyed to users.

Forms of presentation of information on sampling error

269. From its analysis of practices across US agencies, the OMB study identified two broad methods of presenting information on the precision of estimates (OMB 2001, p.3-4). These entail:

- Reporting a direct estimate of the error through the presentation of an estimate of sampling error for every statistic in a statistical report. Users are therefore provided with both the statistic and its sampling error at the same time. An obvious limitation of this approach is the expansion of the publication. Another reason for not recommending this approach cited by the Australian Bureau of Statistics in its *Publishing Manual* (ABS 2004 p. 500) is that it gives the impression that sampling errors are the only or main source of error and that the interpretation of sampling errors is equally important for all statistics.

- The use of indirect estimates of sampling errors. These in turn involve a number of options, namely:

– The provision of a procedure to enable the user to compute approximate sampling errors for the estimates disseminated. The two major disadvantages of this approach cited in the US report were that sampling errors would not necessarily be presented beside the data and the fact that the procedure used to compute the approximate sampling errors may not provide values as accurate as direct estimates.

– The provision of sampling errors for a selected number of key estimates. An advantage of this approach is the provision of direct estimates of sampling errors close to the data, albeit only for a limited range of data. Users therefore need to extrapolate errors for data for which they had not been compiled directly.

The ABS also recommends the use of some form of notation (*e.g.* an asterisk) to highlight those statistics subject to very high sampling (or non-sampling) error. Furthermore, the Bureau recommends the presentation of supplementary data and methods for approximating the standard errors of derived statistics such as estimates of change, ratios of different estimates for the same period, changes in ratios over different periods, etc. (ABS 2004, p. 501).

270. Irrespective of the approach used for the presentation of information on sampling error it should be remembered that this information is an adjunct to the substantive results of the survey and should not therefore clutter or obscure these results. In other words it should serve the purpose of highlighting the reliability of the data (UNSD 1993, p. 176).

Recommended practices for the presentation and reporting of information on sampling error

271. In the interests of data transparency, and to help ensure the appropriate use of data, statistics derived from all sample surveys should be accompanied by information on sampling errors. Such information should be provided for all dissemination media – online databases, websites, other electronic products, paper publications and press releases. It is also important for the information to be expressed in non-technical terms capable of being understood by the non-specialist user. The mode of presentation and the amount of detail provided should therefore meet the specific needs of particular categories of users (UNSD 1993, p. 176). The required information comprises the provision of the following information in accompanying or clearly linked technical notes outlining (OMB 2001, p. 3-8):

- Alerting users to the fact that data are derived from a random or non-random sample. If the latter then inference implications should be clearly stated.

- Sampling error should be identified as a source of error which should be explained and interpreted for data users through provision of a brief definition of sampling error. For example, strong warnings about the unreliability of data with high sampling error.

- Sampling errors must be presented in the context of total survey error. In this context users should be made aware of the fact that sampling error is just one, and often not the most significant, component of total error (UNSD 1993, p. 176, 7.1 (1)).

- If statistical tests are used in the report, the significance level at which statistical tests are conducted should be stated explicitly.

- Sampling errors for key estimates should be available to the user either in a table in the publication or linked on the Internet. Some form of notation should also be placed directly beside estimates with very high sampling (or non-sampling) error.

Sampling errors may be presented in one of a number of different forms, for example:

- as absolute values of the standard error (se);
- as relative values, standard error divided by the estimate (rse); or
- in the form of probability or confidence intervals.

The preferred use of either the absolute or relative forms depends on the nature of the estimate and readers are referred to the United Nations publication, *Sampling Errors in Household Surveys* (UNSD 1993, p.178) for a detailed evaluation of the different forms of presentation and several examples of recommended practice. The UN evaluation emphasizes the importance of ensuring that the chosen method is clearly and unambiguously described and presented with accompanying definitions and notation.

272. In order to ensure consistency in the dissemination of this information across the organisation in all published output subject to sampling error, some statistical agencies mandate a standard set of words to be included in all relevant publications.

273. Where space considerations preclude the inclusion of detailed information, either references or hyperlinks to more detailed technical reports or user manuals should be provided. Such information should enable specialist users to analyse detailed data or compile new tabulations and would therefore:

- identify the specific method used for calculating the sampling error;
- provide sampling error calculations (tabulations) for different types of estimates (*e.g.* levels, percents, ratios, movements, means and medians) for a number of variables and disaggregations. The aim is to provide a basis for extrapolation to statistics for which sampling errors have not been computed by the source agency (UNSD 1993, p. 180);
- contain evaluations of the procedures used for estimating sampling errors.

7.3.2 Non-sampling errors

Background

274. Non-sampling errors are errors in published data which cannot be attributed to sampling fluctuations (ISI 2003). Non-sampling errors may arise from a wide variety of sources including coverage defects in the frame, deficiencies in the collection instrument or questionnaire, problems in the processing system and difficulties in achieving an acceptable response to the enquiry.

275. Information from both the draft United Nations Handbook on household surveys in developing and transition countries (UNSD 2003, ch. 11) and the Eurostat standard quality report (Eurostat 2003c, pp. 7-11) has been used in the preparation of the following typology of non-sampling errors. This is merely intended to illustrate the diversity of such errors. In reality, the differences between some of the various forms of non-sampling error presented may not be all that distinct, particularly with respect to identifying cause[35]. Furthermore, many economic and social statistics, in particular, those estimated using many different sources (*e.g.* balance of payments, national accounts) can combine a number of different types of non-sampling error (as well as sampling error).

[35] Although a little dated in places, the United Nations National Household Survey Capability Programme publication, *Non-sampling Errors in Household Surveys: Sources, Assessment and Control*, New York 1982, provides a detailed description of the causes of non-sampling errors, their measurement and recommended processes to minimise them.

Non-sampling error terminology	
Non-observation errors	*Coverage errors* – resulting from divergences between the target population and the frame population. Coverage errors comprise: under-coverage; over-coverage; multiple inclusion in the frame; incorrect auxiliary information provided in the frame (incorrect activity, size classification, location, etc.). *Non-response errors* – resulting from the failure to obtain data for target units in the census or survey. These comprise: unit non-response when no data are obtained for a target unit; and item non-response when data for some, but not all, of the collection variables are obtained for a target unit.
Observation errors	*Measurement errors* – that occur during data collection and result in the recorded values of variables differing from the true value. Such errors arise from: imperfections in the survey instrument (form, questionnaire or measuring device) which leads to the recording of incorrect values; respondents consciously or unconsciously providing incorrect data; interviewer influencing answers given by respondents. *Processing errors* – originating from processes used by the statistical agency following receipt of data from the source. These include: coding, data entry; data editing; imputation errors. *Model assumption errors* – arising from statistical models estimated and used in the estimation phase of a survey. Errors here stem from the selection of the appropriate model, collection of relevant data and estimation of the model's parameters.

Sources: Derived from: Eurostat, 2003, "Methodological Documents: Standard Report", discussion item 4.2B, pp. 7-11, *Assessment of the Quality in Statistics*, 6th meeting, Luxembourg, October 2003; and UNSD, 2003, *Household Surveys in Developing and Transition Countries: Design, Implementation and Analysis,* New York, ch. 11

276. The very diversity of non-sampling errors outlined above presents a problem in providing users with information about, both their existence in published output, and in particular, quantitative measures of magnitude. For this reason data disseminated by both national agencies and international organisations frequently provide very detailed information on sample errors but only general, broad statements on the existence of non-sampling errors. This may convey a misleading impression that sampling errors are far more important than non-sampling errors.

277. The UN Handbook on household surveys in developing and transition countries raises the issue of a lack of standard methods for estimating parameters for the different components of non-sampling error outlined above. It also refers to the absence of a culture within statistical agencies that recognises the importance of such errors, and that they should receive as much attention as sampling errors in the provision of information to users. Nevertheless, some national statistical agencies and international organisations (in particular, Eurostat 2003c) do provide recommendations on the presentation of non-sampling errors, and in some instances how such measures could be quantified. Although quantitative measures for some non-sampling errors are generally not readily available, there are some that are, *e.g.* coverage rates, non-response rates.

278. The absence of readily available quantitative measures for all types of non-sampling error does not however remove the professional obligation on the part of organisations disseminating data to provide at least some information. Depending on the nature of the survey, qualitative information

indicating the potential main sources of non-sampling error will assist users in their interpretation and use of data disseminated.

Recommended practices for the presentation and reporting of information on non-sampling error

279. The focus of the recommended practice on non-sampling errors outlined below is not the methods by which national agencies minimise their impact but rather guidelines on the type of information on such errors to be reported with disseminated statistics:

- As for the reporting of information on sampling error for all sample surveys, all statistical output disseminated by national agencies and international organisations should be also accompanied by information on non-sampling errors. Such information should be accessible for statistics disseminated on all types of media – online databases, websites, other electronic products, paper publications and press releases. It is also important for the information to be expressed in non-technical terms capable of being understood by the non-specialist user. Such information should either accompany the data disseminated or be provided in clearly linked technical notes.

- Where possible, quantitative measures of non-sampling error should be provided. However, because of the difficulty in quantifying some non-sampling errors, agencies will need to disseminate a mixture of quantitative and qualitative information that enables a non-technical user to clearly understand the strengths and limitations of the data. In particular, information on non-sampling errors should clearly convey to the user the fact that such errors, either individually or in total, may have a greater impact on the reliability of the data than sampling error and that the "ready" availability of quantitative measures of sampling error is not necessarily an indication of their relative significance.

- With respect to precisely what information on non-sampling errors that should be reported, the ideal recommendation is for national agencies and international organisations to disseminate information on all of the non-observation and observation errors summarised above. The second-best option is the adoption of a more pragmatic approach which entails national agencies using their professional judgement and more detailed knowledge about the data to identify a sub-set of key non-sampling errors that have a significant impact on the reliability of the data in question. The important thing is for these agencies to develop a culture of critical appraisal of their statistical output and for key strengths and weaknesses to be documented and disseminated.

- In this context, the following examples of specific non-sampling error information across the whole range of such errors are merely intended to illustrate the types of information that could be provided. These examples have been drawn directly from Eurostat standard reports for the assessment of quality in statistics (Eurostat 2003c).

Examples of reporting indicators for non-sampling error	
Type of non-sampling error	**Reporting indicator**
Coverage errors	• Information about the frame, reference period, updating actions, quality review actions. • Areas of specific strengths and weaknesses of coverage and a qualitative assessment of possible bias. • Type and size of coverage errors (*e.g.* coverage rates).
Non-response errors	• Non-response rates. • Imputation methods used (if any) • Indications of the impact of remaining non-response on disseminated data, areas of possible bias, etc. • Indications of the causes(s) of non-response • Information about the actions and incentives to minimise non-response
Measurement errors	• Indications about the causes of measurement errors in the published output and their impact (*e.g.* areas of imperfection in the collection instrument). • Actions taken to minimise measurement errors in the design and testing phases. • Any quantitative measures (*e.g.* the mean and variance of measurement error per variable of interest).
Processing errors	• Outline of processes used to minimise processing errors (*e.g.* staff training, data editing used, use of automated ITC processes, etc.). • Indication of remaining errors and their impact on statistics, possible bias, etc.
Model assumption errors	• Models used in the production of the survey's statistics and the assumptions on which they rely. • Evidence about the validity of the assumptions. • Statement about the accuracy of any additional data used in the model's estimation. • Indication about any remaining (unaccounted for) bias, etc., which could affect the statistics.

Source: Eurostat, 2003, *Methodological Documents: Standard Report*, discussion item 4.2B, *Assessment of the Quality in Statistics*, 6th meeting, Luxembourg, October 2003

7.4 REBASING INDICES

7.4.1 Introduction

280. Rebasing refers to a number of processes undertaken to maintain an index, not all of which are necessarily undertaken at the same time. These processes comprise changing the:

- weights in an index;
- price reference period of an index number series; or
- index reference base of an index number series.

281. The term "rereferencing" is used in this Handbook in the context of the last process outlined above, *i.e.* where the reference base of 100 is changed from one year to another, *e.g.* from the year 1995 = 100 to 2000 = 100. A long time series of fixed base indexes is usually compiled by recalculating the indices released in the previous reference base into indices expressed in the more recent base by a simple transformation and by linking them to the new indices.

282. As mentioned in Section 7.2 above in the discussion on series breaks, the usefulness of statistics is frequently diminished by breaks in time series, in particular, when fixed base indexes are involved. One of the main causes of series breaks for indices concerns changes to the base year[36]. Ruptures in the time series in many countries are exacerbated by other changes taking place place concurrently with rereferencing such as updating of the weighting system[37] which may also involve changes to the sample of respondents and the sample of products.

283. Much of the text in this Section is drawn extensively and directly from a paper prepared by Anna Ciammola (2003) for the 2003 meeting of the OECD Short-term Economic Statistics Working Party (STESWP).

7.4.2 Existing international standards

284. The only existing international statistical standard providing explicit guidelines and recommendations on the rebasing of indices is the European Commission's 1998 Short-term Statistics Regulation (European Commission 1998) which requires that rebasing should take place every five years (Article 11) and within three years from the end of the base year. For example, rebasing to the 2000 base year should be undertaken by the end of 2003 at the latest.

285. There is however room for interpretation as to whether this requirement means that indices are compiled in January 2004 (which in the case of monthly data may refer to October or November 2003) must be based on 2000 or whether it is the first delivery of data for the first reference period in

[36] As Eurostat's Short-term Statistics Guidelines point out, the term base year is used "to describe the year with respect to which the value of all other reference periods are compared. In a series of index numbers it is the year that takes the value 100". Note that the Handbook on price and values measures in National Accounts (NA) contains a different definition of base year. (Eurostat 2002a, Part 8.5.1, Base years and base year changes). The reference year concept on the other hand refers to the length of time (week, month, quarter or year) for which data are collected. The reference period could also be limited to a specific point in time.

[37] The European Commission's Short-term Statistics Regulation requires that a new weighting system is introduced at least every five years and coordinated with changes in the base years. (European Commission 1998)

2004 (January or the first quarter 2004) that needs to be in the new base year (Eurostat 2002a, Part 8.5.1, Base years and base year changes).

286. More recent work in this area has been undertaken by the United Nations Committee for the Co-ordination of Statistical Activities (CCSA) at the end of 2003 in an attempt to harmonise the base years of indices disseminated by international organisations (UNCTAD 2003). The indices currently disseminated by international organisations contain a mixture of practices including the publication of base years as reported by member countries for their national series or national series that are rereferenced by the international organisation to a common base year for all member countries. A review of current international organisation practices prepared by UNCTAD for the CCSA showed that for most statistical domains a delay of three to six years is usually needed by international organisations to release their rebased index numbers. The reason for this delay is the availability of data on which index numbers are based, either the series themselves or data to be used as new weights in the rebasing of indices. In 2003 the current base years were reported as being 1990 and 1995 and more rarely, 1980 and 2000. In some cases, the weights used for the base year were the average of three years.

287. The outcome of the CCSA discussion was the need for international organisations to harmonise their base years.

7.4.3 Compiling rebased (fixed) index numbers

288. The main criteria for the selection of a suitable base year is that it should be "normal" or "average" and not subject to any major usual circumstance or influence. Common international practice involves the updating of base years every five years with the year being one ending in a "0" or "5".

289. The criterion normally used by statistical agencies to rebase index numbers is that any conversion into a different reference base period must leave month-to-month and year-to-year percent variations (computed on the rebased indices) identical to those characterising the original series, even though the rebased index level changes. Both the direct and the aggregative approaches described below fulfil this criterion.

Direct approach

290. In the direct approach the indices at each level of the activity classification, coming from a linear combination of the indices at lower levels, weighted by the original weighting system, are rebased independently. The result of this independent rebasing is that the additivity property of fixed-base indices is lost, which implies that indices at more detailed level of activity cannot be aggregated to produce indices at higher and higher levels by means of the original weighting system.

Indirect or aggregative approach

291. This approach is computationally more expensive than the direct approach and is performed through the following steps:

- rebasing of the elementary indices (*i.e.* at the most detailed level of product breakdown);

- updating of the previous weighting systems[38];

- aggregating the rebased elementary indices by means of the updated weights.

292. The Eurostat Short-term Statistics Guidelines refer to the *Handbook on Price and Volume Measures in National Accounts*, that recommends use of the direct approach and this approach has been adopted by many European national statistical institutes. For instance Italy, Belgium, Austria, Denmark, Ireland used the direct approach after the migration to base year 2000, even though the same institutes may have different practices for different indicators.

Rounding policy

293. Rounding is performed to prepare index numbers for publication and generally data are rounded to the first decimal place. National practices vary considerably with regard to the stage at which index figures are rounded. Some agencies base their calculations on unrounded data that are rounded only at the final stage (as the US BLS does for compiling their producer price index) for dissemination purposes. Others round data at each step, from elementary to the most aggregated indices. The latter practice cannot be replicated for the calculation of retrospective indices, as this may affect month-to-month and year-to-year percentage changes constrained to be equivalent to those already published. Rounding to the third decimal place in the computation of the rebased indices assures the fulfilment of the above constraint. For dissemination purposes, the rebased data are rounded to a decimal place at the final step. Rebased data have less precision after rounding and the loss of precision due to it is more serious when the rebased index values are smaller than the originally released ones.

7.4.4 Presentation and dissemination of rebased indices

294. The presentation and dissemination practices of national statistical institutes for index rebasing are very different, though the direct approach is the method usually adopted. Influencing factors are the sector breakdown at which index values are released and the impact of a new activity classification and weighting system on the retrospective indices. These issues are discussed below.

Introduction of a new activity classification

295. If the activity classification system used in the series is unchanged rebasing could conceivably be left to the final users and statistical agencies could then simply maintain the database with the historical weights and indices. However, the introduction of a new activity classification may necessitate the calculation of new index values, especially at the more disaggregated classification levels where there could be significant impact on indices already released (*i.e.* the general index, the most aggregated level could remain unchanged). In such situations, statistical agencies would need to compute the indices on the previous base using the new activity classification and splicing coefficients (*i.e.* the averages (in the previous base year) of the retrospective indices over the new base year (at each level of the classification)). Agencies could then:

- provide users with this set of retrospective index values together with the splicing coefficients;

- rebase the indices and provide users with spliced series.

[38] Updating of the original weights is carried out to give higher (lower) importance to a certain economic sector or product, when the average level of its index, not rebased, over the new year base is greater (smaller) than the average level of the most aggregated index, not rebased, over the same time span.

296. The second solution is widely practised by national statistical agencies as it is more user-friendly than the first approach.

Historical data, rebased historical data, "linking" year and base year

297. At each rebase, two sets of retrospective indices are available from the first period of the base year onwards (for example, from January 2000 to December 2002, if the indices base 2000 = 100 are presented starting from January 2003). These comprise old indices rebased by means of one of the two approaches described above and the new indices computed according to the new weighting system, sample of respondents, activity classification, etc. This means that statistical agencies may:

- replace the old index values with the new ones over the whole time span (2000-2002 in the example);
- replace the old index values with the new ones starting from the year following the base (the time span 2001-2002);
- maintain the old index rebased until December 2002.

298. In previous cases, the "link" year, *i.e.* the year at the beginning of which the old rebased index series are linked with the new index series is, respectively, 2000, 2001 and 2003. For presentation purposes, the importance of the "link" year arises because year-to-year percentage changes are computed comparing the index numbers belonging to different structures. Each of these approaches are common practice for statistical agencies. The first is especially appreciated by time series analysts as it removes structural breaks, introduced at the beginning of the "link" year, from the end of the series. The third approach leaves index percentage changes already published unchanged.

7.4.5 Recommended practices for rebasing

299. It is recommended that rebasing be undertaken every five years and within three years from the end of the base year.

300. Unless the year was "unusual" it is also recommended that the base year selected be one ending with a "0" or "5".

301. In order to provide sufficient transparency to users with regards to a rebase it is necessary to ensure that the following metadata accompanies any rebased data, either directly or through the provision of: appropriate references or links:

- the methodological approach adopted for the rebase, in particular, the processes actually undertaken during the rebase, *e.g.* simple rereferencing, introduction of new weights, etc.;
- the link year;
- the classification level at which index numbers are rebased and disseminated;
- the rounding policy followed in the rebasing, even though rounding should only be carried out at the very last stage for presentation purposes;
- a transition table from the old to the new classification system, if this is introduced;

- the description of any new weighting system and its impact on the aggregation of lower level indices;

- when the direct approach is adopted, a note of caution is useful to alert users that any aggregation of rebased indices needs the updating of the weights of the previous bases[39.]

[39] If a statistical agency adopts the direct approach to rebase the indices, it does not provide the updated weights to the final users and the original weighting system cannot be used to aggregate the rebased indices (the additivity property is lost when the rebasing is carried out).

7.5 CITATION

302. This Section draws directly and extensively from a paper prepared by the UNESCO Institute for Statistics (UIS) presented at the 2nd session of the Committee for the Coordination of Statistical Activities (CCSA) in Geneva on 8-10 September 2003. The context of the paper was the need for the adoption of recommended citation practice by international organisations, though the practices cited are also relevant for national agencies. The focus of the paper was citation of datasets, though brief mention in this Section is also given to text citation.

7.5.1 Reasons for citation

303. Proper citation is an essential element of data and metadata reporting. Citation refers to the process of acknowledging within the organisation's current database or text the document, database or other source from where information has been obtained. A reference on the other hand refers to the detailed description of the actual source from which information has been obtained. A bibliography is a list of references consulted (Caledonian University 2003).

304. There are many reasons why citation of data is as important as citation of other published sources of material. These include:

- evaluation of the value of datasets is assisted by being able to track usage accurately. The inclusion of a feedback and tracking mechanism as part of a data citation policy is very useful in this regard;

- it facilitates assessment of the reliability of the information on the basis of its provenance and context. Also, additional information provided at the original source may permit the user to go more deeply into the subject and to verify sources and authenticity;

- the importance of giving appropriate credit to the producers of datasets. This is particularly the case in the increasingly competitive academic sector where credit needs to be attached to the production of high quality, well-documented datasets. It is also important in other sectors in an environment where different agencies re-use one another's data;

- it can enable other researchers to locate the exact version of the data used so that they might re-analyze the data to amplify, extend, confirm or refute the author's interpretation of it, all of which is an important part of the scientific process;

- it can enable other researchers to locate current versions of the same dataset or similar datasets from the same source;

- it is important that producers of the data should be able to locate quickly and accurately the exact version of the data supplied so they can answer queries quickly and can also resolve problems with the data.

305. These reasons underline the fact that effective citation also places an obligation on the data user to subsequently follow common citation best practice. To encourage effective citation, an obligation is therefore also placed upon the data provider to provide the necessary information (metadata) in conjunction with the dataset, *e.g.* as outlined in Section 7.5.4 below.

306. There is a more fundamental issue however. Even with all of the problems and challenges mentioned previously, it is possible for users to provide a basic citation for a dataset based on the guidelines that have been provided in the various citation styles list in Section 7.5.2 below. This basic citation may not address all of the concerns that have been identified as the citation of datasets is commonly not viewed in the same manner as citation of other materials. Unfortunately, the use of appropriate citation practices by both national agencies and international organisations is more the exception than the norm, particularly with respect to providing adequate reference information to statistics accessed from other agencies. The norm in relation to data sourced from databases accessed via websites or other online facilities is merely to cite the name of the organisation and (perhaps) almost generic descriptions of the actual database. There is considerable variation in the amount of citation information provided for data obtained from online sources.

7.5.2 Existing citation standards

307. There are a number of well developed and effective standards and styles for citation and bibliographic reference of material that been developed over many years and are in widespread use. Each of these styles have been updated so that they contain the necessary guidelines to effectively cite many forms of traditional information sources as well as newer information sources, such as the Internet. The most popular of these styles include:

APA	generally used in psychology, education, and other social sciences (APA 2001)
MLA	literature, arts, and humanities (Gibaldi 2003)
AMA	medicine, health, and biological sciences (Iverson *et al* 1998)
Turabian	designed for college students to use with all subjects (Turabian 1996)
Chicago	used with all subjects by books, magazines, newspapers, and other publications (University of Chicago 2003).
Harvard	commonly used in the United Kingdom academia and in the legal profession (Dee 2004)

308. Other standards have also been created in the area of bibliographic references:

ISO 690	Information and documentation – Bibliographic references – Content, form, and structure
ISO 690-2	Information and documentation – Bibliographic references – Part 2: Electronic documents or parts thereof.
Dublin Core	The Dublin Core provides guidelines for encoding bibliographic citation information in Dublin Core metadata. The guidelines focus primarily on bibliographic citations for journal articles but guidelines for other genre are also provided (Dublin Core n.d.).
DDI	Has a specific citation framework developed with statistical data in mind[40].

[40] Refer *DDI Alliance website* (ICPSR n.d.), specifically http://www.icpsr.umich.edu/DDI/dtd/version2-1-all.html?section=2

309. ISO 690-2 specifies the elements to be included in bibliographic references to electronic documents. It sets out a prescribed order for the elements of the reference and establishes conventions for the transcription and presentation of information derived from the electronic source document. ISO 690-2 is intended for use by authors and editors in the compilation of references to electronic documents for inclusion in a bibliography, and in the formulation of citations within the text corresponding to the entries in that bibliography. It does not apply to full bibliographic descriptions as required by librarians, descriptive and analytic bibliographers, indexers, etc.

310. The complexity of dataset citation is increasing due to the ease with which data is redistributed and reused so that the original source may be a number of stages back. Data may be transformed accidentally or deliberately at any of these stages. Data may also be delivered embedded in software and will require metadata for informed understanding. Data may also be very dynamic or provided via a database environment, which could make it difficult in the future to reproduce the state of the data at the time that it was cited. In international organisations, how to credit the data sources within countries for the provision of their data is also an issue.

7.5.3 Data management issues

311. Two of the reasons for data citation outlined in Section 7.5.1 above imply that:

- an historical copy is being maintained of datasets in an organisation; and that the
- exact version of the dataset can be located based upon the information available to the user at the time they initially accessed the dataset.

312. In a highly dynamic environment where the data is constantly changing, these issues become very complex. The introduction of databases also complicates the matter. How to effectively cite the information in a highly dynamic environment will depend upon whether or not the organisation providing the data can recreate the environment at the time of data retrieval. The notion of recording both the date and time of dataset access, as part of the dataset citation may be exactly what is required. Ultimately however, the recommendation of how to cite this dataset effectively will have to be provided by the organisation that provides the dataset. Different technical implementations may require different information be included in the citation.

313. In addition, datasets are copied and redistributed in many forms to meet the needs of the moment. For Internet dissemination, a dataset may be placed in an online database environment with interactive access to the data. The same dataset may be used as the foundation for analytical papers or may be placed in reference databases, CD-ROMs, or publications. The end result is that there are multiple uses of the original dataset both internal and external to the organisation that created the dataset.

314. Organisations need to have an effective data management and data archival policy that will keep an historical record of the datasets. The retention period for various datasets will be different depending upon the data and requirements. The need for the formulation of an archival strategy is also relevant for undertaking the types of data revision analyses outlined in Section 7.1.3 above.

7.5.4 Recommended practices for citation

Citation of datasets

315. If citation of datasets is to be taken seriously, a concerted effort must be made by national agencies and international organisations to:

- Formulate and then place their data citation policy in an obvious position on websites, including the policy for the citation of data disseminated via electronic datasets. Furthermore, this policy should be accompanied by detailed sample citations to be included in specific web pages for users to copy as required. This makes it easy for users to include the correct information in the citation. The following example of this practice is from Statistics Canada's Census web module *Community Profiles* where the following citation instruction is provided at the bottom of the webpage in printer friendly format:

  ***How to cite**: Statistics Canada. 2002. 2001 Community Profiles*
  Released June 27, 2002. Last modified: 2005-11-30.
  Statistics Canada Catalogue no. 93F0053XIE.

- Secondly, encourage a culture of data citation both inside and outside the organisation wherever data is being used. This awareness can be raised by contacting all known users of an organisation's data, all editors of publications known to use an organisation's data, etc., requesting that they follow the citation policy for the organisation in future publications.

316. A simple but effective citation style for datasets would be to include the following elements:

- unambiguous name of the dataset;
- author of the dataset;
- agency (or part of the agency) responsible for the dataset;
- date of the dataset (or version number);
- contact details for queries;
- address of the archive or other place of storage or system for accessing data;
- publisher (if this is different from the author, though for many agencies' publications the author and publisher are the same);
- if appropriate, the paragraph, table or page number.

317. This citation style should be followed for any data that is published internally or externally as well as for the documentation of any datasets that are created or modified. The actual ordering of the elements outlined above, punctuation, use of italics, etc., is a matter of individual (or organisational) choice.

318. Traditionally, a citation only cites the most recent use of a reference even though it may have passed through a number of different organisations since the responsible organisation first created it. That is, hypothetically, if UNESCO data was provided to the World Bank, who then provided it to

another organisation, the World Bank would cite UNESCO and the other organisation would cite the World Bank thus creating a chain of citations. The rationale is that by following the chain of citations, the original source of the reference and the responsible organisation can be found. While this may not be the preferred approach for datasets, it is the most manageable approach. Adhering to this common citation practice would be the recommendation for dataset citations.

319. The challenge of effectively citing data sources in countries can be addressed by following this common citation practice of citing the most recent source. If the data is simply collected from countries by an international organisation, not modified in any way, and placed into the dataset, then the country should be cited as the source of the data. If the data is collected as part of a survey or statistical activity, which acts upon the data and subsequently generates a dataset, then the documentation of the survey activity should credit the data sources in the countries for providing all of the data. The dataset itself should reference the survey activity as the source of the data since it has gone through a lot more than simply a collection process. However, if a publication is produced by the same organisation that has managed the data collection process, then thanking and providing credit to the countries for the original data would be appropriate.

320. If an organisation takes a dataset and modifies it in some way before redistributing the dataset in whole or as part of a publication, the citation for the modified dataset must indicate the source or the original dataset but the citation must also indicate that the data was modified from its original state, together with information about the types of transformation undertaken. In this context, some of the metadata recommendations relating to the unambiguous presentation of similar but not identical series outlined in Section 6.3.5 above are also relevant.

Citation of text

321. The main recommendation for text citation entails the systematic use in all metadata of one of the widely accepted bibliographic reference styles listed in Section 7.5.2 above. The two commonly used systems for presenting references in text for a bibliography are the Harvard system and the Numeric system[41]. It is beyond the scope of the current Handbook to outline these systems in any detail beyond outlining a number of specific areas in metadata presentation where such systems should be used. These include the provision of:

- References or source for concept or variable definitions used in all published output, *e.g.* definitions appearing in explanatory notes, glossaries, etc. At the moment it is almost impossible to identify the primary source of concept and variable definitions published by both national agencies and international organisations. In particular, it is seldom possible for the user to identify whether or not a specific definition: has been taken directly from existing international statistical standards; is a modified version adapted for a specific use (say at the national level); or an entirely new definition.

- Sufficient reference (citation) information to enable the user to readily identify the availability of more detailed information on definitions and concepts, collection methodology, etc.

322. An example of a clear statement of citation policy at the national level is provided in Statistics Canada's publication, *How to Cite Statistics Canada Products* (Statistics Canada 2006a), which provides examples of recommended citation practices for a wide range of statistics products: publications; data products; census products; microdata products; maps and geospatial products; and E-STAT products.

[41] Refer: Dee, Marianne (ed.) (2004); and Caledonian University (2003), respectively.

7.6 ADMINISTRATIVE DATA

7.6.1 Introduction

323. The publication, *Measuring the Non-Observed Economy: A Handbook*, compiled by the OECD, IMF, ILO and the Statistical Office of the Commonwealth of Independent States in 2002 cites two basic mechanisms used by statistical agencies for the collection of data – accessing statistical data already being collected for administrative purposes and collection by an agency by means of a census or sample survey[42]. The Handbook then describes the relative strengths and merits of these sources (OECD *et al*, p. 105-108).

324. Administrative data are derived from administrative processes established by government in response to legislation and regulation. The Handbook cites administrative sources producing two types of data that can be used for statistical purposes:

- registration data describing the institutional units that are required to register under legislation or regulation. Such information may be used to establish and maintain lists of units used for direct surveys;

- transaction data describing the transactions administered under legislation or regulation. This information may be useful to supplement or replace direct survey data.

325. Eurostat's *Use of Administrative Sources for Business Statistics Purposes: Handbook of Good Practices* provides the following comprehensive list of administrative sources that are potentially available in many countries (Eurostat 1999, p. 21):

- value added tax (VAT) data;
- personal income tax data;
- business (including corporate) taxation data;
- social security data;
- business registration and administration records;
- published business accounts;
- records held by central banks;
- records other than VAT held by customs and excise authorities;
- records of non-domestic consumers held by public utilities;
- records held by regulators of public utilities, transport and financial services;
- records held by associations of employers, of employees and of businesses and professions;
- records held by other private sector bodies, *e.g.* credit-rating agencies.

[42] Statistics Canada's *Quality Guidelines*, 4th ed., (Statistics Canada 2003, p. 7) uses the term "survey" in a more generic sense to cover any statistical activity that collects or acquires statistical data. Such activities include census, sample surveys, collection of data from administrative records and what are referred to as "derived statistical activities" where data are estimated , modelled or otherwise derived from existing statistical data sources.

326. Such sources are common to both developed and developing countries. In addition to these, many countries also maintain a vast store of administrative data for births, deaths, education, health and unemployment registration purposes.

327. In recent years almost all national statistical and other national agencies have made greater use of some or most of the types of administrative data cited above, either in lieu of direct survey collection or to supplement data collected from households and business entities.

328. The catalysts for this increased use vary by country, with the main ones being: advances in information technology making access and transformation of administrative data more feasible; and restrictions in budgets, etc., prompting the need for alternatives to direct collection for small and medium size units that contribute to a large proportion of activity in key sectors of the economy, *e.g.* services. However, perhaps the main reason has been to meet increased pressure from government for statistical agencies to reduce the reporting burden of enterprises and households by making increased use of administrative data as either a substitute for direct collection or to supplement such sources for units with particular characteristics such as size, activity, geographic location, etc.

329. As a result of these incentives, agencies at the national level make use administrative data for a wide range of purposes including (Eurostat 1999, pp. 17, 41):

- as a source of legal units for business registers;
- for coverage improvement;
- as a size indicator for units;
- as a sample stratification variable;
- as a universe for grossing up survey returns;
- as a data source for small and medium sized units excluded from direct survey collection;
- for the production of provisional results to improve timeliness;
- for compiling regional data.

330. In many instances, national statistical institutes have been vested with legal powers to access administrative data, to promote such access and even influence the quality of such data through mandatory use by administrative agencies of standard statistical classifications, common business identity numbers, etc.

7.6.2 Recommended practices for the presentation and reporting of administrative data

331. Because statistics derived from administrative sources will be based on data that were not originally compiled or produced for statistical purposes and frequently by other non-statistical agencies, Statistics Canada in their policy guidelines for informing users on data quality and methodology (Statistics Canada 2000, p. 12) states that it is particularly important for such data to be methodologically transparent to users and stressed the need for such data to accompanied by the following types of metadata:

- the name of the source agency for the administrative data. If more than one agency or ministry provides the services and collates data on these (*e.g.* health or education services provided by several agencies in some countries) specific information should be provided as to whether or not the data are from all agencies, or only from the main agency or ministry;

- a precise description of the purposes for which the data were originally compiled and collected by the administrative agency;

- an outline of the strengths and weaknesses of the data in terms of the statistical application of the data. Particular attention should be given to the impact of issues relating to coverage and possible coverage bias, differences in concepts from international statistical guidelines and recommendations, in particular, the use of non-standard classifications and the use of unit concepts that differ from statistical units concepts;

- a description of processing or transformation (if any) undertaken by the statistical agency following receipt of the administrative data. Such processing may attempt to reduce or minimise inherent weaknesses in the original data[43];

- descriptions of the reliability of the data, including adherence to international norms and standards and caveats / limitations on the statistical use(s) of the data, *e.g.* for social indicator generation.

[43] A task force of the OECD Short-term Economic Statistics Working Party (STESWP) was established at the end of 2004 to review and provide recommendations on transformation processes that could expand the use of administrative source data which are available in countries, but which for one or more reasons are not used. Information about this task force is available at http://www.oecd.org/document/37/0,2340,en_2649_33715_34814437_1_1_1_1,00.html

8. REFERENCES

ABS (Australian Bureau of Statistics), 2001, Introductory Course on Time Series Analysis, ABS, Canberra

ABS, 2003, *Time Series Analysis: Issues With Seasonal Adjustment*, Canberra, available at http://www.abs.gov.au/websitedbs/d3310114.nsf/0/70611eabf58a97acca256ce10018a0d3?OpenDocument [Accessed on 16 August 2006]

ABS 2003a, *Time Series Analysis Frequently Asked Questions*, ABS, Canberra

ABS, 2004, *Australian Bureau of Statistics Publishing Manual*, ABS, Canberra, unpublished

ABS, 2006, *Statistical Metadata System and Its Role in a Statistical Organisation*, Part A of the Common Metadata Framework (draft), presented at the Joint UNECE / Eurostat / OECD work session on statistical metadata (METIS), Geneva, 3-5 April 2006, available at http://www.unece.org/stats/documents/ece/ces/ge.40/2006/wp.2.e.pdf [Accessed 8 August 2006]

ABS, 2006a, ABS Annual Report, 2005-2006, ABS, Canberra, available at http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1001.02005-06?OpenDocument [Accessed 25 October 2006]

Algera, Symon, 2005, *Statistical Benchmarking – The Dutch Case*, Statistics Netherlands, Voorburg, paper presented at Eurostat-OECD Workshop on Frontiers in Benchmarking Techniques and Their Application to Official Statistics, 7-8April 2005, available at http://epp.eurostat.cec.eu.int/pls/portal/docs/PAGE/PGP_DS_WORKSHOP_EUROIND/PGE_DS_WORKSHOP_EUROIND_03/TAB41880051/CPP3%20ALGERA.PDF [Accessed 16 August 2006]

American Psychological Association (APA), 2001, *Publication Manual of the American Psychological Association*, 5th ed., American Psychological Association, Washington D.C.

Bank centrale du Luxembourg, 2004, *Glossary,* Bank centrale du Luxembourg, Luxembourg, available at http://www.bcl.lu/en/support/glossary/ [Accessed 16 August 2006]

BEA (U.S. Bureau of Economic Analysis), July 1993, *The Impact of Classification Revisions on Time Series*, Issues Paper No. 5, Economic Classification Policy Committee, Bureau of Economic Analysis, U.S. Department of Commerce, Washington D.C.

Bloem, A.M., Dippelsman, R.J., Mæhle, N.Ø. (2001) *Quarterly National Accounts Manual. Concepts, Data Sources, and Compilation.* International Monetary Fund, Washington D.C. Available at: http://www.imf.org/external/pubs/ft/qna/2000/Textbook/index.htm. [Accessed 16 August 2006]

Brass, W., 1975, *Methods for Estimating Fertility and Mortality from Limited and Defective Data*, Chapel Hill, North Carolina: Laboratories for Population Studies

Caledonian University, 2003, *Citation Guide*, Caledonian University, Glasgow

Carson, Carol, 2000, *Toward a Framework for Assessing Data Quality*, IMF Statistics Department, Washington DC

Ciammola, Anna, 2003, *Presentation of Retrospective Fixed Base Indexes*, paper prepared for meeting of the OECD Short-term Economic Statistics Expert Group, 26-27 June 2003, available at http://www.oecd.org/dataoecd/61/54/2959065.pdf [Accessed 16 August 2006]

Cleveland, W.S., Dunn, D.M., Terpenning, I.J., 1978, SABL: *A Resistant Seasonal Adjustment Procedure With Graphical Methods for Interpretation and Diagnosis*, in Zellner, A., ed. Seasonal Analysis of Economic Time Series, pp. 201-231. U.S. Department of Commerce, Bureau of the Census, Washington D.C.

Dee, Marianne (ed.), 2004, *Quote, Unquote: Guide to the Harvard Type of Referencing*, Leeds Metropolitan University, Leeds, available at http://www.leedsmet.ac.uk/lskills/open/sfl/content/harvard/downloads/harvard_2004.pdf [Accessed 16 August 2006]

Doherty, M, 2001, *The Surrogate Henderson Filter in X-11*, Australian & New Zealand Journal of Statistics, Vol. 43, No. 4, Blackwell Publishing, Oxford, UK

Dublin Core Metadata Initiative, n.d., *Dublin Core Metadata Initiative website*, available at http://dublincore.org/ [Accessed 7 August 2006]

ENCE (Escola Nacional de Ciências Estatísticas do IBGE), 2003, *Reporting and compensating for non-sampling errors for surveys in Brazil : current practice and future challenges*, Ch. 11 of draft UN publication, *Household Surveys in Developing and Transition Countries: Design, Implementation and Analysis*, United Nations, New York 2003

European Commission, 1998, *Council Regulation (EC) No. 1165/98 of 19 May 1998 concerning short-term statistics*, European Commission, Brussels, available from http://forum.europa.eu.int/irc/dsis/bmethods/info/data/new/1165-98en.pdf [Accessed 16 August 2006]

Eurostat, 1998, *Seasonal Adjustment Methods: A Comparison for Industry Statistics*, Eurostat, Luxembourg, available from http://forum.europa.eu.int/irc/DownLoad/kceZA4JGmhGCwf4BArSUDZMkGgTT0H8WVHgZtFcfKeFC20TqM4SbNGnSp-xpTE_/comparison.pdf [Accessed 4 August 2006]

Eurostat, 1999, *Use of Administrative Sources for Business Statistics Purposes: Handbook of Good Practices*, Version 1, Luxembourg, available from http://forum.europa.eu.int/irc/dsis/bmethods/info/data/new/adso/handbook_en/adso_hbk.htm [Accessed 16 August 2006]

Eurostat, 2002a, *Methodology of Short-term Business Statistics: Interpretation and Guidelines,* Eurostat, Luxembourg, available from http://forum.europa.eu.int/irc/dsis/bmethods/info/data/new/embs/MM_Eurostat%202002-0507%20vo.2.pdf [Accessed 16 August 2006]

Eurostat, 2002b, *Standard Quality Report*, discussion item 4, Working Group "Assessment of the Quality in Statistics", fifth meeting, Luxembourg, May 2002, Eurostat, Luxembourg

Eurostat, 2003c, *Methodological Documents: Standard Report*, discussion item 4.2B, Working Group "Assessment of the Quality in Statistics", sixth meeting, Luxembourg, October 2003

Eurostat, 2003d, *Standard Quality Indicators: Producer-Oriented*, discussion item 7, Working Group "Assessment of Quality in Statistics", sixth meeting, Luxembourg, October 2003

Eurostat 2003e, *Methodological Documents: Standard Reports*, Working Group "Assessment of Quality in Statistics", Sixth meeting, Luxembourg, 2-3 October 2003, available from http://epp.eurostat.ec.europa.eu/pls/portal/docs/PAGE/PGP_DS_QUALITY/TAB47143233/STANDARD_QUALITY_REPORT_0.PDF [Accessed 2 August 2006]

Eurostat, 2006a, *Eurostat Concept and Definitions Database* (CODED), Eurostat, Luxembourg, available at http://ec.europa.eu/comm/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_NOM_DTL&StrNom=CODED2&StrLanguageCode=EN&IntPcKey= [Accessed 2 August 2006]

Eurostat, 2006b, *Eurostat Classification Server* (RAMON), Eurostat, Luxembourg, available at http://europa.eu.int/comm/eurostat/ramon [Accessed 2 August 2006]

Eurostat, 2006c, *Metadata Availability from National Web Sites*, Item 7 of the agenda of the meeting of the Metadata Working Group, Luxembourg, 29-30 June 2006, available from http://forum.europa.eu.int/irc/DownLoad/kreuAKJ2mpGUdY7LD-3QKw-6oWPHbTV-YpFGf8yq0Etr589-a3pJ-Y-p-9Yd1GjUW-U-uHvh2H_3Gu74troIwq42_UF/MWG-2006-7-1-national-metadata-web.pdf [Accessed 2 August 2006]

Everitt, B.S., 1989, *The Cambridge Dictionary of Statistics, Cambridge University Press*, Cambridge, UK

Findley, D.F., Monsell, B.C., Bell, W.R., Otto, M.C., Chen, B. –C., 1998, *New Capabilities and Methods of the X-12-ARIMA Seasonal Adjustment Program*, (With discussion), *Journal of Business and Economic Statistics,* 16, 2, 127-177, available from http://ideas.repec.org/a/bes/jnlbes/v16y1998i2p127-52.html [Accessed 16 August 2006]

Finn, Brian, 2003, *Some proposals for standard terminologies relating to data presentation*, discussion paper prepared for the OECD Short-term Economic Statistics Expert Group (STESEG), Paris, 26-27 June 2003, OECD, Paris, available from http://www.oecd.org/dataoecd/12/60/2789033.pdf [Accessed 16 August 2006]

Friez, Adrien, 2003, *Some proposals about identification of published series*, discussion paper prepared for the OECD Short-term Economic Statistics Expert Group (STESEG), Paris, 26-27 June 2003, OECD, Paris, available from http://www.oecd.org/dataoecd/12/61/2789026.pdf [Accessed 16 August 2006]

German Federal Statistical Office, 2006, *The BV4.1 Procedure for Decomposing and Seasonally Adjusting Economic Time Series*, Federal Statistical Office, Germany, Wiesbaden, available at http://www.destatis.de/download/mv/MethodenberichtBV4_e.pdf [Accessed 16 August 2006]

Gibaldi, Joseph, 2003, *Modern Language Association Handbook for Writers of Research Papers*, 6th ed., Modern Language Association of America, New York

Gomez, V., Maravall, A., 1996, *Programs TRAMO and SEATS*, Documentode trabajo n. 9628, Banco de Espana, Madrid

Graf, Monique, 2003, *Sampling error and seasonal adjustment*, discussion paper prepared for the OECD Short-term Economic Statistics Expert Group (STESEG), Paris, 26-27 June 2003, OECD, Paris, available from http://www.oecd.org/dataoecd/61/60/2959043.pdf [Accessed 16 August 2006]

ICPSR (Inter-University Consortium for Political and Social Research), n.d., *Data Documentation Initiative (DDI) Alliance website*, available at http://www.icpsr.umich.edu/DDI/ [Accessed 7 August 2006]

IMF (International Monetary Fund), 1995, *Balance of Payments Compilation Guide*, IMF, Washington DC, Chapter XXI. Publication of Balance of Payments Statistics, paras. 1130-1147, available at http://www.imf.org/external/pubs/ft/bopcg/1995/bopcg.pdf [Accessed 16 August 2006]

IMF, 2001, *Seasonal Adjustment and Estimation of Trend-Cycles*, Chapter 8 of *Quarterly National Accounts Manual – Concepts, Data Sources, and Compilation*, IMF, Washington DC, available from http://www.imf.org/external/pubs/ft/qna/2000/Textbook/ch8.pdf [Accessed 16 August 2006]

IMF, 2001a, *Quarterly National Accounts Manual – Concepts, Data Sources and Compilation*, IMF, Washington D.C., available from http://www.imf.org/external/pubs/ft/qna/2000/textbook/index.htm [Accessed 16 August 2006]

IMF, 2003a, *Reports on the Observance of Standards and Codes (ROSCs)*, IMF, Washington DC, available at www.imf.org/external/np/rosc/rosc.asp [Accessed 16 August 2006]

IMF, 2003c, *Introduction to the Data Quality Reference Site*, IMF, Washington DC, available from http://dsbb.imf.org/Applications/web/dqrs/dqrsintroduction/ [Accessed 16 August 2006]

IMF, 2003d, *Fifth Revision of the Fund's Data Standards Initiatives*, IMF, Washington DC, available from http://www.imf.org/external/np/sta/dsbb/2003/eng/061803.pdf [Accessed 16 August 2006]

IMF, 2003e, *Data Quality Assessment Framework and Data Quality Program*, IMF, Washington DC, available from http://www.imf.org/external/np/sta/dsbb/2003/eng/dqaf.htm#II [Accessed 16 August 2006]

IMF, 2003f, "SDDS Overview", *Special Data Dissemination Standards*, IMF, Washington DC, available from http://dsbb.imf.org/Applications/web/overview/ [Accessed 16 August 2006]

IMF, 2004, Carson, C. S., Khawaja, S., and Morrison, T.K., *Revisions Policy for Official Statistics: A Matter of Governance*, IMF, Washington DC, available from http://unstats.un.org/unsd/accsub/2004docs-4th/IMF-RevisionPolicy.pdf [Accessed 16 August 2006]

IMF, 2004a, *Guide to the General Data Dissemination System* (GDDS), Statistics Department, IMF, October 2004, Washington DC, available from http://dsbb.imf.org/vgn/images/pdfs/gddsguide.pdf [Accessed 16 August 2006]

IMF, 2005, *Common Domain Reference Metadata Concepts: Proposal for Contents Standards*, preliminary draft version 0.5 / 21 January 2005 presented at Workshop on SDMX Issues, Paris 24-26 January 2005, IMF, Washington DC

INSEE, 2003, *Informations rapides.* No. 340. November 12, 2003.

ISI (International Statistical Institute), 2003, *The Oxford Dictionary of Statistical Terms*, edited by Yadolah Dodge, Oxford University Press, Oxford, UK.

ISO / ISE (International Organisation for Standardisation / International Electrotechnical Commission), n.d., ISO/IEC 11179, *Information Technology – Metadata Registries (MDR*), published on the Joint Technical Committee 1 (JTC1) Information Technology Standards website, available at http://metadata-stds.org/ [Accessed 7 August 2006]

Iverson, C., Flanagin, A., Fontanarosa, P.B., *et al*, 1998, *American Medical Association Manual of Style; A Guide for Authors and Editors*, 9th ed., Lippincott, Williams and Wilkins, Philadelphia

Kirchner, Robert, 2003, *Presentation of Growth Rates*, discussion paper prepared for the OECD Short-term Economic Statistics Expert Group (STESEG), Paris, 26-27 June 2003, OECD, Paris, available at http://www.oecd.org/dataoecd/61/42/2959022.pdf [Accessed 16 August 2006]

Koopman, S.J., Harvey, A.C., Doornik, J.A., and Shephard, N., 1995, *STAMP 5.0 – Structural Time Series Analyser, Modeller and Predictor*, Chapman and Hall, London, UK

Ladiray, D, Quenneville, B., 2001, *Seasonal Adjustment with the X-11 Method,* Lecture Notes in Statistics, Springer-Verlag, New York

McManus, R., 2004, *Population and Migration Studies, 2004-2005, Population Tools*, Dept. of Geography, St Patrick's College, Dublin University, Dublin, Ireland, available at http://www.spd.dcu.ie/rmcmanus/Population%20Course/lectures_to_date.htm [Accessed 16 August 2006]

Morgan, D., 2004, *Revisions analysis in the experimental Index of Services*, paper presented at OECD-ONS Workshop: Assessing and Improving Statistical Quality – Revisions Analysis for the National Accounts, 7-8 October 2004, Paris. Available at http://www.oecd.org/dataoecd/42/31/33850833.pps [Accessed 16 August 2006]

Musgrave, J, 1964a, *A Set of End Weights to End all End Weights*, US Census Bureau, Washington DC available from http://www.census.gov/ts/papers/Musgrave1964a.pdf [Accessed on 16 August 2006]

Musgrave, J, 1964b, *Alternative Set of Weights for Proposed X-11 Seasonal Factor Curve Moving Average*, US Census Bureau, Washington DC, available from http://www.census.gov/ts/papers/Musgrave1964b.pdf [Accessed on 16 August 2006]

Nieuwstad, C.H., Algera, S.B., 2005, *Presenting growth rates in press release texts: the Dutch case*, 19 September 2005, Statistics Netherlands, Voorburg, available from http://www.cbs.nl/NR/rdonlyres/FFC7EBCA-F89F-40BA-A77D-4DFB78026134/0/2005PresentingGrowthRatesInPRart.pdf [Accessed 1 August 2006]

OECD (Organisation for Economic Co-operation and Development), 2000, *Basic Principles and Practices in Rebasing and Linking National Accounts Series*, paper prepared by Derek Blades presented at Joint ADB/ESCAP Workshop on Rebasing and Linking of National Accounts Series, 21-24 March 2000, Bangkok, available at http://www.adb.org/Statistics/reta_5874.asp [Accessed 16 August 2006]

OECD, 2002a, *Glossary of Statistical Terms*, OECD, Paris, available at www.oecd.org/std/glossary [Accessed 16 August 2006]

OECD, 2002c, *National Accounts World Wide Exchange* (NAWWE), discussion paper presented at *OECD* National Accounts Expert Meeting, Paris, October 2002, OECD, Paris, available from http://www.oecd.org/dataoecd/10/62/1953780.doc [Accessed 16 August 2006]

OECD, IMF, ILO, CIS Stat, 2002, *Measuring the Non-Observed Economy: A Handbook*, OECD, Paris, available from http://www.oecd.org/document/49/0,2340,en_2649_34253_2463473_1_1_1_1,00.html [Accessed 16 August 2006]

OECD, 2003a, *The new OECD statistical information system*, Discussion paper at Meeting of the OECD High Level Group on Statistics, Geneva, 13 June 2003, OECD, Paris, available from www.oecd.org/dataoecd/27/57/2955756.pdf [Accessed 16 August 2006]

OECD, 2003b, *OECD Main Economic Indicators*, monthly, OECD, Paris

OECD, 2003c, *OECD Quarterly National Accounts*, quarterly, OECD, Paris

OECD, 2003d, *Manuals, Sources and Methods,* OECD Statistics Portal, OECD, Paris, available at www.oecd.org/statistics/manuals [Accessed 16 August 2006]

OECD, 2003e, *Quality Framework for OECD St*atistics, OECD, Paris. Available at http://www.oecd.org/dataoecd/26/38/21687665.pdf [Accessed 24 October 2006]

OECD, 2003f, *Business Tendency Surveys: A Handbook*, OECD, Paris

OECD, 2004, *The OECD-JRC Handbook on Practices for Developing Composite Indicators*, paper presented at a meeting of the OECD Committee on Statistics, 7-8 June 2004, OECD, Paris

OECD and IMF, 2002, *Progress Report on New Developments in Data and Metadata Collection for International Organisations*, discussion paper presented at Conference of European Statisticians (CES), Paris, 10-12 June 2002, UNECE, available from http://www.unece.org/stats/documents/ces/2002/8.e.pdf [Accessed 16 August 2006]

OECD and ONS, 2004, *Accessing and Improving Statistical Quality – Revisions Analysis for the National Accounts*, OECD – ONS Workshop, 7-8 October 2004, OECD, Paris. Available from http://www.oecd.org/document/23/0,2340,en_2825_293564_33729303_1_1_1_1,00.html [Accessed 16 August 2006]

OED (The Oxford English Dictionary), 1989, eds. Simpson, J.A & Weiner, E.S.C., Volume 1, Clarendon Press, Oxford, UK

OMG (Object Management Group), n.d., *OMG website*, available at http://www.omg.org/ [Accessed 7 August 2006]

ONS (UK Office for National Statistics), 2004, *National Statistics Code of Practice: Protocol on Data Management, Documentation and Preservation*, HMSO, London, available from http://www.statistics.gov.uk/about_ns/cop/downloads/datamanagement.pdf [Accessed 16 August 2006]

ONS, 2004a, *National Statistics Code of Practice: Protocol on Revisions*, ONS, Newport, Wales, UK

Palmore, James A., Gardner, Robert W., 1994, *Measuring mortality, fertility and natural increase: a self-teaching guide to elementary measures*, Rev. ed., East-West Centre, Honolulu, Hawaii

Rowland, D., 2003, *Demographic Methods and Concepts*, Section 1: Population Dynamics, Part 2: Population growth and decline, Oxford University Press, Oxford, UK, available at http://www.oup.co.uk/pdAccessed 16 August 2006/bt/rowland/ch02.pdf [Accessed 16 August 2006]

SDMX (Statistical Data and Metadata Exchange), 2005, *A brief introduction to SDMX*, paper presented at the Co-ordinating Committee for Statistical Activities (CCSA), September 2005

SDMX 2006, Statistical Data and Metadata Exchange – BIS, ECB, Eurostat, IBRD, IMF, OECD, UNSD, available at www.sdmx.org [Accessed 3 August 2006]

SDMX, 2006a, *Metadata Common Vocabulary* – BIS, ECB, Eurostat, IBRD, IMF, OECD, UNSD, presented on the SDMX website, available at www.sdmx.org [Accessed 3 August 2006]

Siddiqui, M.K., 1999, *Utilization of Statistical Information: the Case of Population Statistics*, paper presented at Asia-Pacific OPOIN-IFLA Joint Workshop on Demographic Information, Bangkok, August 1999

Solans, Eugenio Domingo, 2003, *Official Statistics for a Global Economy*, presented at the 54th Session of the International Statistical Institute, Berlin, 13-20 August 2003, European Central Bank, Frankfurt

Statistics Canada, 1996, *Thesauri and Controlled Vocabularies,* Ottawa, Statistics Canada, available at http://www.collectionscanada.ca/8/4/r4-282-e.html [Accessed 8 August 2006]

Statistics Canada, 2000, *Policy on Informing Users of Data Quality and Methodology*, Statistics Canada, Ottawa, available from http://www.statcan.ca/english/about/policy/infousers.htm#standards [Accessed 3 August 2006]

Statistics Canada, 2003, *Statistics Canada Quality Guidelines*. 4th ed., Statistics Canada, Ottawa, available from http://www.statcan.gc.ca/english/freepub/12-539-XIE/12-539-XIE03001.pdf [Accessed 24 October 2006]

Statistics Canada, 2006, *Integrated Metadatabase (IMDB)*, Statistics Canada, Ottawa, available from http://www.statcan.ca/english/about/policy/infousers.htm [Accessed 3 August 2006]

Statistics Canada, 2006a, *How to Cite Statistics Canada Products*, Statistics Canada Catalogue No. 12-591-XWE, Ottawa, Version updated 31 March, available from http://www.statcan.ca/english/freepub/12-591-XIE/12-591-XIE2006001.htm [Accessed 3 August 2006]

Statistics Denmark, 2004, *Documentation: Declaration of Contents* in Guide to Statistics, Statistics Denmark, Copenhagen, available at http://www.dst.dk/HomeUK/Guide/documentation/Varedeklarationer.aspx [Accessed 16 August 2006]

Statistics Finland, 2002, *Statistics Guidelines for Official Statistics*, Statistics Finland, Helsinki, available from http://www.stat.fi/tk/tt/laatuatilastoissa/guidelines.pdf [Accessed 16 August 2006]

Statistics Finland, 2003, *Indicators and Indices*, Quality Guidelines, Helsinki, available from www.stat.fi/tk/tt/laatuatilastoissa/lm021400/pe_en.html [Accessed 16 August 2006]

Statistics New Zealand, 2001, *Seasonal Adjustment Within Statistics New Zealand*, Statistics New Zealand, Wellington, available at http://www.stats.govt.nz/products-and-services/Articles/sea-adj-Apr01.htm [Accessed 16 August 2006]

Statistics New Zealand, 2001a, *Statistics New Zealand Graphics Guidelines*, Statistics New Zealand, Wellington, available at http://www.stats.govt.nz/NR/rdonlyres/A1892BF2-6E4A-4D08-9667-BC5EE45B99F4/0/GraphicsGuidelines.pdf [Accessed 16 August 2006]

Turabian, Kate, 1996, *A Manual for Writers of Term Papers, Theses and Dissertations*, 6th ed., University of Chicago Press, Chicago

UNCTAD, 2003, *Harmonisation of Base Years for Index Numbers*, prepared for presentation at the 2nd session of the Committee for the Co-ordination of Statistical Activities, Geneva, 8-10 September 2003, UNCTAD,

UNDG (United Nations Development Group), 2003, *Indicators for Monitoring the Millennium Development Goals: Definitions, Rationale, Concepts and Sources*, United Nations, New York

UNECE (United Nations Economic Commission for Europe), 2000, *Report of the September 1999 Work Session on Statistical Metadata*, prepared for presentation at the 48th plenary session of the Conference of European Statisticians, Paris 13-15 June 2000, UNECE, Geneva, p. 3 (CES/2000/20).

UNECE, Eurostat and OECD, 2004, Report of the February 2004 Joint UNECE/Eurostat, OECD Work Session on Statistical Metadata, UNECE, Geneva. Available at http://www.unece.org/stats/documents/ces/ac.71/2004/22.add.1.e.pdf [Accessed 16 August 2006]

UNEP (United Nations Environment Programme), 2002, "GRI Indicators", *Global Reporting Indicators: A Common Framework for Sustainability Reporting*, United Nations, New York. Available at http://www.globalreporting.org/guidelines/2002/dannex5.asp [Accessed 16 August 2006]

UNESCO, 2003, *Good Practices in Citation in the Outputs of International Statistical Offices: The Citation of Datasets – Report Prepared by UNESCO*, Paris, presented at the 2nd Session, Committee for the Coordination of Statistical Activities, Geneva, 8-10 September 2003

University of Chicago Press, 2003, *The Chicago Manual of Style*, 15th ed. Rev., University of Chicago Press, Chicago

UNSC (United Nations Statistical Commission), 1994, *Fundamental Principles of Official Statistics*, UNSD, New York, available from http://unstats.un.org/unsd/goodprac/bpabout.asp [Accessed 16 August 2006]

UNSC and UNECE, 2000, *Guidelines for Statistical Metadata on the Internet*, Conference of European Statisticians Statistical Standards and Studies – No. 52, United Nations, Geneva, available at http://www.unece.org/stats/publications/metadata.pdf [Accessed 16 August 2006]

UNSC and UNECE, 2000a, *Terminology on Statistical Metadata*, Conference of European Statisticians Statistical Standards and Studies – No. 53, United Nations, Geneva. Available at http://www.unece.org/stats/publications/53metadaterminology.pdf [Accessed 16 August 2006]

UNSC and UNECE, 2001, *Best Practice in Designing Websites for Dissemination of Statistics*, UNECE, Geneva, available at http://www.unece.org/stats/publications/websitebestpractice.pdf [Accessed 16 August 2006]

UNSD (United Nations Statistical Division), 1964, *Recommendations for the Preparation of Sample Survey Reports (Provisional Issue), Statistical Papers, Series C, No. 1 Rev. 2*, United Nations, New York

UNSD, 1982, *Non-sampling Errors in Household Surveys: Sources, Assessment and Control*, United Nations, New York

UNSD 1983, *Manual X: Techniques for Demographic Estimation*, Population Studies No. 81, United Nations, New York

UNSD, 1993, *Sampling Errors in Household Surveys*, UN Department for Economic and Social Information and Policy Analysis, Statistical Division, New York. Available at http://unstats.un.org/unsd/pubs/gesgrid.asp?ID=316 [Accessed 16 August 2006]

UNSD, 2001, *Handbook on the Operation and Organisation of a Statistical Agency,* UNSD, New York, available from http://www.singstat.gov.sg/conferences/consultative/materials/handbook.pdf [Accessed 16 August 2006]

UNSD, 2002a, *Methodological Publications in Statistics*, UNSD, New York, available from http://unstats.un.org/unsd/progwork/ [Accessed 16 August 2006]

UNSD, 2002b, *Definitions for United Nations Common Database*, UNSD, New York, available from http://unstats.un.org/unsd/cdb/cdb_help/cdb_quick_start.asp [Accessed 16 August 2006]

UNSD, 2003, *Household Surveys in Developing and Transition Countries: Design, Implementation and Analysis,* United Nations, New York, available from http://unstats.un.org/unsd/HHsurveys/index.htm [Accessed 16 August 2006]

UNSD, 2004, *Economic and Social Statistical Classifications*, United Nations, New York, available from http://unstats.un.org/unsd/class/default.htm [Accessed 16 August 2006]

US Bureau of Labour Statistics, 1996, "The Tension Between Continuity and Relevance of Economic Time Series", paper prepared by Thomas Plewes presented at UNECE/UNSC *Seminar on Official Statistics – Past and Future*, Lisbon, 25-27 September 1996.

US Census Bureau, 2002, *Census Bureau Releases Benchmark Report for Monthly Manufacturers' Shipments, Inventories, and Orders Survey*, US Census Bureau, Washington DC, available at www.census.gov/indicator/www/m3/bench/bench.htm [Accessed 16 August 2006]

U.S. Census Bureau, 2002a, *X-12-Arima Reference Manual. Version 0.2.10.* US Census Bureau, Washington D.C., available at: http://www.census.gov/srd/www/x12a/x12down_pc.html [Accessed 16 August 2006]

US Census Bureau, 2003, *Frequently asked questions*, US Census Bureau, Washington DC

US Fedstats, 2003, *Schedule of Release Dates for Principal Federal Economic Indicators for 2003*, US Fedstats, Washington DC, available from http://www.fedstats.gov/policy/pei_calendar2003.pdf [Accessed 16 August 2006]

US Office of Management and Budget (OMB), 2001, "Measuring and Reporting Sources of Error in Surveys", *Statistical Policy Working Paper 31, July 2001*, Statistical Policy Office, Office of Information and Regulatory Affairs, Office of Management and Budget, Washington DC, available from http://www.fcsm.gov/01papers/SPWP31_final.pdf [Accessed 16 August 2006]

Wallgren, Anders; Wallgren, Britt; Persson, Rolf; Jorner, Ulf; Haaland, Jan-Aage, 1996, *Graphing Statistics and Data*, Sage Publications, California. English translation originally published in Swedish by Statistics Sweden, 1995 under the title *Statistikens Bilder – Att Skapa Diagram*

World Bank, 2004, *2004 World Development Indicators,* World Bank, Washington DC

World Wide Web Consortium (W3C), n.d., *W3C website*, available at http://www.w3.org/ [Accessed 7 August 2006]

ANNEX

GLOSSARY OF DATA AND METADATA REPORTING AND PRESENTATION TERMS

This Glossary contains definitions of key terms and concepts used in the body of this Handbook. Readers seeking definitions for other statistical terms are referred to the extensive *OECD Glossary of Statistical Terms* which contains over 6 500 terms. The OECD Glossary is available free of charge at www.oecd.org/std/glossary

Annual changes

Annual changes refer to annual changes in levels expressed over the previous year. Such changes are expressed as Y_t-Y_{t-1}.

Y_t denotes the value of an annual time series in year t.

Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Annual growth rates

Annual growth rates are annual rates of change expressed over the previous year. Such rates are expressed (in terms of an arithmetic growth rate) as (Y_t/Y_{t-1}) -1.

Y_t denotes the value of an annual time series in year t.

Context: It should be noted that some phenomena, annual growth rates may be further differentiated and expressed by the nature or pattern of the incremental difference between each successive period and whether or not the values of these increments over a given period are themselves constant or changing. The most commonly used patterns of growth are therefore: arithmetic, geometric and exponential.

Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Annualised growth rate (Annualised rate of change)

Annualised growth rates (Annualised rate of change) show the value that would be registered if the quarter-on-previous quarter or month-on-previous month rate of change were maintained for a full year. Such rates are expressed as $((Q_t/Q_{t-1})^4)$-1 for quarterly data and $((M_t/M_{t-1})^{12})$-1 for monthly data.

M_t denotes the value of a monthly time series in month t and Q_t the value of a quarterly time series in quarter t.

Annualised growth rates attempt to facilitate comparison of data for different time periods (*e.g.* years and quarters). However, because the impact of any irregular is magnified, use of this form of growth rate presentation is not recommended, especially as the key headline series.

Context: In addition to the compounded form of the Annualised growth rate presented here, the term "Annualised growth rate" is sometimes used to describe the quarterly or monthly growth rate multiplied by four or twelve.

Multiplying the quarterly or monthly growth rate by four or twelve is more appropriately referred to as "Linear approximation of the annualised growth rate".

Some agencies use the expression "1-month rate of change, annualised", etc., for such rates.

Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Annualised growth rate, linear approximation	*See* Linear approximation of the annualised growth rate
Annualised semi-annual growth rate	Annualised semi-annual growth rates show the value that would be registered if the rate of change measured with reference to two quarters or six months behind were maintained for a full year. Such rates are expressed as $((Q_t/Q_{t-2})^2)-1$, $((M_t/M_{t-6})^2)-1$. M_t denotes the value of a monthly time series in month t and Q_t the value of a quarterly time series in quarter t. Annualised semi-annual growth rates attempt to facilitate comparison of data for different time periods (*e.g.* years and quarters). However, because the impact of any irregular is magnified, use of this form of growth rate presentation is not recommended, especially as the key headline series. *Source:* Task force on data and metadata presentation for the OECD Short-term Economic Statistics Expert Group (STESEG), Paris, 2004
Arithmetic growth	Arithmetic growth refers to the situation where a variable increases by a constant [amount in terms of the] number of persons (or other objects) in each period being analysed. In general terms an arithmetic growth rate may be expressed as: $\left(\frac{Xn - Xo}{n}\right) \div Xo$ x 100 Where X_o = variable at the start; X_n = variable at the end; n = number of intervals between X_o and X_n *Context:* Arithmetic growth rates may take the form of annual growth rates, quarter-on-previous quarter growth rates or month-on-previous month growth rates. *Source:* Rowland, D., 2003, *Demographic Methods and Concepts*, Section 1: Population Dynamics, Part 2: Population growth and decline, Oxford University Press, Oxford, UK
Balances, survey	Balances (also called net balances) are used to summarise answers to multiple-choice questions in business tendency and consumer opinion surveys. "No-change" answers (such as "normal" or "same") are ignored and the balance is obtained by taking the difference between the weighted percentages of respondents giving favourable and unfavourable answers. *Context*: Survey balances can be positive or negative *Source:* OECD, 2003f, *Business Tendency Surveys: A Handbook*, OECD, Paris, Glossary
Base	A number or magnitude used as a standard of reference. It may occur as a denominator in a ratio or percentage calculation. It may also be the magnitude of a particular time series from which a start is to be made in the calculation of a new relative series – an index number – which will show the observations as they accrue in the future in relation to that of the base period. *Source*: Marriott, F.H.C., 1990, *A Dictionary of Statistical Terms*, 5th ed., Longman Scientific and Technical, Burnt Mill, Harlow, Essex, England, for the International Statistical Institute
Base effect	A base effect occurs when the evolution of a variable's annual rate from month *t* to month *t+1* varies because of the evolution of the variable's level 12 months before and not because of the variation of the variable's level between month *t* and month *t+1*. *Source:* Bank centrale du Luxembourg, 2004, *Glossary*, Bank centrale du Luxembourg, Luxembourg
Base period	A point (or period) in time used as a reference point for comparison with some later period. *Source:* United States Bureau of Labour Statistics (BLS), n.d., *Glossary*, BLS, Washington D.C., available at www.bls.gov

Context: In indexes the base period is usually allocated the value of 100. The base period is frequently one year but it may be as short as one day or as long as the average of a group of years. The concept of the base period is not a precise one and may be used to mean rather different things. In some literature, the terms "base period", "reference period", and "weight reference period" are used interchangeably. In concept the terms have different meanings, although in practice the periods actually referred to may be the same.

Base weight

The weights of a weighting system for an index number computed according to the information relating to the base period instead, for example, of the current period.
Source: Dodge, Y., ed., 2003, *The Oxford Dictionary of Statistical Terms*, Oxford University Press, Oxford, England, for the International Statistical Institute

Business cycle

There are several ways to measure "the business cycle". In general, it is defined as fluctuations in the level of economic activity around an estimate of its underlying trend. Starting from a position where the level of activity is close to the trend level, a business cycle is said to be complete when the level of activity has returned back to the trend following a period when it was above, then below, the trend level, or vice-versa.

Source: OECD, 2001, *Composite Leading Indicator - Glossary*, OECD, Paris, available at http://www.oecd.org/glossary/0,2586,en_2649_34249_33652049_1_1_1_1,00.html#33651918

Calendar adjustment

Calendar adjustment refers to the correction for calendar variations. Such calendar adjustments include working day adjustments or the incidence of moving holidays (such as Easter and Chinese New Year).

Context: The terms “calendar adjustment” and “working day adjustment” (also known as “trading day adjustment”) are often used interchangeably. However, the main difference between the two terms is that working day adjustment is merely one type of calendar adjustment.

Each variable has its own specific calendar adjustment. For example, “shopping day” adjustment for consumer expenditure or retail trade series.

The length of month effect is assigned to the seasonal component because it happens year after year in the same period with the exception of leap year effects.

Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Calendar effects component of a time series

The calendar effects component is that part of the seasonal component that represents calendar variations in a time series, such as trading days / working days, moving holidays and other calendar effects (such as leap year).

The effects of the normal length of a month are assigned to the seasonal component.

Context: The calendar component is often slightly moving and may disturb the stability of the seasonal component.

Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Chain index

An index number in which the value at any given period is related to a base in the previous period, as distinct from one which is related to a fixed base.

Context: The comparison of non-adjacent periods is usually made by multiplying consecutive values of the index numbers, which, as it were, form a chain from one period to another.

In practice chain index numbers are usually formed from weighted average of link-relatives, namely the values of magnitudes for a given period divided by the corresponding values in the previous period.

Source: Dodge, Y., ed., 2003, *The Oxford Dictionary of Statistical Terms*, Oxford University Press, Oxford, England, for the International Statistical Institute

Chain linking	Refers to the joining together of two indices that overlap in one period by rescaling one of them to make its value equal to that of the other in the same period, thus combining them into single time series. More complex methods may be used to link together indices that overlap by more than period. *Context:* Also known as "chaining". *Source:* ILO, IMF, OECD, UNECE, World Bank, 2004, *Producer Price Index Manual: Theory and Practice*, IMF, Washington, Glossary
Classification	A classification is a set of discrete, exhaustive and mutually exclusive observations which can be assigned to one or more variables to be measured in the collation and/or presentation of data. *Context:* The terms "classification" and "nomenclature" are often used interchangeably, despite the definition of a "nomenclature" being narrower than that of a "classification". *Source:* UNSD, 2006, *United Nations Glossary of Classification Terms*, prepared by the Expert Group on International Economic and Social Classifications, UNSD, New York, available at http://unstats.un.org/unsd/class/family/glossary_short.htm#C [Accessed 3 August 2006]
Classifications, standard	Standard classifications are those that follow prescribed rules and are generally recommended and accepted. They aim to ensure that information is classified consistently regardless of the collection, source, point of time, etc. *Source:* UNSD, 2006, *United Nations Glossary of Classification Terms*, prepared by the Expert Group on International Economic and Social Classifications, UNSD, New York, available at http://unstats.un.org/unsd/class/family/glossary_short.htm#C [Accessed 3 August 2006] *Context:* In the international context standard classifications include ISIC Rev. 3, ISCO, CPC, etc. Many national statistical systems also have their own versions of standard classifications which in the main are consistent with international standard classifications, though modified to meet national circumstances.
Coefficient of variation	The standard deviation of a random variable divided by the mean. *Source*: Dodge, Y., ed., 2003, *The Oxford Dictionary of Statistical Terms*, Oxford University Press, Oxford, England, for the International Statistical Institute *Context:* The US Bureau of Census alternatively refers to the coefficient of variation as the ratio of the standard error to the value being estimated, usually expressed in terms of a percentage. Also known as the relative standard deviation. (*Source:* United States Census Bureau, n.d., *Glossary of Selected Abbreviations and Acronyms*, Census Bureau, Washington D.C., available at http://www.census.gov/dmd/www/glossary.html#C)
Composite indicator	A composite indicator is formed when individual indicators are compiled into a single index, on the basis of an underlying model of the multi-dimensional concept that is being measured. *Context*: A composite indicator measures multi-dimensional concepts (*e.g.* competitiveness, e-trade or environmental quality) which cannot be captured by a single indicator. Ideally, a composite indicator should be based on a theoretical framework / definition, which allows individual indicators / variables to be selected, combined and weighted in a manner which reflects the dimensions or structure of the phenomena being measured. *Source:* OECD, 2004, *The OECD-JRC Handbook on Practices for Developing Composite Indicators*, paper presented at the OECD Committee on Statistics, 7-8 June 2004, OECD, Paris
Constant prices	Constant prices are obtained by directly factoring changes over time in the values of flows or stocks of goods and services into two components reflecting changes in the prices of the goods and services concerned and changes in their volumes (*i.e.* changes in "constant price terms"); the term "at constant prices" commonly refers to series which use a fixed-base Laspeyres formula. *Source:* Commission of the European Communities – Eurostat, IMF, OECD, United Nations, World Bank, 1993, *System of National Accounts: 1993*, paras. 16.2, 16.71.

Cross-domain concepts	Refers to the list of standard concepts covering structural and reference metadata, which should be used wherever possible to enhance possibilities of the exchange of data and metadata between organisations. *Context:* Within the SDMX initiative, cross-domain "metadata" concepts are envisaged to cover various aspects of the statistical data, including data quality. When exchanging statistics, institutions can select from a standard set of content-oriented concepts. The list of concepts and their definitions reflects good practices and can be the basis for mapping between internal systems when data and metadata are exchanged or shared between and among institutions. Examples of common concepts are data source used, periodicity, population coverage, seasonal adjustment *Source:* Statistical Data and Metadata Exchange (SDMX) – BIS, ECB, Eurostat, IBRD, IMF, OECD and UNSD, 2006, *Metadata Common Vocabulary*
Cumulative data	*See* Year-to-date-data
Cyclical component of a time series	The cyclical component of a time series refers to (regular or periodic) fluctuations around the trend, excluding the irregular component, revealing a succession of phases of expansion and contraction. The cyclical component can be viewed as those fluctuations in a time series which are longer than a given threshold, *e.g.* 1½ years, but shorter than those attributed to the trend. *Source:* Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004
Decomposition	The act of splitting a time series into its constituent parts by the use of statistical methods. A typical time series is often regarded as composed of four parts: (a) a long-term movement or trend; (b) oscillations of more or less regular period and amplitude about this trend; (c) a seasonal component; (d) a random, or irregular, component. Any particular series need not exhibit all of these but those which are present are presumed to act in an additive fashion, *i.e.* are superimposed; and the process of determining them separately is one of decomposition. *Source*: Marriott, F.H.C., 1990, *A Dictionary of Statistical Terms*, 5th ed., Longman Scientific and Technical, Burnt Mill, Harlow, Essex, England, for the International Statistical Institute
Deflation	The division of the value of some aggregate by a price index - described as a "deflator" - in order to revalue its quantities at the prices of the price reference period or to revalue the aggregate at the general price level of the price reference period. *Source:* ILO, IMF, OECD, UNECE, World Bank, 2004, *Producer Price Index Manual: Theory and Practice*, IMF, Washington, Glossary
Dissemination, data	Dissemination is the release to users of information obtained through a statistical activity. *Source:* Statistics Canada, 1998, *Statistics Canada Quality Guidelines*, 3rd ed., Statistics Canada, Ottawa, October 1998, page 59. *Context:* Data dissemination consists of distributing or transmitting statistical data to users. Various release media are possible; for example: electronic format including the Internet, CD-ROM, paper publications, files available to authorised users or for public use; fax response to a special request, public speeches, press releases.
Double deflation	Double deflation is a method whereby gross value added is measured at constant prices by subtracting intermediate consumption at constant prices from output at constant prices; this method is feasible only for constant price estimates which are additive, such as those calculated using a Laspeyres' formula (either fixed-base or for estimates expressed in the previous year's prices).

Source: Commission of the European Communities – Eurostat, IMF, OECD, United Nations, World Bank, 1993, *System of National Accounts: 1993*, para. 16.5

Exponential growth

Exponential growth refers to the situation where growth compounds continuously at every instant of time.

Because compounding takes place at intervals much longer than an instant, geometric growth is regarded as being a "special case" of exponential growth.

In general terms an exponential growth rate may be expressed as

$$\frac{In\left(\frac{Xn}{Xo}\right)}{n}$$

Where X_o = variable at the start; X_n = variable at the end; n = number of intervals between X_o and X_n; In = natural logarithm.

Source: Rowland, D., 2003, *Demographic Methods and Concepts*, Section 1: Population Dynamics, Part 2: Population growth and decline, Oxford University Press, Oxford, UK

Context: Exponential growth rates may take the form of annual growth rates, quarter-on-previous quarter growth rates or month-on-previous month growth rates.

The exponential growth rate is the growth rate between two points in time for certain indicators, notably labour force and population.

This growth rate is based on a model of continuous exponential growth between two points in time. It does not take into account the intermediate values of the series. Nor does it correspond to the annual rate of change measured at a one-year interval, which is given by:

$$(X_n - X_{n-1})/X_{n-1}$$

Source: World Bank, 2004, *2004 World Development Indicators,* World Bank, Washington DC

Filter

Any method of isolating harmonic constituents in a time series; a mathematical analogy of the "filtering" of a ray of light or sound by removing unsystematic effects and bringing out the constituent harmonics.

Source: Marriott, F.H.C., 1990, *A Dictionary of Statistical Terms*, 5th ed., Longman Scientific and Technical, Burnt Mill, Harlow, Essex, England, for the International Statistical Institute

Flow series / data

Statistical series presented as flow series/data are cumulated during the reference period, for example, passenger car registrations, where the figure for the reference period is the sum of daily registrations.

Source: OECD, monthly, *Main Economic Indicators*, OECD, Paris

Forecasting

"Forecasting" and "prediction" are often used synonymously in the customary sense of assessing the magnitude which a quantity will assume at some future point of time: as distinct from "estimation" which attempts to assess the magnitude of an already existent quantity. For example, the final yield of a crop is "forecast" during the growing period but "estimated" at harvest.

Source: Marriott, F.H.C., 1990, *A Dictionary of Statistical Terms*, 5th ed., Longman Scientific and Technical, Burnt Mill, Harlow, Essex, England, for the International Statistical Institute

Geometric growth rate

Geometric growth refers to the situation where successive changes in a variable differ by a constant ratio (as distinct from a constant amount for arithmetic change).

In general terms a geometric growth rate may be expressed as

$$\sqrt[n]{\frac{Xn}{Xo}} - 1$$

Where X_o = variable at the start; X_n = variable at the end; n = number of intervals between X_o and X_n

Source: Rowland, D., 2003, *Demographic Methods and Concepts*, Section 1: Population Dynamics, Part 2: Population growth and decline, Oxford University Press, Oxford, UK

Context: Geometric growth rates may take the form of annual growth rates, quarter-on-previous quarter growth rates or month-on-previous month growth rates.

The geometric growth rate is applicable to compound growth over discrete periods, such as the payment and reinvestment of interest or dividends. Although continuous growth, as modelled by the exponential growth rate, may be more realistic, most economic phenomena are measured only at intervals, in which case the compound growth model is appropriate.

As with the exponential growth rate, the geometric growth rate does not take account intermediate values of the series.

Source: World Bank, 2004, *2004 World Development Indicators,* World Bank, Washington DC

Growth rates

Growth rates are ratios of total change in a specified time reference period to values at the beginning of the period or at a specified earlier time reference.

Source: Adapted from UNSD, 1958, *Multilingual Demographic Dictionary, English Section*, Population Studies, No. 29, United Nations Department of Economic and Social Affairs, New York

Indicator, statistical

A statistical indicator is a data element that represents statistical data for a specified time, place, and other characteristics.

Source: Economic Commission for Europe of the United Nations (UNECE), 2000, *Terminology on Statistical Metadata*, Conference of European Statisticians Statistical Standards and Studies, No. 53, UNECE, Geneva, 2000.

Index number

An index number is a quantity that shows by its variations the changes over time or space of a magnitude.

Important features in the construction of an index number are its coverage, base period, weighting system and method of averaging observations.

Context: The above definition relates to the usual meaning of the expression "index number". In full generality, however, the term can also be applied to a series of values which are standardised by being referred to a basic period or area, *e.g.* if the price of a fixed commodity in a basic year is 40 units and those in succeeding years are 60 and 68 units, the index number of those years would be, on the basis of 100 for the first year, 150 and 170. Such simple cases are, however, usually referred to as "relatives" and the index number is constructed as an average of a number of relatives.

Source: Dodge, Y., ed., 2003, *The Oxford Dictionary of Statistical Terms*, Oxford University Press, Oxford, England, for the International Statistical Institute

Irregular component of a time series

The irregular component of a time series is the residual time series after the trend-cycle and the seasonal components (including calendar effects) have been removed. It corresponds to the high frequency fluctuations of the series.

Context: The irregular component results from short term fluctuations in a series which are not systematic and in some instances not predictable, *e.g.* uncharacteristic weather patterns. Some irregular effects can however be expected in advance, *e.g.* changes in value added tax.

In a highly irregular series, these fluctuations can dominate movements, which will mask the trend and seasonality. (ABS)

Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Least-squares growth rate

The least-squares growth rate, r, is estimated by fitting a linear regression trend line to the logarithmic annual values of the variable in the relevant period. The regression equation takes the form:

$$\text{In } X_t = a + bt$$

Which is equivalent to the logarithmic transformation of the compound growth equation,

$$X_t = X_o (1 + r)^t$$

In this equation X is the variable, t is time, and a = In X_o and b = In $(1 + r)$ are parameters to be estimated. If b^* is the least-squares estimate of b, then the average annual growth rate , r, is obtained as $[\exp(b^*) - 1]$ and is multiplied by 100 for expression as a percentage. The co-efficient b* is also directly interpretable as the average exponential growth rate for the series X. No transformation is needed for this.

The calculated growth rate is an average rate that is representative of the available observations over the entire period. It does not necessarily match the actual growth rate between any two periods.

Context: Least-squares growth rates are used whenever there is a sufficiently long time series to permit a reliable calculation. No growth rates are calculated if more than half the observations in a period are missing.

Source: World Bank, 2004, *2004 World Development Indicators,* World Bank, Washington DC

Level (monthly, quarterly, annual) data

Data expressed as levels are expressed as values, numbers, units, etc., for a given period (month, quarter, and year).

Source: Organisation for Economic Co-operation and Development (OECD), monthly, *Main Economic Indicators*, OECD, Paris

Linear approximation of the annualised growth rate

Linear approximation of the annualised growth rate is a quick calculation of the annualised growth rate that show the rate of change that would be measured for a quarter or month if maintained for a full year. Quarterly rates of change are multiplied by 4 and monthly rates of change are multiplied by 12. Such rates are expressed as $4*([Q_t-Q_{t-1}] /Q_{t-1})$ for quarterly data or $12* ([M_t- M_{t-1}] / M_{t-1})$ for monthly data.

M_t denotes the value of a monthly time series in month t and Q_t the value of a quarterly time series in quarter t.

Such rates attempt to facilitate comparison of data for different time periods (*e.g.* years and quarters). However, because the impact of any irregular is magnified, use of this form of growth rate presentation is not recommended, especially as the key headline series.

Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Metadata

Metadata is data that defines and describes other data.

Source: ISO/IEC FCD 11179-1, 2003, *Information technology - Metadata registers-Part 1: Framework*, May 2003.

Metadata, statistical

Statistical metadata are data about statistical data.

Context: Statistical metadata provide information on data and about processes of producing and using data. Metadata describe statistical data and - to some extent - processes and tools involved in the production and usage of statistical data.

Source: United Nations Statistical Commission and Economic Commission for Europe of the United Nations (UNECE), 1995, *Guidelines for the Modelling of Statistical Data and Metadata*, Conference of European Statisticians, Methodological material, United Nations, Geneva

Monthly average

By analogy with annual averages and moving averages generally this term ought to refer to the average values of a time series occurring within a month, the resulting figure being representative of that particular month.

Context: In practice the phrase is sometimes used to denote the averaging of monthly values occurring in the same month, *e.g*. January from year to year, the object being to provide a pattern of seasonal fluctuation. This is objectionable and a better expression would be "seasonal average by months".

Source: Marriott, F.H.C., 1990, *A Dictionary of Statistical Terms*, 5th ed., Longman Scientific and Technical, Burnt Mill, Harlow, Essex, England, for the International Statistical Institute

Month-on-previous-month growth rates

Month-on-previous-month growth rates are rates of change expressed with respect to the previous month. Such rates are expressed as (M_t/M_{t-1}) -1.

M_t denotes the value of a monthly time series in month t.

Context: Also often referred to as Month-to-month (Period-to-period) growth rates, Month-over-month growth rates, 1-month rate of change, or Rate of change on the previous month.

For some phenomena, month-on-previous month growth rates may be further differentiated by the nature or pattern of the incremental difference between each successive period and whether or not the values of these increments over a given period are themselves constant or changing. The most commonly used patterns of growth are: arithmetic, geometric and exponential.

Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Month-on-previous-month changes

Month-on-previous-month changes are changes in levels expressed with respect to the previous month. Such rates are expressed as M_t-M_{t-1}.

M_t denotes the value of a monthly time series in month t.

Context: Also often referred to as Month-to-month (Period-to-period) changes, or Month-over-month changes.

Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Moving average

A moving average is a method for smoothing time series by averaging (with or without weights) a fixed number of consecutive terms. The averaging "moves" over time, in that each data point of the series is sequentially included in the averaging, while the oldest data point in the span of the average is removed. In general, the longer the span of the average, the smoother is the resulting series.

Context Moving averages are used to smooth fluctuations in time series or to identify time series components, such as the trend, the cycle, the seasonal, etc.

A moving average replaces each value of a time series by a (weighted) average of p preceding values, the given value, and f following values of a series.

If $p = f$ the moving average is said to be centered.

The moving average is said to be symmetric if it is centered, and if for each $k = 1, 2, \ldots, p = f$, the weight of the k-th preceding value is equal to the weight of the k-th following one.

The moving average is not defined for the first *p* and the last *f* time series values. In order to compute the moving average for those values, the series must be backcasted and forecasted.

Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Moving holidays

Moving holidays are holidays which occur each year, but where the exact timing shifts. Examples of moving holidays include Easter and Chinese New Year. Easter generally falls in April but it can also fall in late March.

Context: Also known as variable holidays

Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Non-sampling error

An error in sample estimates which cannot be attributed to sampling fluctuations.

Non-sampling errors may arise from many different sources such as defects in the frame, faulty demarcation of sample units, defects in the selection of sample units, mistakes in the collection of data due to personal variations or misunderstanding or bias or negligence or dishonesty on the part of the investigator or of the interviewer, mistakes at the stage of the processing of the data, etc.

Source: Dodge, Y., ed., 2003, *The Oxford Dictionary of Statistical Terms*, Oxford University Press, Oxford, England, for the International Statistical Institute

Original data

Original data in the context of this Handbook refers to statistical information that has not undergone any transformation process such as the compilation of indices, growth rates or ratios. Original data are normally expressed either in physical unit terms (tonnes, cubic metres, etc.) or as values (at current or constant prices).

Context: Original data could also be described as data received directly from survey or administrative sources. Original data are also commonly referred to as "absolute figures" or "absolute data", though these terms in this context should be avoided due to the specific mathematical meaning of the term, *i.e.* the numeric value of a number without regard to its sign.

Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Percentage

A percentage is a special type of proportion where the ratio is multiplied by a constant, 100, so that the ratio is expressed per 100.

Percentage change

The change in an index [or other] series from one period to another expressed as a percentage of its value in the first of the two periods.

Context: However, when numbers expressed as percentages are subtracted from each other the result is a percentage point difference and not a percentage change.

Preliminary / Provisional

Some statistical agencies use the term "Preliminary data" to describe the first released version of a series and "Provisional data" to describe subsequent versions prior to final amendment. However, the two terms are often used interchangeably, though users in general should have no great problem in understanding that data labelled either "preliminary" or "provisional" are subject to revision provided this is clearly highlighted by the agency in the release.

Clearly informing the use that the data is subject to revision is more important than the term used to describe such data.

Source: OECD, 2004, *Some proposals for standard terminology relating to data presentation*, paper presented to the OECD Short-term Economic Statistics Working Party (STESWP), 28-30 June 2004, Paris, 2004

Price index

A measure reflecting the average of the proportionate changes in the prices of a specified set of goods and services between two periods of time.

Source: ILO, IMF, OECD, UNECE, World Bank, 2004, *Producer Price Index Manual: Theory and Practice - Glossary*, IMF, Washington D.C.

Context: Usually a price index is assigned a value of 100 in some selected base period and the values of the index for other periods are intended to indicate the average percentage change in prices compared with the base period.

Probability

A probability is similar to a rate, the difference being that the denominator comprises all those objects in a given population at the beginning of the period of observation. For example: If 10 people die in one year out of a population of 1 000 at the start of a year, the probability of dying during that year was 10/1 000, or 0.01000.

Context: On the other hand the denominator of a rate is frequently the average or mid-period population exposed to the event in question.

Source: Palmore, J., Gardner, R.W., 1994, *Measuring mortality, fertility and natural increase: a self teaching guide to elementary measures*, East-West Centre, Honolulu, Hawaii

Proportion

A proportion is a special type of ratio in which the denominator includes the numerator.

An example is the proportion of deaths that occurred to males which would be deaths to males (X) divided by deaths to males plus deaths to females (Y) (*i.e.* X/(X+Y).

Source: Palmore, J., Gardner, R.W., 1994, *Measuring mortality, fertility and natural increase: a self teaching guide to elementary measures*, East-West Centre, Honolulu, Hawaii

Context: More common usage of the term "proportion" is in the context of a portion or part in its relation to the whole (*Source*: The Oxford English Dictionary, 1989, eds. Simpson, J.A & Weiner, E.S.C., Volume 1, Clarendon Press, Oxford)

Qualitative data

Qualitative data is data describing the attributes or properties that an object possesses. The properties are categorized into classes that may be assigned numeric values. However, there is no significance to the data values themselves, they simply represent attributes of the object concerned.

Source: Economic Commission for Europe of the United Nations (UNECE), 2000, *Glossary of Terms on Statistical Data Editing*, Conference of European Statisticians Methodological material, Geneva

Quantitative data

Quantitative data is data expressing a certain quantity, amount or range. Usually, there are measurement units associated with the data, *e.g.* metres, in the case of the height of a person. It makes sense to set boundary limits to such data, and it is also meaningful to apply arithmetic operations to the data.

Source: Economic Commission for Europe of the United Nations (UNECE), 2000, *Glossary of Terms on Statistical Data Editing*, Conference of European Statisticians Methodological material, Geneva

Context: Strictly, this term, as contrasted with qualitative data, should relate to data in the form of numerical quantities such as measurements or counts. It is sometimes, less exactly, used to describe material in which the variables concerned are quantities, *e.g.* height, weight, price as distinct from data deriving from qualitative attributes, *e.g.* sex, nationality or commodity.

This usage is to be avoided in favour of such expressions as "data concerning quantitative (qualitative) variables" or "data concerning numerical variables (attributes)" (*Source*: Marriott, F.H.C., 1990, *A Dictionary of Statistical Terms*, 5th ed., Longman Scientific and Technical, Burnt Mill, Harlow, Essex, England, for the International Statistical Institute).

Quantity index

A measure reflecting the average of the proportionate changes in the quantities of a specified set of goods and services between two periods of time. Usually a quantity index is assigned a value of 100 in some selected base period and the values of the index for other periods are intended to indicate the average percentage change in quantities compared with the base period.

Source: ILO, IMF, OECD, UNECE, World Bank, 2004, *Producer Price Index Manual: Theory and Practice - Glossary*, IMF, Washington D.C.

Quarter-on-previous-quarter growth rates

Quarter-on-previous-quarter growth rates are rates of change expressed with respect to the previous quarter. Such rates are expressed as $(Q_t / Q_{t-1}) - 1$.

Q_t denotes the value of a quarterly time series in quarter t.

Context: Also often referred to as Quarter-to-quarter (Period-to-period) growth rates, Quarter-over-quarter growth rates, 1-quarter growth rates, or Rate of change on the previous quarter.

For some phenomena, quarter-on-previous quarter growth rates may be further differentiated by the nature or pattern of the incremental difference between each successive period and whether or not the values of these increments over a given period are themselves constant or changing. The most commonly used patterns of growth are: arithmetic, geometric and exponential.
Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Quarter-on-previous-quarter changes

Quarter-on-previous-quarter changes are changes in levels expressed with respect to the previous quarter. Such rates are expressed as $Q_t - Q_{t-1}$.

Q_t denotes the value of a quarterly time series in quarter t.

Context: Also often referred to as Quarter-to-quarter (Period-to-period) changes, or Quarter-over-quarter changes.

Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Rate

A rate refers to the occurrence of events over a specific interval in time.

Similarly, a rate refers to the measure of the frequency of some phenomenon of interest given by:

$$\text{Rate} = \frac{\text{number of events in a specified period}}{\text{average population during the period}}$$

Source: Everitt, B.S., 1989, *The Cambridge Dictionary of Statistics, Cambridge University Press*, Cambridge, UK

The term "rate" can also be used in the context of a proportion.

Context: Caution must be used with the term "rate" as it is sometimes applied to ordinary percentages such as a "literacy rate" which is the percentage of a population that is literate and an "unemployment rate" which is the percentage of unemployed persons of a labour force population.

Different constants (commonly 100, 1 000, 100 000) are used in the presentation of different rates (*e.g.* crude death rates and crude birth rates are usually expressed per 1 000). Palmore and Gardner (1994) recommend that when calculating a rate to proceed without the use of a constant until the final answer is derived and then use the constant to express the rate per 100, 1 000 or whatever is the usual constant for that type of rate. (*Source:* Palmore, J., Gardner, R.W., 1994, *Measuring mortality, fertility and natural increase: a self teaching guide to elementary measures*, East-West Centre, Honolulu, Hawaii)

Rates of change

See Growth rates

Ratio

A ratio is a number that expresses the relative size of two other numbers.

The result of dividing a number *X* by another number *Y* is the ratio of *X* to *Y*, *i.e.*:

$$\frac{X}{Y} = \text{ratio of } X \text{ to } Y$$

Context: Ratios are useful for analysing the composition of two sets of events.
Source: Palmore, J., Gardner, R.W., 1994, *Measuring mortality, fertility and natural increase: a self teaching guide to elementary measures*, East-West Centre, Honolulu, Hawaii

Rebasing	Rebasing may mean: - changing the weights in an index, - changing the price reference period of an index number series, or - changing the index reference period of an index number series. The weights, the price reference period, and the index reference period may be changed at the same time, but not necessarily so. *Source:* ILO, IMF, OECD, UNECE, World Bank, 2004, *Producer Price Index Manual: Theory and Practice - Glossary*, IMF, Washington DC
Reference base, index	The period for which an index series is given the value of 100.0 (or 100). Rereferencing involves the situation where an index base of 100 is changed from one period (*e.g.* year) to the next.
Reference metadata	Reference metadata describe the contents and the quality of the statistical data. *Context:* Preferably, reference metadata should include all of the following: a) conceptual metadata describing the concepts used and their practical application, allowing users to understand what the statistics are measuring and, thus, their fitness for use; b) methodological metadata describing methods used for the generation of the data (*e.g.* sampling, collection methods, editing processes); c) quality metadata describing the different quality dimensions of the resulting statistics (*e.g.* timeliness, accuracy). *Source:* Statistical Data and Metadata Exchange (SDMX) – BIS, ECB, Eurostat, IBRD, IMF, OECD and UNSD, 2006, *Metadata Common Vocabulary*
Reference period	A point (or period) in time for which data are collected. *Source*: Dodge, Y., ed., 2003, *The Oxford Dictionary of Statistical Terms*, Oxford University Press, Oxford, England, for the International Statistical Institute [modified]. *Context:* This period is frequently one year or one week but it may be as short as one day. In some literature, the terms "base period", "reference period", and "weight reference period" are used interchangeably. In concept the terms have different meanings, although in practice the periods actually referred to may be the same.
Relative standard error	*See* Coefficient of variation
Release calendar	A general statement on the schedule of release of data. *Source:* International Monetary Fund (IMF), 1996, *Guide to the Data Dissemination Standards, Module 1: The Special Data Dissemination Standard*, IMF, Washington DC *Context:* An advance release calendar provides a general statement on the schedule of release of data, which is publicly disseminated so as to provide prior notice of the precise release dates on which a national statistical agency, other national agency, or international organisation undertakes to release specified statistical information to the public. Such information may be provided for statistical releases in the coming week, month, quarter or year. Advance release calendar information is one of the requirements of the IMF's Special Data Dissemination Standards (SDDS). Such information is disseminated on the Internet on the IMF`s Data Standards Bulletin Board (DSBB) or on national websites.
Rereference	*See* Reference base, index
Revisions, data	Data revisions are defined broadly as any change in a value of a statistic released to the public by an official national statistical agency.

Source: IMF, Carson, Carol C., 2003, *Revisions Policy for Official Statistics: A Matter of Governance*, presented at the 2nd Session of the Committee for the Coordination of Statistical Activities, Geneva, 8-10 September 2003, IMF, Washington DC

Revision policy

A policy or set of policies, aimed at ensuring the transparency of disseminated data whereby preliminary data are compiled that are later revised when more and better source data become available.

Source: International Monetary Fund (IMF), 2001, *Quarterly National Accounts Manual*, IMF, Washington D.C.
Context: Providing users with documentation regarding the source data used and the way they are adjusted gives compilers with the possibility to incorporate new and more accurate information into estimates, thus improving their accuracy without introducing breaks in the time series.

Data may also be subject to ad hoc revisions as a result of the introduction of new classifications, compilation frameworks and methodologies which result in the compilation of historical data that replaces previously released data. Whether or not such changes constitute an actual "revision" or the compilation of a "new" series is a matter of judgment on the part of the statistical agency.

Under the requirements of the Special Data Dissemination Standard (SDDS), an organisation's revision policy for specific statistics is disseminated on the Internet on the IMF`s Dissemination Standards Bulletin Board (DSBB).

Sampling error

That part of the difference between a population value and an estimate thereof, derived from a random sample, which is due to the fact that only a sample of values is observed; as distinct from errors due to imperfect selection, bias in response or estimation, errors of observation and recording, etc.

The totality of sampling errors in all possible samples of the same size generates the sampling distribution of the statistic which is being used to estimate the parent value.

Source: Dodge, Y., ed., 2003, *The Oxford Dictionary of Statistical Terms*, Oxford University Press, Oxford, England, for the International Statistical Institute

Context: Sampling errors arise from the fact that not all units of the targeted population are enumerated, but only a sample of them. Therefore, the information collected on the units in the sample may not perfectly reflect the information which could have been collected on the whole population. The difference is the sampling error (Eurostat, Quality Glossary).

Sampling variance

The variance of a sampling distribution. The word “sampling” can usually be omitted, as being defined by the context or otherwise understood. The sampling variance of a statistic is the square of its standard error.

Source: Marriott, F.H.C., 1990, *A Dictionary of Statistical Terms*, 5th ed., Longman Scientific and Technical, Burnt Mill, Harlow, Essex, England, for the International Statistical Institute

Seasonal adjustment

Seasonal adjustment is a statistical technique to remove the effects of seasonal (including calendar) influences operating on a series. Seasonal effects usually reflect the influence of the seasons themselves either directly or through institutional factors or social conventions.

Context: Other types of calendar variation occur as a result of influences such as the number of days in the calendar period, the accounting or recording practices adopted or the incidence of moving holidays (such as Easter and Chinese New Year).

(A slightly modified version of the definition from: ABS, 1997, *An Analytical Framework for Price Indexes in Australia: Glossary and References*, ABS, Canberra)

Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Seasonal adjustment programs	Seasonal adjustment is normally done using off-the-shelf programs—most commonly worldwide by one of the programs in the X-12 family. Other programs in common use include the TRAMO-SEATS package developed by Bank of Spain and promoted by Eurostat, the German BV4 program, SABL, DAINTIES, STAMP, etc. *Context:* The original X-11 program was developed in the 1960s by the U.S. Bureau of the Census. It has subsequently been updated and improved through the development of X-11-ARIMA by Statistics Canada and X-12-ARIMA by the U.S. Bureau of the Census, which was released in the second half of the 1990s. The core of X-11-ARIMA and X-12-ARIMA is the same basic filtering procedure as in the original X-11. *Source:* IMF, 2001, *Quarterly National Accounts Manual – Concepts, Data Sources and Compilation*, IMF, Washington DC, para. 8.13
Seasonal component of a time series	The seasonal component is that part of the variations in a time series representing intra-year fluctuations that are more or less stable year after year with respect to timing, direction and magnitude. *Context:* The seasonal component is also referred to as the seasonality of a time series. The seasonal component reflect "normal" variations that recur every year to the same extent, *e.g.* weather fluctuations that are representative of the season, length of months, Christmas effect. *Source:* Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004
Seasonal variation	The seasonal variation is that part of the variations in a time series representing intra-year fluctuations that are repeated more or less regularly in the same period year after year. *Source:* OECD, 2004, *Some proposals for standard terminology relating to data presentation*, paper presented to the OECD Short-term Economic Statistics Working Party (STESWP), 28-30 June 2004, Paris
Seasonally adjusted component of a time series	The seasonally adjusted component is the result of the extraction of the seasonal component (including the calendar effects component) from a time series. If neither seasonal nor calendar influences are present in the original data, the seasonally adjusted series is given by the original data. For series with no identifiable seasonal variations but with identifiable calendar variations, the seasonally adjusted series is given by the calendar adjusted series. *Context:* Trading / working day corrections are alternative ways to normalise the time series. *Source:* Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004
Seasonally adjusted time series	Seasonally adjusted time series are series that have been adjusted for seasonal variations, including trading-day (working-day) effects and other regular calendar variations if present. *Source:* Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004
Smoothing	The process of removing fluctuations in an ordered series so that the result shall be "smooth" in the sense that the first level differences are regular and higher order differences small. Although smoothing can be carried out by freehand methods, it is usual to make use of moving averages or the fitting of curves by least squares procedures. In fact, the concept is closely tied to that of trend fitting. *Source*: Marriott, F.H.C., 1990, *A Dictionary of Statistical Terms*, 5th ed., Longman Scientific and Technical, Burnt Mill, Harlow, Essex, England, for the International Statistical Institute

Spatial data	Spatial data is any data with a direct or indirect reference to a specific location or geographical area. *Source:* World Meteorological Organisation, 2004, *Report of CBS Expert Team on Integrated Data Management*, Fourth Meeting, Geneva, 1-3 September 2004
Special Data Dissemination Standard (SDDS)	The Special Data Dissemination Standard (SDDS) was established by the International Monetary Fund (IMF) to guide members that have, or that might seek, access to international capital markets in the provision of their economic and financial data to the public. Subscription to the SDDS was opened in early April 1996. The SDDS identifies four dimensions of data dissemination: a) The data: coverage, periodicity, and timeliness; b) Access by the public; c) Integrity of the disseminated data; and d) Quality of the disseminated data. The SDDS prescribes that subscribing members provide a summary description of methodology for each data category, including statements of major differences from international guidelines. The term "methodology" is used in the SDDS in a broad sense to cover the aspects of analytical framework, concepts, definitions, classifications, accounting conventions, sources of data, and compilation practices. *Source:* International Monetary Fund (IMF), 1996, *Guide to the Data Dissemination Standards, Module 1: The Special Data Dissemination Standard*, Washington DC
Standard error	The positive square root of the variance of the sampling distribution of a statistic. It includes the precision with which the statistics estimates the relevant parameter as contrasted with the standard deviation that describes the variability of primary observations. *Source*: Dodge, Y., ed., 2003, *The Oxford Dictionary of Statistical Terms*, Oxford University Press, Oxford, England, for the International Statistical Institute
Statistical subject matter domain	A statistical subject matter domain refers to a statistical activity that has common characteristics with respect to concepts, and methodologies for data collection, manipulation and transformation. *Context:* Within SDMX, the list of Statistical Subject Matter Domains (aligned to the UN/CES Classification of International Statistical Activities) is a standard reference list against which the categorisation schemes of various participants in exchange arrangements can be mapped to facilitate data and metadata exchange. This allows the identification of subject matter domain groups involved in the development of guidelines and recommendations relevant to one or more statistical domains. Each of these groups could define domain-specific data structure definitions, concepts, etc. *Source:* Statistical Data and Metadata Exchange (SDMX) – BIS, ECB, Eurostat, IBRD, IMF, OECD and UNSD, 2006, *Metadata Common Vocabulary*
Stock series / data	Statistical data presented as stock series/data are measured at the end of the reference period, for example, money supply data which can refer to an observation on the last working day of the reference period. *Source:* Organisation for Economic Co-operation and Development (OECD), monthly, *Main Economic Indicators*, OECD, Paris
Structural metadata	Structural metadata are metadata that act as identifiers and descriptors of the data. *Context:* Structural metadata are needed to identify, use and process data matrixes and data cubes, *e.g.* names of columns or dimensions of statistical cubes. Structural metadata must be associated with the statistical data, otherwise it becomes impossible to identify, retrieve and navigate the data. *Source:* Statistical Data and Metadata Exchange (SDMX) – BIS, ECB, Eurostat, IBRD, IMF, OECD and UNSD, 2006, *Metadata Common Vocabulary*

Tendency

The term tendency is used in business tendency surveys where the respondent is asked for a judgment on the direction of changes (*e.g.* up/down/same).

Source: Organisation for Economic Co-operation and Development (OECD), monthly, *Main Economic Indicators*, OECD, Paris

Time series

A time series is a set of regular time-ordered observations of a quantitative characteristic of an individual or collective phenomenon taken at successive, in most cases equidistant, periods / points of time.

Context: In the context of sub-annual [infra-annual] statistics, a time series (TS) can be decomposed into unobservable components. In the most complete case, these components are the trend (T), the cyclical (C), the seasonal (S) and the irregular (I) components.

The four components of the time series may each be independent of all the others, in which case the behaviour of the time series is simply the sum of `the components which are additively related (*i.e* TS = T+C+S+I). However, most analysts believe that it is unlikely that the time series components are perfectly independent of each other, and are therefore more likely to be multiplicatively related (*i.e.* TS=T*C*S*I).

Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Time series breaks

Breaks in statistical time series occur when there is a change in the standards for defining and observing a variable over time. Such changes may the result of a single change or the combination of multiple changes at any one point in time of observation of the variable.

Context: The specific causes of breaks in a statistical time series include changes in: classifications used, definitions of the variable, coverage, etc.

Statistical agencies and users of time series data for economic research to analyse and interpret economic and social events and conditions attach very high importance to the continuity and consistency of data over time. However, it should be emphasized that the occurrence of time series break may not necessarily jeopardise the reliability of a time series. Statistical agencies frequently apply a number of techniques to ensure the continuity of a time series.

Finally, the impact of a time series break is often a matter of judgement on the part of the user and depends on the use(s) to which the data are put.

Source: Statistical Data and Metadata Exchange (SDMX) – BIS, ECB, Eurostat, IBRD, IMF, OECD and UNSD, 2006, *Metadata Common Vocabulary*

Trend component of a time series

The trend is the component of a time series that represents variations of low frequency in a time series, the high and medium frequency fluctuations having been filtered out. This component can be viewed as those variations with a period longer than a chosen threshold. Usually 8 years is considered as the maximum length of the business cycle.

Context: The trend is normally referred to as the long-term movement in a cyclical context (*i.e.* the trend variations have a longer period than the maximum duration of the business cycle).

In practice, statistical agencies do not calculate the trend but rather focus on the trend-cycle component (see Trend-cycle).

There is no international consensus involving the preferred use of the terms “fluctuation” or “variation”. Common usage of the former term is in the context of a rise or fall in number or amount, and the latter in terms of changes or slight differences in amount or level, typically within certain limits. In the main, the term “variations” has been used in this Handbook.

Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Trend-cycle	The trend-cycle is the component that represents variations of low frequency in a time series, the high frequency fluctuations having been filtered out. This component can be viewed as those variations with a period longer than a chosen threshold. Usually 1½ years is considered as the minimum length of the business cycle. *Context:* In practice, statistical agencies calculate the trend-cycle by estimating and removing the seasonal and irregular components. *Source:* Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004
Trend estimates	Trend estimates are derived from seasonally adjusted estimates via an averaging process which attempts to remove the irregular component of the time series. This allows the underlying direction of a time series to be identified. *Source:* ABS, 1997, *An Analytical Framework for Price Indexes in Australia: Glossary and References*, ABS, Canberra
Trend fitting	The general process of representing the trend component of a time series. A trend may be represented by a particular curve form, *e.g.* the logistic, or by a particular form of the general class of polynomial in time, or by a moving average. *Source*: Marriott, F.H.C., 1990, *A Dictionary of Statistical Terms*, 5th ed., Longman Scientific and Technical, Burnt Mill, Harlow, Essex, England, for the International Statistical Institute
Volume index	A volume index is most commonly presented as a weighted average of the proportionate changes in the quantities of a specified set of goods or services between two periods of time; volume indices may also compare the relative levels of activity in different countries (*e.g.* those calculated using PPPs). A major aim of economic analysis is to develop an understanding of changes taking place in an economy over time. This includes the measurement of short-term growth or decline. To achieve this for key economic value aggregates, such as the value of industrial production or the value of retail turnover, it is necessary to distinguish between changes arising solely from price changes and those arising from other influences such as quantity and quality, which are referred to as changes in "volume". *Source:* Commission of the European Communities – Eurostat, IMF, OECD, United Nations, World Bank, 1993, *System of National Accounts: 1993*, para. 16.11.
Weighting base	The period to which [the fixed] weights relate.
Working / trading day adjustment	Working day or trading adjustments refer to the correction for differences in the number of working or trading days in a given month or quarter which differ from year to year which will impact upon the level of activity in that month or quarter for flow series or the sort / type of day for stock series. In most countries working day adjustment and trading day adjustment are used as synonyms. *Context:* The number of working or trading days in a given month or quarter can vary significantly for each statistical domain (*e.g.* production, merchandise trade) because of differing institutional arrangements, trade specific holidays, etc.). Some countries also include bridging effects in working day adjustments. These result from people taking holidays, for example, on Mondays and Fridays when an official public holiday occurs on Tuesdays and Thursdays respectively. The type of working / trading day adjustment carried out needs to be tailored to the cultural and institutional environment operating within individual countries. In the United States, for example, working day adjustment classifies the days of the week into workdays (Monday through to Friday) and non-workdays (Sat. and Sun.) and thus the seasonal adjustment estimates two factors – workday and non-workday. Trading day adjustment (as performed in the US at least) allows for a different effect for each day of the week and computes seven factors – a Monday factor, a Tuesday factor and so on. Essentially, trading day adjustment is a more fine tuned seasonal adjustment method to account for calendar variation.

In other countries there may be very distinct differences between workdays and non-workdays in the amount of business conducted, but not so much difference between Mondays, Tuesdays, through the Fridays. The US on the other hand, has distinctly different patterns of activity each day of the week and methods used in that country try to account for that difference.

Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Year-on-year change — *See* Year-on-year growth rates

Year-on-year (YoY) growth rates — Year-on-year growth rates are rates of change expressed over the corresponding period (month or quarter in relation to the frequency of the data) of the previous year. Such rates are expressed as (M_t/M_{t-12}) -1 or (Q_t/Q_{t-4}) -1.

M_t denotes the value of a monthly time series in month t and Q_t the value of a quarterly time series in quarter t.

Context: Also often referred to as Year-over-year growth rates, Year-to-year growth rate, Rate of change from the previous year, or 12-month rate of change.

Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Year-on-year changes — Year-on-year changes are changes in levels expressed over the corresponding period (month or quarter in relation to the frequency of the data) of the previous year. Such changes are expressed as M_t-M_{t-12} or Q_t-Q_{t-4}.
M_t denotes the value of a monthly time series in month t and Q_t the value of a quarterly time series in quarter t.

Context: Also often referred to as Year-over-year changes, or Year-to-year changes.

Source: Task force on data and metadata presentation for the OECD Short-term Economic Statistics Working Party (STESWP), Paris, 2004

Year-to-date data — Data expressed in cumulative terms from the beginning of the year; sometimes referred to as cumulative data.
Source: Statistical Data and Metadata Exchange (SDMX) – BIS, ECB, Eurostat, IBRD, IMF, OECD and UNSD, 2006, *Metadata Common Vocabulary*

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Data and Metadata Reporting and Presentation Handbook

The OECD *Data and Metadata Reporting and Presentation Handbook* contains guidelines and recommended best practice for the presentation of statistical data and metadata disseminated by national agencies and international organisations in various dissemination media. The *Handbook* brings together in one publication relevant presentation guidelines embodied in existing international statistical standards where they exist. The *Handbook* also presents for the first time a standard set of terminologies and guidelines for the presentation of growth rates, indices and seasonally adjusted data developed by the OECD Short-Term Economic Statistics Working Party.

The need for a comprehensive data and metadata presentation *Handbook* comes from the imperatives to improve the quality of statistics presented to users at both the national and international levels, in particular, with respect to interpretability and coherence (within datasets, across datasets, over time and between countries) and the need to minimise the reporting burden of national agencies in their provision of data and metadata to international organisations.

The *Handbook* also contains recommendations on a small number of key data presentation areas that can also have a significant impact on data interpretability and where different approaches currently used by national and international agencies complicate the co-ordination of data collection by different organisations and comparisons of national data, etc.
Such presentation practices involve:

- data revision;
- series breaks;
- presentation of sampling and non-sampling errors;
- practices for re-basing indices;
- citation practices;
- availability and presentation of metadata;
- presentation of administrative data.

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