COMPILATION MANUAL FOR AN INDEX OF SERVICES PRODUCTION

3rd Draft Version

OECD STESEG Task Force on Services

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Foreword

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Section 1: INTRODUCTION

1.1 Need and aims for indicators of short-term services production

Indexes of industrial production and related capacity indexes and utilization rates, have traditionally been used to track short-term changes in economic activity. As the industrial sector and construction have historically accounted for most variations in total output over the course of the business cycle, policy makers and business analysts have used these measures to objectively assess the need for, and impact of, a wide range of public policy decisions.

A fundamental shift, however, has occurred in the economies of OECD Member countries over the last several decades. Fueled by the growth of new technologies and an increasingly liberal global trading environment, services are accounting for a larger and ever increasing share of total economic activity. The externalization of routine services by manufacturers and the development of new high value-added business services have further fuelled this transition and have increased each sector's dependence on the other. As a result, there is a growing recognition that indexes of industrial production (IIPs) alone are no longer adequate to evaluate the short-term performance of an entire economy and need to be accompanied by similar information for the services sector.

Flowing on from this, the two main aims for compiling a short-term indicator for services production are to provide:

- economic analysts with information that would complement an IIP on the short-term movement of an economy;

- national accountants with relevant and timely information on the performance of the services sector to be used in compiling quarterly national accounts.

1.2 International efforts to measure short-term services production activities

In general, services data are less detailed and available less frequently than data for the goods-producing sector of the economies of OECD Member countries. This imbalance has its origins from a period when goods production was the larger and more rapidly growing part Member' non-farm economies. The more cyclical nature of goods production, the rapid pace of technological change in manufacturing, and the importance of merchandise trade in international transactions prolonged this situation.

Many OECD Member countries, however, have recently made significant efforts to obtain a more accurate view of short-term economic phenomena in their services sectors. Some have developed more detailed

statistics for services and enhanced the quality of existing series. The United Kingdom (UK), for instance, has introduced an experimental monthly index of services (IoS) by expanding its Index of Distribution, which covers Category G of ISIC Rev. 3.1. The Republic of Korea (Korea) has revised their monthly Services Activity Index (SAI) which had been introduced in the late 1980s. Canada has worked to improve the quality of monthly GDP by enhancing its services data; and the United States recently introduced a new quarterly services survey covering information, communications, and technology–intensive industries – its first new principle economic indicator in over thirty years. Finally, the Statistical Office of the European Communities, Eurostat, now requires European Union member states to collect a wide range of turnover data for the services sector on a regular basis.

Despite these and other similar efforts elsewhere, indicators representing the services sector have, to date, received less attention by economic analysts and policy makers. Such users tend to treat these data as supplementary sources of information. Possible explanations include:

- The types and range of indicators available for the services sector are still very limited and vary significantly from country to country.
- Service indicators are less comparable between countries than those for the industrial sector, due in part to an absence of international guidelines for their development.
- There is a long lag in enhancing the statistical environment to collect the necessary information for the services sector since services cover a wide range of economic activities. This arises from inherent characteristics of the services sector itself, such as the large proportion of small and medium sized establishments that enter and leave the market frequently, making it difficult to identify and maintain an accurate population frame. Similarly, services may be performed as a secondary activity of manufacturing or by other non-service establishments.
- The belief that indicators of this type do not "really" approximate the monthly value added of these sectors.

The OECD Short-term Economic Statistics Working Party (STESWP) task force on services (TFS) was created in 2002 to work on the issues outlined above. Although it touched on a wide range of issues concerning supply and demand indicators for short-term services activities in OECD Member countries, the TFS was particularly interested in issues related to the compilation of a production index to measure short-term economic activities in the services sector. In this Manual the indicator is referred to as an "Index of Services Production" (ISP).

The TFS sought to identify the most preferred and practical methodologies for the compilation of a monthly ISP. It identified the most suitable variables to measure various services activities, and formulated recommendations to harmonise the definitions and titles of key variables for a monthly ISP. The outcomes from this work are embodied in this Manual.

As for the IIP, the ISP is a gross output index with value-added weights. Since coherence and consistency with the national accounts is a high-priority objective of the ISP, aggregations of real gross value added

would be the conceptually preferred measure rather than real gross output in constructing the index. The Manual, however, recognizes the general lack of available short-term measures of gross value added by industry in making its recommendations.

The Manual also recommends the use of a wide variety of gross output price indexes for computing the preferred deflated gross output measures. Again, for consistency with the national accounts, the preferred deflator would ordinarily be a gross value added price index that reflects the difference between gross output prices and intermediate input prices. Gross output price indexes generally are good proxies for gross value added price indexes, however, since gross output and intermediate input price indexes are highly correlated. Some distortions could however arise with sharp fluctuations in the price of energy inputs or other raw materials that are not fully reflected in the gross output price index. In making its recommendations, the Manual recognizes the difficulty in developing monthly gross value added price indexes and the general absence of these measures.

Concepts and terminology used throughout the Manual conform to existing international standards to the greatest extent possible,. In the absence of existing international standards, the Manual recommends use of the most common practices.

In addition to the TFS, other groups of statisticians are also currently working on related issues for the services sector. The most relevant of these are the Joint OECD-Eurostat Task Force on Services Prices, and the Voorburg Group. The TFS worked closely with these two groups and has presented its work at their meetings and visa versa. Since its first attendance in 2003, the TFS has become a regular member of the Voorburg Group.

As will be seen below, the work of the Eurostat-OECD Task Force on Services Prices is quoted extensively in this Manual, as many monetary variables are recommended as a means of collecting basic information on services production. The TFS is also indebted to work of the Voorburg Group with respect to key methodological, classification and technical issues.

1.3 Purpose and use of the Manual

This Manual was prepared primarily to provide official statisticians with practical guidelines to compile a short-term ISP, rather than to merely discuss various methodological aspects for measuring services activities. While the development of a monthly index is envisaged and preferred, the TFS recognizes that the availability of services data within Member countries may constrain the development of a monthly indicator. The Manual's recommendations are therefore just as relevant for the compilation of a quarterly ISP.

As a by-product it is intended that this Manual will also be a useful aid for the design of monthly (or

quarterly) surveys to measure the production of services industries. It therefore necessarily draws from or makes direct use of text from a number of sources, such as the *SNA 1993* (European Commission *et al* 1993)*;* various Eurostat manuals (e.g. *The Methodology of Short-term Business Statistics* (Eurostat 2002) and *The Handbook on Price and Volume Measures in National Accounts* (Eurostat 2001); the IMF *Handbook on Quarterly National Accounts* (IMF 2001); and the *OECD Glossary of Statistical Terms* (OECD 2002a)). At the same time, as has already been mentioned, the Manual utilises the outputs of other related groups such as the Joint OECD-Eurostat Task Force on Services Prices and the Voorburg Group. As a result, the Manual has been prepared in a cost-efficient way, minimising duplication with related work.

Throughout the discussion on the sources and methods for compiling an ISP (in Section 4), the Manual recommends the use of a wide range of quarterly or annual sources to compile a monthly ISP. This is partly due to the lack of basic monthly data, but more importantly, the intention is to reduce the need for collecting monthly information for less- or non-cyclical components, and for small services sectors.

At the same time, Member countries should adopt the recommendations presented in the Manual with some flexibility according to their statistical environment. For example, the levels of index compilation can be divided into two groups: elementary and intermediate level on one hand, and dissemination level on the other. The former allows more national flexibility and independence in index compilation. For the latter, however, harmonisation among national ISPs is necessary to enable international comparisons**.**

1.4 Organisation of the Manual

This Manual is organised into six Sections. Sections 1 and 2 discuss general issues and infrastructure regarding the services sector and its production activities. Sections 3 and 4 deal with terminology, methods, and input data and their deflators to be used in the compilation of a monthly ISP. Detailed technical issues regarding the compilation of a monthly ISP are presented in Section 5. Brief remarks for implementation and dissemination of the index are given in Section 6. Annex 1 briefly proposes a list of deflators using UK practice as an example, and Annex 2 presents recommended variables and deflators, and their sources for all services activities as defined in this Manual, i.e. Tabulation categories G through P of ISIC Rev. 3.

Section 2: INFRASTRUCTURE

In this Section, statistical units, classifications and coverage of the services sector as defined in international publications are reviewed in order to produce a set of harmonized definitions to be used in the compilation of a short-term Index of Services Production.

2.1 Statistical units

In this Section, definitions for various types of statistical units presented in international publications are reviewed in order to identify optimal definition(s) for each statistical unit. At the same time, the Section recommends the preferred statistical unit(s) from which data for services activities can be collected.

2.1.1 Definition

The International Standard Industrial Classification, Revision 3.1 (ISIC Rev. 3.1) defines the Statistical unit as "The entities for which information is sought and for which statistics are ultimately compiled." (United Nations 1990, paras 63 and 76) The European Commission (EC) on the other hand, describes a unit as "a specific entity which is defined in such a way that it can not be confused with any other unit. Units are the elements of a population. It must be possible to count these elements without omissions or duplication. Statistical units may be identifiable legal or physical entities or statistical constructs." (Eurostat 2002, para. 5.1.2, page 14).

ISIC Rev. 3.1 provides a general definition for statistical units but the EC focuses on more practical aspects. Thus, both definitions are used as they complement each other.

Statistical units

Both ISIC Rev. 3.1 and Eurostat provide a list of the types of statistical units which satisfy the definitions of statistical units provided above. Statistical units in ISIC Rev. 3.1 comprise:

- enterprise;
- enterprise group;
- kind-of-activity unit (KAU);
- local unit;
- establishment;
- homogeneous unit of production.

Eurostat mentions two additional units, i.e. the local KAU and the Local unit of homogeneous production, but excludes the establishment. As outlined below in the discussion on the establishment (see Eurostat 2003, Section 2.1.2), the local KAU corresponds to the operational definition of the establishment. It is therefore recommended to use the types of statistical units listed in ISIC Rev. 3.1.

2.1.2 Various types of statistical units

In this Section, detailed descriptions for various types of statistical units (i.e. enterprise, kind-of-activity unit, local unit, establishment, and homogenous unit of production) extracted from international publications are presented and compared in order to identify the most appropriate definition for each unit. These definitions can also be found in the *OECD Glossary of Statistical Terms* (OECD 2002a) which presents Eurostat[1], ISIC Rev. 3.1 and / or 1993 SNA definitions for the enterprise, enterprise group, kind-of-activity unit (KAU), local unit, and the establishment.

Enterprise

The definition of an enterprise can be found in European Commission regulation (1993), ISIC Rev. 3, and the 1993 SNA. The following definition from the European Commission is recommended:

> "An enterprise is the smallest combination of legal units that is an organisational unit producing goods or services, which benefits from a certain degree of autonomy in decision-making, especially for the allocation of its current resources. An enterprise carries out one or more activities at one or more locations." (European Commission 1993)

The above definition should be complemented by that from ISIC Rev 3.1:

> "An enterprise is an institutional unit or the smallest combination of institutional units that encloses and directly or indirectly controls all necessary functions to carry out its production activities. An enterprise may be a corporation, a quasi-corporation, a non-profit institution, or an unincorporated enterprise." (United Nations 1990, para. 79)

Kind-of-activity unit

Definitions for the kind-of-activity are available in the European Commission Regulation, ISIC Rev. 3 and the 1993 SNA. Definitions from the three sources complement each other, i.e. each definition provides

[1] Source: Council Regulation (EEC), No. 696/93, on the statistical units for the observation and analysis of the production system in the Community.

precision or clarification on aspects not included in the others. The Commission definition lists various quantitative indicators which are available for each KAU. The SNA definition introduces the notion of 'principal productive activity'. The ISIC describes KAU as not being restricted by the geographic area in which the activity is being carried out.

> European Commission: The kind of activity unit (KAU) groups all the parts of an enterprise contributing to the performance of an activity at class level (4-digit) of NACE Rev. 1 and corresponds to one or more operational subdivisions of the enterprise. The enterprise's information system must be capable of indicating or calculating for each KAU at least the production value, intermediate consumption, manpower costs, the operating surplus and employment and gross fixed capital formation. (European Commission 1993)
>
> 1993 SNA: A KAU is an enterprise, or a part of an enterprise, which engages in only one kind of (non-ancillary) productive activity or in which the principal productive activity accounts for most of the value added. (European Commission *et al* 1993, para. 5.19)
>
> ISIC Rev. 3.1: A KAU is an enterprise, or a part of an enterprise, which engages in one kind of economic activity without being restricted to the geographic area in which that activity is carried out. (United Nations 1990, para 91)

Local unit

Definitions for the local unit are available in the European Commission Regulation, ISIC Rev. 3 and the 1993 SNA. The three definitions are very similar. Thus, the definition from Eurostat can be used.

> "The local unit is an enterprise or part thereof (e.g. a workshop, factory, warehouse, office, mine or depot) situated in a geographically identified place. At or from this place economic activity is carried out for which - save for certain exceptions - one or more persons work (even if only part-time) for one and the same enterprise." (European Commission 1993)

Establishment

Definitions for the establishment are available in the European Commission Regulation, ISIC Rev. 3 and the 1993 SNA. Although the ISIC and SNA definitions are similar, the ISIC definition explicitly emphasises the availability of necessary data to evaluate the production activities of the establishment which, for example, allow the calculation of operating surplus. The ESA (European System of Accounts) notes that an establishment corresponds to a local KAU operationally.

ISIC Rev. 3.1: An establishment is an enterprise, or part of an enterprise, which engages in one, or predominantly one, kind of economic activity at or from one location or within one geographic area, for which data are available, or can meaningfully be compiled, that allow the calculation of the operating surplus. (United Nations 1990)

ESA: According to the European Commission Regulation on statistical units, the local kind-of-activity unit (local KAU) corresponds to the operational definition of the establishment. According to the European System of Accounts (ESA) the local KAU is called the establishment in the 1993 System of National Accounts (SNA) and ISIC Rev. 3.1. ((European Commission – Eurostat 1995) and (European Commission 1993))

Homogeneous unit of production

The 1993 SNA provides the following definition for the homogeneous unit of production**:**

"A unit of homogeneous production is a producer unit in which only a single (non-ancillary) productive activity is carried out; this unit is not normally observable and is more an abstract or conceptual unit underlying the symmetric (product- by-product) input-output tables." (European Commission *et al* 1993, para. 15.14)

2.1.3 Preferred statistical units

Unlike the situation in the industrial sector, services activities are often carried out by a large number of small and medium sized firms. It is therefore rather difficult to collect information on services production activities on a regular basis and to keep the statistical population constant for an extended period. Similarly, a firm can engage in multiple activities in various sectors. At the same time a service activity may be the secondary activity of a firm whose predominant activity belongs to either another service activity or a non-service activity such as manufacturing.

Therefore, the establishment is recommended as the primary source for collecting information. An alternative could be the enterprise or kind-of-activity unit as a primary or a secondary information source, if it is more compatible with statistical environment of a country.

2.2 Classification

This Section compares classifications that are currently used by more than one OECD Member country to enable identification of differences for the services sector. This Section also outlines the differences between ISIC Rev 3 and ISIC Rev 4.

2.2.1 Classifications used by OECD countries

The three main relevant international industrial classifications currently in use in the OECD area are the:

- ISIC Rev. 3.1 (International Standard Industrial Classification of All Economic Activities, Revision 3.1): This is the reference industry/activity classification of the United Nations. National classifications such as those for Australia, Japan, Korea and New Zealand[2] are related to ISIC Rev. 3.1;
- NACE 1.1 (Statistical Classification of Economic Activities in the European Community): This is derived from ISIC Rev. 3.1. This classification is used in most European-OECD countries;
- NAICS 2002 (North American Industry Classification System): This is an ISIC Rev. 3.1 related classification and is used in Canada, Mexico and the United States.

2.2.2 Preferred classifications

The industry / activity classifications used by all OECD Member countries are either derived from or related to ISIC Rev. 3.1. Some use ISIC unchanged, whilst others derive their national classifications from ISIC and others are related more or less closely to ISIC. Therefore, this Manual takes ISIC Rev 3.1 as the reference classification. Other regional or national classifications could alternatively be used with relevant adjustments similar to Table 3 below.

2.2.3 Concordance between ISIC Rev. 3.1 and ISIC Rev. 4

Although the definitions and recommendations provided in this Manual are based on ISIC Rev. 3.1, ideally they should also be valid for the revised version of ISIC (i.e. ISIC Rev. 4), currently being developed and which is expected to be finalised by the end of 2007. To this end, it is important to examine how the two versions of ISIC will correspond to each other, especially for services activities. Current concordance information can be found at http://unstats.un.org/unsd/cr/registry/isic-4.asp.

[2] The ANZSIC 1993 (Australian and New Zealand Standard Industrial Classification) is an ISIC Rev. 3.1 related classification used in Australia and New Zealand.

Table 3: Industries to be included in an Index of Service Production (approximate concordance)

Industry descriptions based on ISIC Rev. 3.1		ISIC Rev 3.1		NAICS 2002	NACE 1.1
		Section codes included	Differences		
Wholesale and Retail Trade (G)		G	None	41, 44, 45, 81 pt	G
Accommodation and Food Services (H)		H	None	72	H
Transportation and Warehousing (I)		A part of I (60-63 and 641)	- 642	48, 49 + 5615	61-63 and 64.1
Finance, Insurance and Management of Companies (J)		J	None	52, 55 pt	J
Real estate, renting and business activities (K)	Real Estate and Rental and Leasing	A part of K (70 and 71)	None	53	70 and 71
	Information and Cultural Industries	A part of K (72)	+ 642 from I, + 9213, 922, and 9231 from O	515, 516, 517, 5415, 8112 pt	64.2, 72, 92.1, 92.2, 92.4, 92.5
	Professional, Scientific, Technical, Administrative and Support Services	A part of K (73 and 74)	None	54 pt, 55 pt, 561	73 and 74
Public Administration (L and Q)		L and Q	None	91 (Can) 92 (U.S.) 93 (MX)	L and Q
Educational Services (M)		M	None	61	M
Health Care and Social Assistance (N)		N	None	62, 54194	N
Other community, social and personal service activities (O) and private household with employed persons (P)	Waste Management and Remediation Services	A part of O (90)	None	562	90
	Arts, Entertainment and Recreation	A part of O (92)	- 9213 and 9231	71, 512	92.3, 92.6, and 92.7
	Other Services (except Public Administration)	A part of O (91 and 93) and P	+ P	81 pt	91, 93, and P

Section 3: TERMINOLOGIES FOR INDEX OF SERVICES PRODUCTION

This Section outlines key concepts and terminologies used in the compilation of an Index of Services production (ISP) using the sources and methods described in Section 4 below. The current Section deals primarily with the boundary of the services sector and concepts related to market and non-market services. It also discusses definitions of the ISP and its input variables such as turnover, sales, physical quantities, etc. This Section utilizes some of the units concepts outlined in Section 2 above.

With the closer integration of the global economy, the need to arrive at a set of internationally harmonised terminology and related definitions for services sector terms is an important issue when considering the comparability of a monthly or quarterly Index of Services Production (ISP) compiled on the basis of recommendations outlined in this Manual. This Manual therefore proposes a set of harmonised definitions for key terms and concepts used in the context of the ISP.

At the moment, there isn't a common set of terminologies or definitions that describe the various types of services activities across the OECD area. This stems mainly from the heterogeneous nature of the services sector itself and varying national practices resulting from the diverse statistical, regulatory or social environment across countries, and in some cases, within a country. For example, the public sector is the main provider of inland transportation (e.g. train services) in France, whilst the UK privatized train services companies in the late 1980s. Similarly, a major courier company is operated by the Korean central government, while similar activities are carried out by the private sector in the US. As a result, services activities classified as market and non-market can differ between France, Korea, the UK and the US. As further discussed in the following Sections, in some cases, such differences can be quite significant and strongly influence the comparability of statistical information derived for the services sector.

In order to avoid adding yet another set of "international" concepts, etc., the definitions presented in this Section have been derived to the maximum extent possible from existing international guidelines and recommendations. To some extent there exists some inconsistency between concepts and definitions at the international level and in such situations the recommended definition in this Manual are based on the most common formulation derived from various international publications and sources. The definitions presented below were largely derived from the *System of National Accounts 1993* (European Commission *et al* 1993) and the *European System of Accounts 1995* (European Commission- Eurostat 1995). Each concept and their variants are available in Eurostat's CODED glossary and the *OECD Glossary of Statistical Terms*.

Although it is preferable to present a single harmonised definition for all the variables and concepts discussed in this Section, in some instances this has not proven possible or practical in terms of implementation. In this situation a range of terms are presented.

3.1 Terminologies related to ISP

Key terminologies related to the actual definition of an ISP are presented in this Sub-section. Although many of these terms have a widely accepted understanding, there are variations which are highlighted and compared.

3.1.1 Services activities

Services

The following 1993 SNA definition for services includes information about the coverage of the services sector (i.e. the inclusion of both market and non-market activities):

> "Services are not separate entities over which ownership rights can be established. They cannot be traded separately from their production. Services are heterogeneous outputs produced to order and typically consist of changes in the conditions of the consuming units realized by the activities of producers at the demand of the consumers. By the time their production is completed they must have been provided to the consumers (…). The service sector covers both market and non-market services." (European Commission *et al* 1993, paras. 6.8-6.9)

Services sector

While services can be defined as above, activities included in the services sector vary with the classification used. NACE and ISIC present the 1993 SNA definition for services as follows:

> NACE Rev. 1: The terms services industry(ies), services sector(s) or simply service(s) are generally used to refer to economic activities covered by Sections G to K and M to O of NACE Rev. 1, and the units that carry out those activities.
>
> ISIC Rev. 3: In terms of International Standard Industrial Classification (ISIC) Rev. 3 services are defined loosely in terms of the following Tabulation Categories:

- wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods (G);
- hotels and restaurants (H);
- transport, storage and communications (I);
- financial intermediation (J);
- real estate, renting and business activities (K);
- public administration and defence, compulsory social security (L);

- education (M);
- health and social work (N);
- other community, social and personal activities (O);
- private households with employed persons (P).

Note that NACE Rev. 1 does not provide a definition for the Services sector on the basis of ISIC Rev. 3.1. However, given the similarities between NACE and ISIC, the Services sector should be identical. Thus, this Manual recommends that the boundaries of the Services sector be defined to include ISIC Codes from G to P[3].

3.1.2 Market and Non-market services

Market establishments

There are only slight variations between the 1993 SNA and the ESA 1995 accounting standards in their definitions for "market producers", "market output", and "market services". However, there is no difference for "market establishment" concept whose SNA definition is:

> "Market establishments produce mostly goods and services for sale at prices which are economically significant." (European Commission *et al* 1993, para. 2.46)

Market and non-market producers

ESA 1995 provides two relevant definitions, one for "market producers", the other for "market/non-market producers". A similar related definition is provided in the 1993 SNA. The difference between the two standards is that ESA 1995 provides a more operational definition for market producers. This difference is clearly stated under "market/non-market producers" for ESA 95[4], which is therefore preferable:

> ESA 1995 (market/non-market producers): Market producers are producers that sell their output at economically significant prices. Non-market producers are producers that provide most of their output to others free or at prices that are not economically significant. Moreover, the ESA95 provides additional rules for the distinction between market and non-market producers. In distinguishing market and other non-market producers by means of the 50% criterion, "sales" and "production costs" are defined as detailed in the corresponding CODED definitions. (Eurostat 2002)

[3] It should also be noted that the three main industry classifications (ISIC, NACE, and NAICS) do not always clearly identify each industry class as either a goods-producing or a services-producing industry.

[4] Similar definitions can be found in the 1993 SNA (European Commission et al 1993, para. 4.58 [6.52]) and 4.60 [6.52]]

Market output

Both the 1993 SNA and ESA 1995 present definitions for market output. More precision, however, is given in ESA 1995 compared to the 1993 SNA with regard to the definition of "market output". Thus, the ESA 1995 definition is preferable.

> ESA 1995: Market output consists of output that is disposed of on the market or intended to be disposed of on the market. Market output includes:
>
> - products sold at economically significant prices;
> - products bartered;
> - products used for payments in kind (including compensation of employees in kind and mixed income in kind);
> - products supplied by one local KAU to another within the same institutional unit to be used as intermediate inputs or for final uses;
> - products added to the inventories of finished goods and work-in-progress intended for one or other of the above uses (including natural growth of animal and vegetable products and uncompleted structures for which the buyer is unknown). (European Commission – Eurostat 1995, paras. 3.17 and 3.18)

Economically significant prices

Similar differences can be found for the definition of "economically significant prices" between ESA 1995 and the 1993 SNA, though the definition in ESA 1995 is more precise.

> ESA 1995: In ESA, the economically significant price of a product is defined partly in relation to the institutional unit and local KAU that has produced the output (see paragraphs 3.27. - 3.40). For example, by convention, all the output of unincorporated enterprises owned by households sold to other institutional units is sold at economically significant prices, i.e. to be regarded as market output. For the output of some other institutional units, output is only sold at economically significant prices when more than 50% of the production cost is covered by sales (see paragraphs 3.32. - 3.37). (European Commission – Eurostat 1995)

Market and non-market services

Market services are generally provided by market producers and non-market services by non-market producers. Thus, for example, market services could include such services as repair services, wholesale and retail trade services, and lodging and catering services. On the other hand, non-market services comprise branches covering general public services, non-market services of education and research provided by general government and private non-profit institutions, non-market services of health provided by general government and private non-profit institutions, domestic services and other non-market services.

At present, there are no internationally agreed definitions that clearly delineate these services. This arises from the wide heterogeneity in services provision by the public sectors in different countries. For example, the major part of education and health services are generally provided by public sectors in European countries. On the other hand, in the United States the private sector is responsible for a larger portion of services provision in these areas.

Nevertheless, this Manual attempts to make distinctions between market and non-market services for the main services activities in order to facilitate the compilation of ISP only for market services, for instance. Market services should comprise all the services activities listed in Tabulation categories G to P of ISIC Rev. 3 less non-market services activities described below:

- general public services of national defence, of compulsory social security;
- non-market services of refuse disposal, sanitation, cemeteries, provided by general government;
- non-market services of social welfare, hostels, tourist offices, employers' and professional associations, economic organisations provided by general government;
- non-market services of recreational and cultural activities provided by general government (entertainment's, sports grounds and clubs, libraries, public archives, museums, botanical and zoological gardens);
- non-market services of education provided by general government and private non-profit institutions;
- non-market services of research and development provided by general government and private non-profit institutions;
- non-market services of health provided by general government and private nonprofit institutions;
- non-market services of social welfare, hostels, tourist offices, trade unions, employers' associations, religious organisations and learned societies, political parties, consumers' and civic organisations etc. provided by private non-profit institutions;
- non-market services of recreational and cultural activities (entertainments, sports grounds and clubs, libraries, public archives, museums) provided by private non-profit institutions
- domestic services.

3.1.3 Definition of ISP

Index of Services Production

As the primary aim of compiling an Index of Services Production (ISP) is to measure short-term movements in the production activity of the services part of an economy, the ISP should be defined as a weighted average of the real output of these industries, where the weights are based on their shares in the value added of the Services sector.

One can adapt the description of the Index of Industrial Production given by Hong & Chavoix-Mannato (2000) to obtain the following definition of the ISP:

> "An ISP measures changes over time in the volume of output of the Services sector. More precisely, it is defined as the ratio of the volume of output produced by the services industries in a given time period to the volume produced by the same industries in a specified base period. The products included are all those that contribute to the gross output of the services industries, and may include products that are not primary to the industries; products may either be goods or services."

It is also preferable that the ISP is presented together with its main industrial components, and is also disaggregated by market and non-market activities. However, there are slight variations between standards with regard to the definition of market and non-market activities. These differences are now examined to determine the extent to which they could affect international comparability.

Index of Market Services Production and Index of Non-Market Services Production

The fact that industrial classifications currently used do not generally distinguish between market and non-market establishments explains the use of "tailored" classifications where this distinction is made. Although the relative importance of market and non-market establishments by industry class varies between countries, market establishment production is more likely to undergo economic cycles that differ from those for non-market establishments.

It is therefore recommended that the ISP should be presented together with two sub-indexes, one for Market Services Production and the other for Non-market Services Production. This breakdown cannot be mapped precisely with current industry classifications, but is recommended for the whole economy by both the 1993 SNA and ESA 1995 national account standards.

For international comparability, there are slight differences between the two standards with regard to establishments to be considered as market or non-market. However, it is very likely that the differences between countries will be largely explained by differences in the institutional environment than by

differences in standards. In addition, for many countries the bulk of non-market activities occur in ISIC Tabulation categories M, N, L and Q.

3.2 Types and definitions of variables to measure services production

The output of services production can be measured directly from the amount of services production or indirectly from inputs that are used for the production. Although output variables are always preferable, there are many situations where information on input measures is the only readily available source. Thus, in this Section, the types and definitions of variables to measure services production will be reviewed and compared.

3.2.1 Deflated gross output

There are a number of related concepts used in the evaluation of output, which differ in terms of their component items. These concepts include "sales", "turnover", "revenue", "receipts", and "gross output". These concepts are reviewed in this Section. As the concepts are mostly expressed in value terms, they need to be deflated in the compilation process using a set of price indices so that the resulting ISP can reflect volume changes in services production during the reference period.

Output (Gross output)

As noted previously, an ISP should include the value of the output of all products of the industries covered. Since these products may include goods, changes in inventories of these goods should be part of the output for the services sector. The following definition is derived from the 1993 SNA. This states that output should be:

- sold;
- entered into the producer's inventories prior to sale, barter, etc;
- supplied to other establishments belonging to the same enterprise for use as intermediate inputs;
- retained by their owners for own final consumption or own gross fixed capital formation;
- supplied free, or sold at prices that are not economically significant to other institutional units;
- provided to their employees as compensation in kind or used for other payments in kind;
- bartered in exchange for other goods, services or assets. (European Commission *et al*, para. 6.38)

Turnover / sales

As noted in the OECD Glossary, there is currently wide variation between countries in the definition of turnover and sales. The Council Regulation on structural business statistics of the European Union provides a definition of turnover. At the same time, definitions for sales can be found in the ESA 95 manual on government deficit and debt (Eurostat 2002)**,** and *the Manual on Statistics of International Trade in Services,* (Eurostat *et al* 2002, Annex II, Glossary). As the definitions in various sources are not fully comparable in terms of the component items described, it is not obvious whether there are in fact any significant conceptual differences between the turnover and sales concepts in the international context.

At the national level, different terms may be used for different economic activities, e.g. sales for goods and turnover for services. However, it is not clear whether practical differences in data collection exist due to the availability of information or accounting practices. In addition, in some countries, e.g. Canada and the United States, the term turnover is not used at all, and the terms "sales" and "receipts" are used to refer to similar concepts.

In order to avoid the creation of any "artificial" distinction between the "turnover" and "sales" concepts at the international level which may not be reflected in reality at the national level, this Manual therefore recommends the interchangeable use of the terms for the compilation of the ISP. The following definition on turnover is derived from the definition of turnover included in the European Council Regulation on structural business statistics. Some of the detail in this definition has been expanded to provide further clarification:

> "Turnover comprises the totals invoiced by the observation unit during the reference period, and this corresponds to gross sales of goods or services supplied to third parties. Turnover includes all duties and taxes on the goods or services invoiced by the unit with the exception of VAT invoiced by the unit vis-à-vis its customer and other similar deductible taxes directly linked to turnover.
>
> It includes all other charges (shipping and handling, installation, maintenance and repair, alteration, storage, etc.) passed on to the customer, even if these charges are listed separately in the invoice. It also includes receipts from the rental of vehicles, equipment, instruments, tools, and other merchandise; commissions from the arrangement of financing; payments for work in progress; and market value of compensation received in lieu of cash. In addition, it includes gross sales from departments, concessions, and amusements and vending machines operated by others; and amounts received from work subcontracted to others.
>
> Reduction in prices, rebates and discounts as well as the value of returned packing must be deducted. Income classified as other operating income, financial income and extra-ordinary income in company

accounts is excluded from turnover. Operating subsidies received from public authorities [or the institutions of the European Union are also excluded][5]."

In addition to turnover / sales, another set of output variables are also used to collect basic information at the country level, the principal additional terms being "revenue" and "receipts". The relationship between the concepts of turnover, sales, revenue and receipts in terms of their component items are summarized in Table 4 below.

Table 4: Comparison between turnover / sales, revenue and receipts concepts

Component item	Turnover / Sales	Operating Revenue	Total Revenue	Total Receipts
Gross sales of goods	yes	yes	yes	yes
Provision of services	yes	yes	yes	yes
Shipping and handling	yes	yes	yes	yes
Installation	yes	yes	yes	yes
Maintenance and repair	yes	yes	yes	yes
Alteration	yes	yes	yes	yes
Storage	yes	yes	yes	yes
Receipts from the rental of vehicles, equipment, instruments, tools, and other merchandise	yes	yes	yes	yes
Commissions from the arrangement of financing	yes	yes	yes	yes
Payments for work in progress	yes	yes	yes	yes
Market value of compensation received in lieu of cash	yes	yes	yes	yes
Gross sales from departments, concessions, and amusement and vending machines operated by others	yes	no	no	yes
Units share of sales from departments, concessions, and amusement and vending machines operated by others	no	yes	yes	no
Amounts received from work subcontracted to others	yes	no	no	yes

[5] Note that indirect taxes can be separated into three groups:

i) The first comprises VAT and other deductible taxes directly linked to turnover which are excluded from turnover. These taxes are collected in stages by the enterprise and fully borne by the final purchaser.

ii) The second group concerns all other taxes and duties linked to products which are either: 1) linked to turnover and not deductible, or; 2) taxes on products not linked to turnover. Included here are taxes and duties on imports and taxes on the production, export, sale, transfer, leasing or delivery of goods and services or as a result of their use for own consumption or own capital formation.

iii) The third group concerns taxes and duties linked to production. These are compulsory, unrequited payments, in cash or in kind which are levied by general government, or by the institutions of the European Union, in respect of the production and importation of goods and services, the employment of labour, the ownership or use of land, buildings or other assets used in production irrespective of the quantity or the value of goods and services produced or sold. [*Source:* Definitions of SBS Regulation variables (12 11 0)]

Component item	Turnover / Sales	Operating Revenue	Total Revenue	Total Receipts
Consumption, sales, and value added taxes	no	no	no	yes
Proceeds from the sale of real estate, investments, or other assets held for resale	no	no	no	yes
Income from interest and dividends	no	no	yes	yes
Rental of real estate	no	no	yes	yes
Contribution, gifts, loans and grants	no	no	yes	yes
Reduction in prices, rebate, discounts and returned packing	no	no	no	no
All duties and taxes on the goods or services invoiced by entity	no	no	no	no
Operating subsidies received from public authorities	no	no	no	no

Note: "yes" stands for inclusion; "no" stands for exclusion. **Source: [to be inserted]**

3.2.2 Other relevant variables

Output volume indicators

Physical quantity is a typical volume indicator. It refers to the volume of quantity unit in which a service can be measured. This unit is either discrete or continuous. The quantity of services provided in discrete units is obtained simply by counting the number of units, e.g. number of haircuts, cars washed or customers to be served in a bank to obtain loans. The quantity of services provided in continuous units, on the other hand, varies continuously with respect to characteristics such as weight, volume, power, duration, distance, etc. Examples of quantity indicators are readily found in the transportation industry.

Thus, output volume indicators should be used when there is a lack of information on turnover / sales or of their price measures.

Input indicators

Employment is one of the main variable groups included in structural business statistics. It is readily available for most services sectors on a monthly (or at least quarterly) basis for most countries. Although it is related to inputs of production, it can be used as a proxy measure of production activities where no other variables for the sectors are readily available.

Employment represents the number of workers on the payroll for the pay period in question. Employment should include all corporate officials, executives, supervisory personnel, clerical workers, wage earners, pieceworkers and part-time workers. Employment should also include persons on paid sick leave, paid holiday, and paid vacation. Those on leave without pay for the payroll period should be excluded. Employment should also exclude proprietors and partners of unincorporated businesses.

The 1993 SNA state that "Hours worked are the aggregate numbers of hours actually worked during the period in employee and self-employment jobs (SNA 15.102)." Thus, use of hours worked is recommended when no other indicators are readily available.

Other variables

The compilation of an ISP requires a great deal of information from a variety of sectors at different levels of activity disaggregations. At the same time, a number of composite or synthetic indicators exist for specific individual services sub-sectors to measure those activities. It is therefore recommended to use pre-existing information as long as they are comparable or consistent with recommended variables presented in Section 4 below, until a country is in a position to develop all the necessary statistics that are required to compile a more reliable (i.e. methodologically acceptable) ISP. For example, retail trade and wholesale trade indices can be used directly as components to form an overall ISP with proper weights.

Section 4: SOURCES AND METHODS FOR COMPILING AN ISP

This Section presents data sources and methods which, if adopted, would optimise the comparability of the Index of Services Production (ISP) within and outside the OECD area. The discussion recognises the challenges of measuring short-term change in the services sector, and national constraints with respect to data availability, etc..

The Section describes the approach of classifying variables as "preferred" (representing best practice), "alternative", and "other". The Section also discusses a framework and criteria to assess the quality of the variables to be used. For example, a variable that is regarded as best practice conceptually may not be sufficiently timely, or it may not be sufficiently accurate. In this case it would be preferable to use another variable that scores more highly against other assessment criteria in an overall evaluation of suitability for use in compiling a monthly ISP.

The Section concludes with the presentation of a set of preferred, alternative and other variables for each ISIC Rev. 3 category along with their deflators and sources, based on the recommended terminologies and definitions identified in Sections 2 and 3 above.

Because of the very heterogeneous nature of the services sector, the compilation of a monthly aggregated production index for this sector is far less straightforward than for the industrial sector. As a consequence, a wide range of practices are currently being used by OECD Member countries to evaluate the economic performances of the services sector, depending on national needs and the availability of basic information. For example, Japan compiles a monthly index for tertiary industry. Canada does not publish a separate index for a services industry but instead compiles a monthly GDP by economic activities which can be regrouped into a production index for services industry. Many European countries, on the other hand, collect monthly or quarterly information on production for various services sectors but do not aggregate them into a single index.

A major difficulty encountered in the services sector by data compilers is the non-availability of a single type of variable or source from which various services production activities can be measured. Only output measures in current prices may be available without an appropriate deflator. Also, statistical information at lower frequencies (e.g. annual or quarterly) may be available but nothing for higher frequency (i.e. monthly). Collecting basic information for a monthly index implies additional reporting burden and compilation resources. Furthermore, due to the 'non-material nature' of many service outputs, there are some services categories for which the choice of the most appropriate variable to measure their evolution may not be obvious (e.g. the financial sector) and as a consequence the choice adopted can vary across countries. As a result, there are considerable differences in approaches to the measurement of short-term services production between OECD countries.

4.1 Description of “Preferred”, “Alternative” and “Other” methods for compiling an ISP

If just one "recommended variable" for each ISIC category, representing the best approach conceptually, were to be presented in this Manual the result could be a set of recommendations relating to data that many countries would not have available and would not have the resources to collect. On the other hand, if the recommended variables were those that are easiest to collect, there could be some compromise in quality. As the aim of this Manual is to provide support and assistance in the collection and presentation of services sector data, it presents a range of possible variables that could be used for each ISIC Rev. 3 activity. For each ISIC activity a table is described in Section 4.4.3 below, that presents three options:

- preferred data source(s);
- alternative acceptable data source(s);
- other data sources that might be used, accepting that they will produce a less precise measure.

The actual tables for each ISIC activity are presented below in Annex 2 at the end of this Manual.

The Eurostat *Handbook on price and volume measures in national accounts* (Eurostat 2001) provides guidance on compiling annual data. The broad principles from the Eurostat Handbook will be referenced to assess the conceptual appropriateness and hence whether a data source or method should be categorised as "preferred", alternative" or "other". Although some of the recommendations are not practical for monthly or quarterly data, much of the Handbook's text on compiling output is relevant.

In addition to providing suggested sources and methods, this Section outlines quality measures for assessing the appropriateness of suggested data sources as proxies for short-term change in gross value added (GVA).

The preferred approach presents the data sources and methods that are considered to be most appropriate conceptually as a short-term indicator. However, they are only suitable if the data sources also meet the general conditions for short-term indicators (as outlined below in Section 4.2). If this preferred data source is not available, or does not meet the general conditions, the use of alternative data sources should be considered. The 'other data sources' column presents alternative data sources that produce a less precise measure but, in the absence of other data sources, could reasonably be used to compile a monthly ISP at least until a preferred (or even an “alternative”) data source becomes available.

4.2. Evaluation of the suitability of data sources and methods

This Section describes issues that should be considered in evaluating the suitability of data sources used in the compilation of an ISP. The issues discussed are consistent with the dimensions of quality outlined below in Section 5.3.4 in the discussion on the overall quality assessment of ISPs. Overall assessment includes issues relating not only to input variables but also the index compilation issues described in Section 5 below.

The six issues relevant to an assessment of the suitability of input variables focus specifically on the requirements for short-term indicators. Such an assessment uses a subjective approach rather than a quantitative evaluation. The statistician or "industry expert" may wish to use a simple scoring system to assess a data source/method, assigning marks 1 to 5 for each of the following six issues.

Coverage: An indicator that estimates short-term change in value-added should cover, in some representative fashion, the full range of businesses or other types of organisations or activity that are included within the industry or sector category in question. A proxy or indicator should ideally relate exactly to the relevant part of the ISIC. Nevertheless, at times indicators can be used where this match is not exact; for instance if an indicator is only available which covers more than the industry in question, the indicator might still be used, as a necessary compromise.

Timeliness: As the purpose is to estimate short-term change in GVA of the services sector, a short-term proxy or indicator is required to be made available quickly - delivering early estimates, say, within a month or two from the end of the period to which they relate. Punctuality is closely related to timeliness. Data sources should be made available in accordance with any agreed delivery dates.

Periodicity/frequency: To reflect monthly (or quarterly) GVA, an indicator should ideally consist of independent monthly (or quarterly) observations. A quarterly indicator interpolated to provide monthly data is less suitable but may be acceptable if the series is not volatile or indeed if the intention is to produce a quarterly ISP.

Accuracy: The level of accuracy of the indicator itself should be acceptable. Accuracy can be assessed in terms of 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 an estimated result and the (unknown) true value. It is preferable to calculate sampling errors but if this is not possible a more subjective assessment might be that the variability of the series of observations should not be considered to be so great as to obscure the path or rate of change of the indicator series.

Relevance: As the purpose is to measure short-term change in services GVA, an indicator should be designed to do that; rather than, for instance, being designed to measure the level of the indicator at a point in time. That is, the indicator should measure changes in output (or GVA) rather than some other variable or concept. It is impracticable to collect timely monthly data for intermediate consumption, so generally it will be necessary to assume that the GVA to output ratio is constant in the short-term. Series can be benchmarked to quarterly or annual GVA data to reduce the possibility of long-term bias.

Consistency: The same indicator should be used throughout the entire time series. If there are definitional changes, adjustments should be applied to ensure consistency and to enable comparison over time and between countries, etc.

The information box below provides an example of a system of subjective assessment used by Statistics Canada.

Framework for the subjective assessment of the quality of monthly GDP: An example from Statistics Canada

This example provides a brief summary of Statistics Canada's assessment of the quality of monthly GDP.

This particular assessment was carried out in 2004 and was restricted to two dimensions of quality: (i) a subjective assessment of the quality of the indicators used to track the monthly growth rates of value added (GDP) for each industry; (ii) an analysis of the revisions to the growth rates of GDP for each industry.

This example summarises the subjective assessment of quality: an assessment of accuracy. Accuracy refers to the property of an estimate to match the true but unknown value of the characteristic of interest, whereas reliability refers to the stability of the estimate. Clearly, revision analysis is the appropriate tool to study, and quantify, the reliability of the monthly GDP estimates. Their accuracy however cannot be quantified objectively; only a subjective assessment based on professional opinion can be undertaken. Statistics Canada produces a list of criteria by which each analyst can subjectively rate the accuracy of the indicators used for their industries. The list of categories is broadly similar to the quality measures described in Section 4.2 of this Manual. With a common understanding of these criteria, the assessments become consistent across analysts, and can be summarized to assess the accuracy of industry aggregates.

Each analyst rates her/his indicators according to each of the criteria described in the list on an absolute scale of **1 (worst)** to **5 (best**). A score of 5 should be used to indicate that there is absolutely no other indicator, existing or achievable, that would outperform the one currently used with respect to a particular criterion. A score of 1 should be used to indicate that the current indicator is inappropriate **for a particular criterion** and that a replacement indicator could be found. (Note that the overall appropriateness of a set of indicators for a particular industry reflects

a compromise between the various criteria. Hence, it is not anticipated having any indicator scoring 1 or 5 on all criteria.). For the accuracy assessment, where coefficients of variation (CV) are available, the following grading system is suggested:

CV	Grade
< 3%	5
3-4.9%	4
5-9.9%	3
10-14.9%	2
15% +	1

Statistics Canada compiles an overall weighting for each industry giving more weight to some quality measures than others. An overall rating for GVA is calculated by aggregating the marks for the individual industries using the latest weighting structure for these industries.

4.3 Criteria for conceptual appropriateness

Section 4.2 above describes the parameters of quality that help to identify the strengths and weaknesses behind a set of proxy indicators. This Section sets out criteria for the conceptual appropriateness of proxy indicators. These criteria are based on the criteria set out in the Eurostat *Handbook on price and volume measures in national accounts*. However, the Eurostat price and volume Handbook was developed as a best practice guide for compiling annual indicators. Therefore, while many of the principles are relevant, monthly data are not expected to have the same degree of conceptual appropriateness. For example, when compiling a monthly or quarterly estimate of services it is not practical to collect information on intermediate consumption.

When estimating gross value added using turnover / sales information (estimating the outputs), it will usually be necessary to assume that in the short-term the movement in output is a reasonable indicator of movement in gross value added (i.e. that the ratio of GVA to output is constant in the short-term). Where it is appropriate to assume a constant net to gross ratio in the short-term the index should, ideally, be benchmarked to quarterly or annual estimates of constant price GVA, for example, as derived from Supply Use tables, where available.

The Eurostat *Handbook on price and volume measures in national accounts* classifies output indicators into three categories: A, B and C; with C category indicators being considered as undesirable. These three categories relate solely to conceptual appropriateness, they do not address the aspects of quality presented in Section 4.2 above. An output indicator should measure change, which is related to some kind of change in gross value added or output. Eurostat now favours gross constant price output indicators, principally deflated turnover, as the best type of proxy for short-term change in constant price value-added.

Appropriately deflated turnover would be classified as an “A method”. Turnover deflated by a less appropriate deflator (e.g. with wider industry coverage) would be classified as a “B method”. Generally the Eurostat Handbook classifies volume measures as B methods. However, if there is a detailed breakdown by type of commodity ensuring reasonable homogeneity, and there is very little change in quality, a volume indicator could be classified as an A method. 'Input' indicators are classified as C category indicators by Eurostat, because they do not adequately detect changes in productivity; employment is an example.

The Eurostat *Handbook on price and volume measures in national accounts* aspires to an "A method" for each industry category regardless of whether it is practical to achieve it. It presents a theoretical best for each industry. However, the current Manual presents preferred measures that are achievable. Consequently, some of the preferred data sources presented here would be considered to be a "B method" by the Eurostat Handbook. Section 4.4.1 below presents the guidelines that have been used to compile the table of recommended variables discussed in Section 4.4.2 and presented in Annex 2.

4.4 Recommendations for variables and deflators by services activity

4.4.1 Proposed criteria for deciding conceptually appropriate indicators

This Section outlines how the principles explained in Section 4.3 above are used to categorise methods of deflation as:

- preferred;
- alternative; and
- other.

Turnover / sales deflated by an appropriate output price index

Turnover / sales deflated by an appropriate output price index is considered by the Eurostat Handbook to be an "A method" and will usually be the first choice for a preferred data source. The price index used should be representative of the particular ISIC industrial classification activity being deflated.

In practice, many national statistical organisations will, on occasion, need to combine price indexes from different sources in order to develop a representative output price index for use as a deflator. If a combination of price indices is used, then ideally these price indices should be weighted together, at a detailed level, using data related to production values. The most ideal source of such data for weighting purposes would come from national accounts input-output or supply and use tables which identify the destination of industry production (output) to business use (i.e. intermediate consumption), household

consumption, government consumption (including non-profit institutes serving household) and export. Other sources of this information may come from past structural surveys of the industry or from industry associations[6].

It is important to note that the aim of compiling such a hybrid index is to deflate services industry output, and as such must be constructed using data on the same pricing basis (i.e. basic prices). For example, if components of a consumer price index adjusted to basic prices are used in conjunction with a services industry producer price index (SPPI) they will need to be weighted together using turnover data for the different components. In addition, potential classification difficulties may arise when using a component of a CPI index (usually classified according to purpose of product) to represent output from a particular industry.

It is likely that in most countries SPPIs will be produced as quarterly indicators. For compilation of a monthly ISP it may be appropriate to use these by extrapolating the series and interpolating a monthly path, provided the indices are relatively stable (see Section 5 for further information on interpolating methods that could be applied).

Where turnover / sales is deflated by an appropriate output price index, this will be classified as a "preferred" method. The ideal situation is where an SPPI covering the output of the entire industry exists. This will often be satisfied where an industries' output is consumed almost entirely as intermediate consumption, government consumption or export which are included within the scope of most countries SPPI. Examples of such industries are freight transport, market research, business management consultancy, engineering, advertising etc.

Where a significant portion of an industries' output is consumed by households and this is not covered within the scope of an existing SPPI for the industry, then construction of a hybrid output index using components of the CPI as described above is also regarded as a preferred method (e.g. this may be required in some countries for telecommunication services). Where an industries' output is consumed almost entirely by the household sector then use of appropriately adjusted components (i.e. adjusted to basic prices and combined using production value weights) of the CPI is considered a preferred method (e.g. personal services).

Deflating output (turnover) by a less appropriate, but satisfactory, price index would be classified as an "alternative indicator." The price index might be less appropriate because its scope and/or coverage does not relate directly to the output being deflated, or because it is not adjusted for known changes in quality.

[6] Such 'industry associations' exist for most service industries in most countries. Their members are those who own businesses in the relevant industry. These associations often have a reasonable understanding of the likely split of output for the industry between various end users (e.g. businesses and households). Advice from these associations is generally sought when establishing a services producer price index (SPPI) for the industry.

Examples might include the use of a SPPI for another industry where price change is expected to be similar. Under other circumstances an industrial producer price indices (PPI) may be used where a SPPI is not available (e.g. to deflate wholesaling). If the deflator is less satisfactory, e.g. the total CPI or total PPI, the approach would be classified as "other."

Volume indicator

Deflated turnover / sales is presented as the preferred indicator, where practical. Where it is difficult to use deflated turnover, a volume indicator is presented, either as an alternative "preferred indicator" or as the sole "preferred indicator". Volume indicators can be useful where it is difficult to measure price changes due to a lack of available data or the complexity of the data source. For example, in the case of air transport it is difficult to measure price changes so a measure of the volume of air passenger kilometres may be more practical, although it is important to categorise such a measure into business travel, economy travel, etc.

Where deflated turnover is considered practical as a preferred indicator, an appropriate and representative volume indicator for well-defined products not subject to rapid quality change is presented as an "alternative indicator". It is important that these volume indicators are applied in sufficient detail that the products are relatively homogenous. If a volume indicator cannot be broken down into relatively homogenous groups, it should be classified as an "other" indicator.

Input indicator

Although it is preferable for the ISP to be compiled from output variables, use of a list of inputs to production, e.g. employment, can also be recommended as alternative variables under certain circumstances for some services sectors. The consideration of input variables arises due to the fact that output measures for several sectors may not be readily available, especially in the short-term, as many national statistical agencies may not be in the position to undertake new surveys to collect all the necessary data. Where changes in input and output are proportional to each other or input data are supplemented by other estimates (i.e. productivity adjustments), use of input variables instead of output figures may produce reliable estimates. However, if the assumption of input and output proportionality is not likely to hold or adjustments for productivity[7] are not made, use of input variables should be avoided where possible.

[7] Generally, a rise in productivity means that a larger volume of services can be produced with a given input. The change in volume may be a consequence of a change in the quantity or quality of the services. Alternatively, a rise in productivity means that output prices fall even though input prices remain unchanged [see OECD/Eurostat SPPI guide (OECD and Eurostat 2005) and the OECD Manual on Productivity (OECD 2001) for further discussion and methods that can be employed to reflect changes in productivity].

Therefore, with the exception of non-market collective services, input indicators are generally classified as "other". For the case of non-market collective services, input indicators are classified as "preferred" or "alternative".[8]

4.4.2 Deflation

Why remove prices? The concept of deflation

The ISP is defined as a weighted average of the real output of services industries, where the weights are based on their shares in the value added of the services sector. The ISP is intended to measure changes over time in the volume of output of the services sector; it should not reflect any change in price. Users of an ISP are interested in how the volume of output of the services sector has changed over a period of time. Comparison will be made with the percentage change in output (volume) over other periods of time and, possibly, with change in the volume of services sector output in other countries. The rate of change in price will be different at different periods of time and in different countries. Therefore, it is important to remove changes in price to allow a realistic comparison of change in output.

Deflation is a process that removes the impact of price changes from an estimate of nominal value or 'current price' output (e.g. turnover). This is normally performed by dividing the current price estimate of output by a price index, referred to as the *deflator*. The deflator, if chosen with care, will give a good approximation of the price movements that have affected the current price series and allow for the calculation of an accurate constant price series (i.e. a volume index). For many industries, the preferred approach to measuring real output (i.e. output at constant prices) for the ISP is deflated turnover, using a representative price index.

Services Industry Producer Price Indexes (SPPIs)

The OECD/Eurostat *Methodological Guide for Developing Producer Price Indices for Services* (OECD/Eurostat SPPI guide) recommends that the coverage of the SPPI should include all domestic output from the relevant industries. The coverage of *all* output means that the SPPI should comprise prices in the provision of services to all institutional sectors, financial and non-financial corporations, government units, non-profit institutions serving households (NPISH), households and the rest of the world. However, services provided for different markets are not necessarily the same, and their price development can be different. Sub-division of a SPPI by destination of output can therefore be desirable and would enhance its use, particularly for purposes of deflation in national accounts.

[8] For further discussion on this issue, see the Eurostat Price and Volume Handbook (OECD 2001).

It is noteworthy that the scope of the SPPI as defined in the OECD/Eurostat SPPI guide is wider than the provision of goods and services from business to business, and this is not universally adopted by all national statistical agencies that produce SPPI. The OECD/Eurostat SPPI guide explicitly recognises this issue where it states:

> "The present guide has adopted as a principle that the scope of SPPI should cover all types of users, even though the empirical focus is on those SPPI where deliveries to businesses play an important role. Nonetheless, there is an overlap between SPPI and CPIs when it comes to the pricing of services delivered to households.
>
> There is no general rule for how the compilation of SPPI vis-à-vis CPIs is best organised. The situation varies between service products, and data sources may also differ between countries. It may be possible to use CPI information to obtain prices for household end users, and in this case the data collection for the SPPI would be reduced to business-to-business and export if significant. Note, however, that the price concept underlying the CPI is not the same as the concept underlying the SPPI. There may be other cases, where the service output and its prices for different end-users are very similar or cannot be separated in practice (e.g., economy-fare air travel), in which case it may be easier to cover service output prices to all end users in a single estimation.
>
> Statistics by end use, like supply and use tables, are the appropriate tool to identify the relative importance of groups of purchasers (export, intermediate consumption, households) of the output of an industry." (OECD and Eurostat 2005, Section 1.10)

The current ISP Manual therefore proposes a pragmatic approach depending on the industry being deflated and the data sources available within a country when defining preferred, alternative and other measures for deflators. Preferred measures can therefore include deflation using a composite index compiled by weighting together an SPPI which measures price change for business to business transactions (notionally including in its scope services provided for export and use in government or NPISH consumption) and a CPI which measures price change of business to household transactions.

In practice, most countries establish individual SPPIs at the 4-digit industry level. Price movements for products primary to the industry are surveyed within businesses and aggregated to form these 4-digit industry level indexes. This implies that price changes for products not primary to the industry (i.e. secondary production) will not generally be covered, although their value would be recorded in current price (i.e. turnover) estimates for an industry. This generally does not present a problem because for most service industries secondary production tends to be small[9].

[9] The OECD/Eurostat SPPI guide does note some exceptions, such as for the management consultancy and computer services industries. This may imply that more care is needed in choosing appropriate deflators for current price data. For example other SPPI which could be expected to adequately represent price change for the secondary products produced within the industry may be required to be given some weight in a composite deflator.

Quality change: included as volume change rather than price change[10]

As it is important for quality and quantity changes to be taken into account, the current price output (turnover) data should preferably be deflated by an appropriate and representative output price index that takes account of quality change.

The 1993 SNA, in general, treats differences in quality as differences in volume; different qualities reflect different use values (and in the case of goods and services, different resource costs). Different qualities are, therefore, economically different from each other (European Commission *et al* 1993, para. 12.20).

The expression "different qualities" is used to cover sets of goods or services whose characteristics are sufficiently different to make them distinguishable from each other from an economic point of view but which are sufficiently similar to each other to be described by the same generic term, such as potato, computer, or transportation (European Commission *et al*, 1993, para. 16.106).

Thus in the compilation of the ISP, it is essential that changes in quality of the services produced flow through as changes to the index. Therefore, any price index used in the production of the ISP must *price to constant quality*. Such pricing is an ongoing challenge for compilers of both SPPI and CPIs but nonetheless an important aspect to which considerable attention is given in most countries in the compilation of these price indices.

Application of deflators

Level of deflation

It is recommended that the indicators of current price output are deflated at the ISIC 4-digit level for the ISP as output price indexes at this level provide sufficient detail. As noted above, many countries produce 4-digit industry SPPIs so this recommendation should be in line with the level of data availability in most countries. Again, in the case where a component of the CPI is used, some correspondence needs to be made between the use of the product classification in the CPI and the industry of origin classification required for the deflator.

For this to be achieved the CPI and SPPI should be available at this level of detail. If deflators are not available in sufficient detail to deflate at the 4-digit level, the current price series could be deflated at the ISIC 3-digit level instead.

[10] For more information on this topic, see SNA93 16.105 – 16.117.

Examples of the application of deflators

The table in Annex 1 below describes an assessment by the United Kingdom Office for National Statistics (ONS) of where CPIs are appropriate and where SPPIs are appropriate, by ISIC category, for deflating current price series within an ISP.

The table provides a detailed list of recommended variables for compiling an ISP, including sources for deflating current price data. The first column lists the preferred variables. The other two columns provide alternative and other variables that could be used if the preferred source is not available. For deflation within many industry groups a 'more general' PPI is presented as an alternative. A more general indicator might be an SPPI that has wider or different industry coverage than the ISIC industry group of the current price series that is to be deflated. For some industry groups the use of a 'more general' SPPI might involve using an ISIC division level SPPI. The definition and appropriateness of a 'more general' PPI is contextual and its appropriateness must be considered within the context of the industry group being deflated.

Periodicity

If the ISP is being compiled as a monthly index, monthly price indices will be needed. If the SPPI (or CPI) is only available quarterly it will be necessary to interpolate a monthly path. In fact, the monthly path can be created from a quarterly series using a variety of methodological procedures (see Section 5 for further discussion).

Guidelines on compiling the CPI and SPPI

The OECD / Eurostat *Methodological Guide for Developing Producer Price Indices for services* provides guidance on constructing SPPIs. The Guide sets out three options for SPPIs which can be based on industries, products or both. The Guide recommends sample frames for each of these. The Guide also gives an overview of pricing methods including:

- direct use of prices of repeated services;
- component pricing;
- unit value method;
- model pricing;
- percentage fee method; and;
- pricing based on working time (e.g. charge-out rates).

Each of these pricing methods is clearly defined in the Guide, with an explanation under which circumstances each can be applied. The Guide provides advice on each stage in the process of developing a SPPI, covering issues such as sampling frames, service identification, pilot surveys, treatment of quality

change, index formula, weights and aggregation, and quality assessment.

The OECD / Eurostat *Methodological Guide for Developing Producer Price Indices for services* (OECD and Eurostat 2005) is available at **[a link to be inserted**]. Advice on compiling Consumer Price Indices is provided in the *Consumer Price Index Manual: Theory and Practice* (ILO 2004) at **[a link to be inserted].**

4.4.3 Recommended variables and deflators and their sources

In this Section, a list of recommended variables and deflators are presented, along with their sources for all services activities as defined in Section 2, i.e. Tabulation categories G through P of ISIC Rev. 3. As already mentioned in the previous Section, a set of preferred, alternative and other methods are proposed for 4-digit ISIC levels of each 2-digit ISIC group. Thus, twenty-seven tables cover all twenty-five services industries defined in ISIC Rev. 3 and two additional groups which are undifferentiated goods-producing activities of private households for own use (NACE code 96) and undifferentiated services-producing activities of private households for own use (NACE code 97). A list of services industries covered in the tables is presented below:

- Code 50: Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel;
- Code 51: Wholesale trade and commission trade, except of motor vehicles and motorcycles;
- Code 52: Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods;
- Code 55: Hotels and Restaurants;
- Code 60: Land transport; transport via pipelines;
- Code 61: Water transport;
- Code 62: Air transport;
- Code 63: Supporting and auxiliary activities; activities of travel agencies;
- Code 64: Post and telecommunications;
- Code 65: Financial intermediation, except insurance and pension funding;
- Code 66: Insurance and pension funding, except compulsory social security;
- Code 67: Activities auxiliary to financial intermediation;
- Code 70: Real estate activities;
- Code 71: Renting of machinery and equipment without operator and of personal and household goods;
- Code 72: Computer and related activities;
- Code 73: Research and development;
- Code 74: Other business activities;
- Code 75: Public administration and defence; compulsory social security;
- Code 80: Education;

- Code 85: Health and social work;
- Code 90: Sewage and refuse disposal, sanitation and similar activities;
- Code 91: Activities of membership organisations not elsewhere classified;
- Code 92: Recreational, cultural and sporting activities;
- Code 93: Other service activities;
- Code 95: Activities of private households as employers of domestic staff;
- Code 96: Undifferentiated goods-producing activities of private households for own use; and
- Code 97: Undifferentiated service-producing activities of private households for own use.

There are two parts in each presentation at the Division level (two-digit ISIC group): a general comment and a table. The general comment describes the types of services activities included and excluded in the corresponding Division, the desirable method for measuring gross value added, definitions of turnover data, and types of preferred deflators. The table presents explanatory notes and descriptions for each 4-digit ISIC class and preferred, alternative and other methods to measure the economic activities of each ISIC class.

It should be emphasised that the selection of the recommended variables and their deflators are made based mainly on current UK practices supplemented by information from Canada and Korea. As the aim of this Manual is to be as practical as possible, any methods that are theoretically optimal but practically less plausible have not been included in the tables. It is, however, worth noting that the contents of the tables are subject to change in the future, if better methods, sources, etc., are developed and employed.

This Manual does not explicitly propose a (group of) preferred source(s) of statistical information to be used to compile the ISP, as the statistical environment of OECD countries varies widely. The data can be collected from already existing surveys or from new surveys. At the same time, extensive use of administrative sources is highly recommended to minimise concerns arising from budgetary constraints.

[The actual tables, which are in Annex 2 in the current version, will be presented here for the final version of the Manual]

Section 5: INDEX COMPILATION

This Section deals with practical issues that can be encountered during the actual ISP compilation process. These can be grouped into three categories: types of indices: transformation of input data; and, issues emerging at the stage of consolidation.

A range of index methods are currently employed by national statistical agencies for various types of economic time series. Although the Laspeyres index and Paasche index are the most commonly used forms, the Fisher index is also used by several OECD Member countries despite its technical difficulties and resource intensity. To enhance the comparability of economic analysis on the services sector across the OECD area, it is important for national ISPs to be compiled according to comparable indexing method(s). Practical advantages and disadvantages, especially with regard to measuring short-term movements, of various indexing methods will be examined in order to identify a set of preferred types of indices to be used for ISP compilation.

It is often observed that not all input variables are ready or fully suitable to be integrated into an ISP or its sub-groups. Differences in measurement, data in raw or other forms and with adjustments, breaks in a series, or missing data are typical examples of unexpected values and heterogeneities often encountered during ISP compilation. In order to cope with these problems, a range of solutions are currently being adopted by national statistical agencies, depending upon their statistical environment and resource availability. As different options may produce different results which could hamper the comparability of ISPs across the OECD area, this Section also suggests a set of viable methods for transformations to input data that can be applied to aid the compilation of a monthly or quarterly ISP.

At the same time, compilers are often required to consider other issues at the consolidation stage in order to ensure overall quality of the ISP itself or with other related statistical information. This Section therefore also presents issues concerning weighting, comparability with national accounts and overall quality of short-term ISPs.

5.1 Types of indices

As discussed in Section 4 above, variables used as inputs for ISP compilation may be very different in nature, e.g. in monetary value, index or unit of quantity. Harmonisation of their heterogeneous aspects is a prerequisite before they can be aggregated into an index. The most widely recognised means of harmonisation involves the transformation of all the input variables into indices. In fact, a volume index is most appropriate as it is free from inflationary effects. Thus, all nominal data will have to be deflated before indexing according to the recommended procedures described in Section 4. Deflated data in monetary values and other data in units of quantity will then have to be indexed before further processing.

Theoretical and practical aspects of various indices are reviewed in this Section. Based on their advantages and disadvantages, this Manual recommends the preferred index types for the ISP compilation. Discussions in this Section are based on several national and international sources such as the UK Office for National Statistics *Methodology of the experimental monthly index of services* (Fenton and Pike 2001) the *1993 SNA*, and the Eurostat *Handbook on Price and Volume Measures in National Accounts*.

The choice of a particular index type should be guided by the criteria that a monthly or quarterly ISP has to meet. A list of frequently discussed requirements for indices is described in Table 5 below.

Table 5: A list of criteria and their definitions

Criteria	Definition
Symmetry	The index formula assigns equal weight to the two situations being compared; i.e. the situation during the current period and the situation during the base period.
Time reversal	The index for a period *t* using period *0* as base is the reciprocal of the index for the period *0* using the period *t* as base.
Factor reversal	Multiplying a price index and a volume index of the same type is equal to the proportionate change in the current values (SNA 1993, para. 16.24).
Additivity	According to the 1993 SNA (para. 16.55), "Additivity is a property pertaining to a set of interdependent index numbers related by definition or by accounting constraints under which an aggregate is defined as the sum of its components; additivity requires this identity to be preserved when the values of both an aggregate and its components in some base period are extrapolated over time using a set of volume index numbers".
Identity	If the volumes in the base and reporting periods are identical, then the index does not show any change.
Monotony	On the assumption of two similarly defined ISPs, during the base period, the input volume indices are equal. If, during the reporting period, the volume index for just one economic sector is higher (lower) for the first ISP than for the second, the first ISP is higher (lower) than the second.
Linear homogeneity in the volumes	When all the volumes in the reporting period are multiplied by a standard factor x, the ISP shows x-times higher value.
Homogeneity of degree zero in prices	The ISP depends only on the price structure, not the absolute level of prices.
"Real" volume comparison	Changes to the index result only from a change in volumes (and not from a change in

over any period	weights).
Up-to-date weighting structure[11]	The index formula ensures that the weighting structure is up-to-date, not out of date.
Interpretability for users and cost of maintenance	Represent the more practical issues to be taken into consideration.
Timeliness	The speed of dissemination of the data is reasonable, i.e., the lapse of time between the end of a reference period (or a reference date) and dissemination of the data.

5.1.1 Laspeyres, Paasche and Fisher indices

The three main types of indices widely used internationally to aggregate economic quantities for various periods are the Laspeyres, Paasche and Fisher. For the Laspeyres index the weights of some earlier base period are used. For the Paasche index, the weights of the most recent period are used. Finally, the Fisher index is defined as the geometric mean of the Laspeyres and Paasche indices.

For a fixed base year *0* and time *t*, a Laspeyres-type index can be expressed mathematically as follows:

$$L_t = \sum_i (w_{i,0} \frac{C_{i,t}}{C_{i,0}}) * 100$$

where $w_{i,0}$: relative share of value added of sector i at time 0

$C_{i,0}$: volume index for sector i at time 0

$C_{i,t}$: volume index for sector i at time t

A Paasche-type series can be written as:

$$P_t = \frac{1}{\sum_i (w_{i,t} \frac{C_{i,0}}{C_{i,t}})} * 100$$

where $w_{i,t}$: relative share of value added of sector *i* at time *t*

$C_{i,0}$: volume index for sector *i* at time *0*

$C_{i,t}$: volume index for sector *i* at time *t*

[11] Weights should reflect relative prices and shares of the intermediate consumption on the output.

A Fisher-type series is obtained for each period by taking a geometric mean of the values for the same period in the Laspeyres-type index and Paasche-type index. Thus, it is expressed mathematically as follows:

$$F_t = [L_t \; P_t]^{1/2}$$

Comparisons of indices

In addition to the index types described above, other index types exist which largely depend on the weighting reference period used. For a detailed discussion on index types and their theoretical properties, the reader is referred to the *International Producer Price Index Manual*, Chapter 15 (IMF, 2004). When changing the base year and index weights, one option is to recompile values for all periods using the weights from a new base year. In this case, the entire historical series will be revised as the weights for the whole series are expressed in terms of the economic situation in the new base year. This type of index is referred to as a fixed-weight index.

Strictly speaking, a fixed weight Laspeyres index would never have its weights updated, as by definition they must relate to the starting point of the time series which therefore becomes less and less relevant the longer the length of the time series. In practice, fixed weight indices are neither Laspeyres nor Paasche because the weighting reference period generally refers to some point within the time series assigned by a pre-determined weight updating strategy. For example, weights might be updated for a fixed weight index every 5 years based on data from censuses or structural surveys generally available with a considerable lag.

When changing the base year and index weights, the index time series should not be revised for its entire history – as is the case for fixed weight indices. It is therefore necessary that discrete intervals (e.g. 1 year, 5 years) of the component indexes are aggregated by using weights derived from the economic situations for periods near to these intervals. To achieve this, each time the weights and base year for the index are updated, data are only compiled with the new weights for periods close to the reference period for these weights, and the series is then linked to the historical portion. This is called a chain-linked index, as it is compiled for a succession of different segments while keeping the original weights for each past segment fixed.

The weighting methodology for the segments will depend on the type of index used, e.g. chained Laspeyres, chained Paasche, or chained Fisher[12]. For example in the case of a 5 year chained Laspeyres

[12] Other chain-linked indexes can be considered where the weights refer to some mid point of the index segment to which they are applied. For example, if a new base year of 2005 was introduced, an index could be calculated with the new weights back until 2003, and then be linked to the segment from 1998 – 2002 based on weights from 2000 and so on. Such an index is called a 'midyear index', belonging to the class of 'Lowe' indexes (IMF PPI manual, 2004)

index with a time series starting in 1990, the portion of the index from 1990 – 1994 would be compiled using weights from 1990; linked to the portion of the index from 1995 – 1999 compiled using weights from 1995; linked to the portion of the index from 2000 onwards compiled using weights from 2000 (assuming that weights relevant to the year 2005 were not yet available).

Based on the criteria presented in Table 5 above, the advantages and disadvantages of chain-linked indices for Laspeyres, Paasche and Fisher types are compared in order to identify the most suitable index type for an ISP. Table 6 below outlines the criteria that are met by the Laspeyres, Paasche and Fisher indices. An "X" in Table 6 indicates that an index possesses the corresponding property or represents that the criterion is more relevant for the index / indices than other type(s).

Table 6 demonstrates that the properties of the resulting ISP can be very sensitive to the choice of an index type, with each type having different advantages and disadvantages. Paasche types do not seem to possess any comparative advantage over the other types. The Fisher index possesses several theoretical advantages such as symmetry and time reversals. However, it is still a complicated and burdensome technique to be applied for short-term statistics such as ISP, especially from the lower level, as it requires very detailed and timely information. At the same time, Fisher index is known to be non-additive[13].

The Laspeyres index, on the other hand, can be employed to overcome the main drawbacks of the Fisher index. The Laspeyres index is more interpretable, less costly and more timely. However, Laspeyres indices also have drawbacks. They do not measure actual production growth if the price structure changes rapidly. As such, there is a trade-off between the need for an "up-to-date weighting structure" and a "real comparison of volumes". This conflict can be attenuated by more frequent updating of the weighting structure.

Ultimately, however, the choice of index type should be made according to the purpose of an ISP and to practical considerations such as the availability of data. As mentioned earlier in this Manual, the ISP is designed for two-main purposes: for short-term economic analysis, and for quarterly GDP compilation. Thus, users would expect the ISP to measure real changes in production in the services sector. Such changes should reflect changes in volumes over time rather than changes in the price structures. At the same time, users require the timely availability of this information. A chain-linked Laspeyres index (see below) with weights updated at an appropriate frequency fulfils both of these requirements.

[13] A procedure proposed by Statistics Canada can be employed to resolve the problem of non-additivity.

Table 6: Criteria met by various types of chain-linked indices

Criteria	Laspeyres	Paasche	Fisher
Symmetry			X
Time reversal			X
Factor reversal			
Additivity			
Identity			
Monotony	X	X	X
Linear homogeneity in the volumes	X	X	X
Homogeneity of degree zero in prices	X	X	X
"Real" comparison of volumes	X		
Up-to-date weighting structure	X	X	X
Interpretability	X		
Cost efficiency	X		
Timeliness	X		

Note: "X" indicates that the index meets the criteria

5.1.2 Recommendations for ISP compilation

Based on the comparisons presented in Table 6, this Manual recommends a chained Laspeyres index[14] as a preferred approach for the compilation of an ISP. Chain-linked indices, in practice, show very reliable results for the majority of cases as they take account of modifications to the relative weights of the

[14] While recognising the theoretical advantages of the Fisher index, Eurostat also recommends a chain-linked Laspeyres index for volumes in their *Handbook on Price and Volume Measures in National Accounts.*. The formula for an annual chain-linked Laspeyres index is as follows:

$$L_t^C = \sum_i (w_{i,t-1} \frac{C_{i,t}}{C_{i,t-1}}) * \sum_i (w_{i,t-2} \frac{C_{i,t-1}}{C_{i,t-2}}) * \ldots * \sum_i (w_{i,0} \frac{C_{i,1}}{C_{i,0}}) * 100$$

where $w_{i,t}$: relative share of value added of sector *i* at time *t*

$C_{i,t}$: volume index for sector i at time *t*

different categories of services over the whole historical series. In addition, rebasing revisions occur to a much lesser extent than for fixed weight indices which should not be used. In the case of annual chain-linking, the inaccuracies caused by the assumption of a stable relationship between GVA and turnover are reduced, and, furthermore, as every year is automatically a link year, no subjective choice is required.

However, it is a costly exercise to apply chain-linking frequently and at lower levels. At the same time, characteristics of the index are closely related to the choice of linking method. Thus, the issues of linking method and frequency and level of chain linking will be discussed in the remainder of this Section.

Linking method

As mentioned before, the characteristics of chain-linked indices are known to be dependent upon the linking method used. In their *Quarterly National Accounts Manual*[15] for example, the IMF discusses three linking methods, the:

- over-the-year technique: data are chained using the respective quarter in the previous year;
- one-quarter overlap: data are chained using the last quarter in the respective year;
- annual overlap: data are chained using annual averages.

Although the Laspeyres index chained using the *over-the-year technique* meets the requirement of a real volume comparison for year-on-year rates of change, the rates of change from the previous period calculated using this method always have breaks for statistical reasons caused by frequent changes to the weighting structure. Following their analysis, the IMF stated that the over-the-year technique should be avoided.

In contrast, the chained Laspeyres index based on the *one-quarter overlap* measures real volume development from one quarter to the next. These data are therefore particularly well-suited to measuring developments. However, series compiled using this method may differ from those in independent annual accounts. To avoid this, this method is, in practice, usually discussed together with benchmark techniques (to fit the independently derived annual results). However, this results in calculation procedures becoming more complicated and opaque for non-specialist users.

With an *annual overlap,* on the other hand, the average quarterly results match the independently derived annual figures. As the weighting structure is changed only once a year concurrently with the first-quarter result, and as the weighting structure thus remains constant over the year, the changes in an ISP calculated using this method between the first and second, second and third, and third and fourth quarters are caused only by changes to the volume indices. Nevertheless, statistical breaks stemming from the change to the

[15] Adriaan M Bloem, Robert J. Dippelsman and Nils Ǿ. Mæhle, *Quarterly National Accounts Manual: Concepts, Data Sources and Compilation*, International Monetary Fund, Washington D.C., 2001; Chapter IX.

weighting structure may remain in the transition between the fourth quarter of one year and the first quarter of the following year.

As IMF analyses show, the annual overlap results approach those obtained using the one-quarter overlap. This is also borne out by experiences with national accounts in Germany, the Netherlands and Spain. It is also much easier to aggregate components when using the annual overlap approach over the other two methods. For instance, users of German national accounts data can calculate the time series not included in the standard tables or check the consistency of the official data simply by using the data included in the standard publications and one of the Excel macros developed by the Deutsche Bundesbank (available on request). However, because of the annual change to the weighting structure, year-on-year comparisons of the quarterly results (but not of the annual figures) always include fluctuations that are not caused solely by the volume series. Provided the prices structure does not change significantly, however, such statistical breaks are limited.

Thus, as presented in Table 7, this Manual recommends to link chained Laspeyres index based on the annual overlap technique or on one-quarter overlap technique as a preferred method; and on over-the-year technique as an alternative.

Frequency and level of chain-linking

Important issues to consider are how frequently ISP compilers should update the weights and base period, and at which level the chain-linking should be applied. The most common practice for production indices in OECD countries is to re-weight, rebase and chain indices every five years. However, in recent years some countries have moved to annual chain-linking for the compilation of their industrial production indices (e.g. the United Kingdom). Annual chain-linking takes better account of changes in relative prices. Nevertheless, five-year chain-linking may also be an acceptable option if the weighting structure is not subject to rapid change.

In practice, the choice of the periodicity of chain-linking may depend on the activity in question. This Manual recommends, as a preferred method, to apply annual linking for services industries whose structure of weights evolve rapidly, while, for other activities, 5-years may be appropriate. For detailed aggregation at a lower than 4-digit level, it may be more practical to use five-yearly rebasing.

As regard to implementation of the chain-linked method at the disaggregated levels, it is highly preferable to use the chain-linked Laspeyres method at least at the dissemination level, in order to enhance the international comparability of countries' indices. However, countries could employ other types of indices at the elementary and intermediate levels according to limitations in their statistical environment.

Table 7: Types of indexing methods for various stages of ISP compilation

	Preferred	Alternative	Other
Index type	Chain-linked Laspeyres index	Any form of chain-linked index (e.g. mid-year, see footnote 18) depending upon the national situation. The type of index used to compile the national ISP should be consistent with those of the national IIP or volume index of national GDP at the corresponding levels.	Any other indices depending upon the national situation. The type of index used to compile the national ISP can be inconsistent with those of national IIP or volume index of national GDP at the corresponding levels.
Linking method	Based on the annual overlap technique or one-quarter overlap technique	Based on over-the-year technique	
Frequency	Annually for services whose structure of weights evolve rapidly and every five years for others and detailed level of aggregation	Every five years or consistent with IIP	Other frequencies depending on resource constraints (e.g. 10 years)

Note: Contents in Table 7 are sourced from various publications.

5.2 Transformation of input data

Practitioners in national statistical agencies are often confronted with extensive heterogeneity with respect to input variables and deflators that could be used for the compilation of an ISP. As these could influence the overall quality of the index, it is important to ensure the suitability of each input variable before actual compilation. The list of variables recommended in Section 4 above and in Annex 2 below refers to various measures in a variety of forms of presentation such as monetary value, units of quantities, and index form. Another difference in data presentation arises from the various adjustments made previously such as working day or trading-day adjustment, and seasonal adjustment. Although such differences can be overcome by applying additional standardisation techniques, the choice of method and stage at which these adjustments are applied are often dependent on the needs and resource availability of each statistical agency. Furthermore, more complicated processes would be required to remove any abnormalities in the data arising from underlying defects, e.g. missing values, breaks or outliers.

5.2.1 Managing problems in input data

Missing input variables

In practice, compilers are often confronted with a situation where all necessary information is not readily available. Missing data for part of a series can occur at the beginning of a series due to a shorter length of historical data, or in the middle of the series due to exceptional events in the statistical environment. Missing data can also be found at the most recent period due to the less timely nature of data collection in some services industries.

Also, because of the specific nature of the services industry, data for some services industries can only be collected at lower frequencies, i.e. collected annually or quarterly for a monthly ISP or annually for a quarterly ISP. This means that necessary information for a particular period will have to be estimated from existing information at different frequencies. At the same time, data for some service industries may not be available at all. This may require the compilers' judgement as to whether these industries should be included in the compilation of the ISP.

Table 8 below presents preferred, alternative and other options which can be used to resolve a range of problems with missing data. If the frequencies of the ISP and input variables with missing data are the same, it is preferable to estimate the missing values using information available for other variables in the same ISIC group, as long as they are readily available and their long-term behaviours are similar to the series with missing data. Alternatively, estimates may be made using only information from the series with missing values. When the missing data point occurs at the beginning of the series it is preferable to do this estimation using backcasting techniques. Interpolation can be used if it is located in the middle of the series Forecasting is preferable if missing data are found at the end of the series. Alternatively, in situations where a series with missing data has only a small number of observations, the missing information can be recuperated by imputation using information on other variables in the same ISIC group or by estimation using basic methods such as a simple moving average.

When the frequency of an input variable with missing data is lower than that of the ISP, it is preferable to forecast quarterly or annual data for three periods ahead and then to interpolate[16] a monthly or quarterly path from the forecasted data.

[16] A monthly path can be created from a quarterly series using various mathematical functions. For example, the UK Office of National Statistics uses a cubic spline. It is recommended that the series is forecast three data points ahead before a monthly path is interpolated using a cubic spline. Various approaches could be used for forecasting the data. A common approach is to use a univariate model such as Auto-Regressive Integrated Moving Average (ARIMA).

ARIMA models are a broad category of models that bring together three concepts in forecasting a time series, the:

- auto-regressive (AR) part of the model assumes that individual values in a time series can be described by linear models based on previous observations;
- moving average (MA) part assumes that the value for any point in a time series depends on the error of the linear auto-regressive model in estimating the previous point. These errors are then taken into account in

When there is no data for a particular services activity, the index for the services sector can be compiled with available information in other sectors at the same level of the same ISIC group. This operation assumes that their long-term behaviours are reasonably comparable. Otherwise, no attempt should be made to compile any index for the services industry.

Table 8: Missing data in input variables

Missing data in input variables	Nature of problems	Preferred	Alternative	Other
Input variables with same frequency as the ISP	Missing data at the beginning of series	Backcast with information on other variables in the same ISIC group; or Backcasting with series information only	Impute using information on other variables in the same ISIC group and with the same statistical behaviour.	Backcast with simple method, e.g. simple moving average; or use of implicit imputation
	Missing data in the middle of series	Interpolate with information on other variables in the same ISIC group; or Interpolation with series information only	Impute using information on other variables in the same ISIC group and with the same statistical behaviour.	Interpolate with simple method, e.g. simple moving average; or use of implicit imputation.
	Missing data at the end of series	Forecast with information on other variables in the same ISIC group; or Forecasting with series information only	Impute using information on other variables in the same ISIC group and with the same statistical behaviour.	Forecast with simple method, e.g. simple moving average; or use of implicit imputation .
Input variables with lower frequency than ISP		Forecast quarterly or annual data for three	Impute using information on other variables in the	Interpolate using own information only.

estimating the next value; and

- integrated (I) part refers to the operations used to model the long-term trend.

The Holt-Winters model is a specific type of ARIMA forecasting. The level, slope and seasonality of a series are forecast separately using 'exponential smoothing'. This means that the moving averages used to take account of errors in forecasting previous points are exponentially weighted, that is, more weight is given to the most recent period than to earlier periods. This is appropriate in forecasting short-term indicators. The Holt-Winters model is not designed for forecasting long runs of missing data points. If it is used to forecast more than three periods, results can sometimes be subject to substantial revision.

Other possible approaches to forecasting involve the use of secondary data sources, model-based forecasting and expert judgement taking account of information from secondary sources.

Missing data in input variables	Nature of problems	Preferred	Alternative	Other
		periods ahead and interpolating a monthly or quarterly path from the forecasted data.	same ISIC group and with the same statistical behaviour which are available at higher frequency.	
No data for a services activity	No information is available for any indicators in the same ISIC group	Do nothing for this sector.		
	Some information is available for other indicators in the same ISIC group	Compile index with available information only, if these indicators are expected to provide a reasonable estimate for changes in output of the activities with no data (i.e. implicit imputation).	Do nothing for this sector.	

Note 1: Implicit imputation can be defined as: if no data is available for a particular component which would normally be part of an aggregation process (e.g. ISP for a 4 digit level industry required for aggregation to the 3 digit level) then excluding this component from the aggregation process is equivalent to imputing the weighting mean of all other components that are included in the aggregation process. Hence this practice is referred to as implicit imputation – the imputation is implicit because no actual value has been assigned to the missing component for the purposes of aggregation.

Note 2: Contents in Table 8 are sourced from various publications.

Breaks in time series

A long and statistically consistent historical time series is one of the most desirable characteristics for an ISP. The availability of a long time series maximises the usefulness of an index in empirical analysis and as a tool to predict future turning points as well as growth rates of an economy. As a consequence, this property is also required for input variables used in ISP compilation. However, a variety of changes in statistical behaviour are frequently observed in a time series with long historical data. These can be due, for example, to changes in technology, in the political, social and economic environment, and methodologies

used for compiling statistics. These changes can affect the comparability of data for the same series over different periods of time, and may often cause unexpected values or 'breaks' in the time series. These breaks could influence the quality of both the input series and the resulting ISP. It is therefore crucial for the reliability of the ISP to treat breaks in input variables properly. This Section presents several recommendations for the detection and treatment of temporary and permanent breaks.

Temporary breaks

A temporary break in an economic time series is observed when a value for a given period (or for a few consecutive periods) is significantly different from the overall pattern of the series. This break, however, has no significant impact on the long-term behaviour of a series. There are two types of temporary break. A break can be due to exceptional events, e.g. strikes or temporary changes to regulations or market conditions, which is called an outlier. This break is a true value, which should be kept in the series as it reflects actual economic phenomenon and contains true information on the market. It is, however, often removed or smoothed during compilation processes such as seasonal adjustment.

The second type of temporary break consists of errors arising from recording or transmission processes. Such breaks in a series should be removed and replaced by correct (or more plausible) values. A careful investigation by statisticians with help of economists and consultation with data suppliers is often necessary to distinguish outliers from possible errors.

Permanent breaks

There are several possible explanations for a permanent break. It may happen because of a significant change in methodology such as an increase or decrease in sectoral or geographical coverage, or changes in data collection from survey to administrative sources or vice versa. Permanent breaks may also be the result of changes in market conditions, regulations or changes in consumer behaviour. For example, introduction of sales via the Internet may reduce turnovers from conventional markets and thus lead to a break if Internet sales are not captured by the relevant survey.

Permanent changes in the series are observed in a series in various forms: level shift; change in long-term growth rates, i.e. slope changes; both level and slope changes; or change in seasonality.

Table 9 below presents recommended processes that can be used to detect and correct series breaks. If a strange data point is observed, it is preferable to examine its property by a relevant statistical test and to then consult with economists and data providers, if further verification is necessary. Alternatively, it can be determined by consultation with economists and data providers followed by graphical checking and simple statistics of the series, in situations when the number of observations is not large enough for a statistical test. If consultation is not possible due to time constraints or non-availability of data providers

and economists, the breaks may be determined by graphical checking and simple statistics of the series such as growth rates or averages before and after the suspected break.

If errors are found in a series they will have to be corrected. It is far preferable to try and obtain the correct data from the data compiler. Otherwise, the information for this period has to be considered as missing and this problem is analogous to recovering the missing input variables, discussed in the previous Section. The alternative solution is therefore to compute an estimate by interpolation, possibly using information from other variables in the same ISIC group.

For permanent breaks involving a level shift, if a series shows the same trend-cycle behaviour before and after the rupture, information for the whole period should be used in the ISP compilation. Both parts of the series (i.e. before and after the break) will have to be linked, in order to remove the effects of the change in the level, by use of a factor. In other words, the level of the data before the break should be harmonised with the level of the data after the break. The main difficulty is that in most cases there is no common period between the two parts of the series and, as a consequence, strong assumptions are necessary.

As Table 8 above shows, the preferred method is to compile an average monthly (or quarterly) growth rate over several periods before and after the break and to assume that this average rate corresponds to the movement of the series between the months (or quarters) immediately before and immediately after the break. The periods to be used to compile this average growth rate should be chosen carefully. For a seasonally adjusted series, for example, these could be the 12 months (or 4 quarters) immediately before or after the break. For a series with seasonality, these could be the same month (or quarter) for the same years immediately before and after the break. The alternative is to compute this change using changes in series with clear correlation if available.

For permanent breaks with changes in level and slope, i.e., for series whose trend-cycle behaviour is significantly changing along with the level shift, it is more hazardous to consider that consistent information between both parts of the series (i.e. before and after the break) can be drawn. For this reason, only the data after the break should be kept. The data before should therefore be estimated. This becomes an issue of estimating missing values in the beginning of a series. The recommendations for this are the same as in Table 8 above.

Table 9: Treatment of breaks

Treating breaks		Preferred	Alternative	Other
Detecting breaks		Relevant statistical tests and consultation with economists and data providers.	Graphical checking and simple statistics of series and consultation with economists and data providers.	Graphical checking and simple statistics of the series.
Fixing	Errors	Try to obtain the correct data	Replace the error by an	Replace the error by an

Treating breaks		Preferred	Alternative	Other
breaks		from the data provider.	estimate obtained by interpolation from other variables in the same ISIC group; or from series information only.	estimate obtained by imputation using information on other variables in the same ISIC group; or by interpolation from a simple method, e.g. simple moving average; or implicit imputation.
	Permanent breaks with level shift only	Modify data before the break by multiplying them with a factor based on the average of growth rates before and after the break.	Modify data before the break by multiplying them with a factor computed using changes in series with clear correlation.	
	Permanent breaks with changes in level and slope	Only keep data after the break and estimate the data before by backcasting with information on other variables in the same ISIC group; or backcasting with series information only (after the break).	Only keep data after the break and estimate the data before by imputing using information on other variables in the same ISIC group.	Only keep data after the break and estimate the data before by backcasting with simple method, e.g. simple moving average; or use of implicit imputation.

Note: Contents in Table 9 are sourced from various publications.

5.2.2 Adjustments

A variety of forms of Index of Services Production are required by different users depending upon their needs for economic analyses. The most frequently requested forms are ISP in raw, in working day adjusted, and in seasonally adjusted forms[17]. ISP in raw form can be compiled by integrating basic information without any further adjustments. The other two forms of ISP, on the other hand, require further adjustments for unequal number of working days or seasonality for different periods. Seasonally adjusted data are implicitly (by the nature of the computer software) adjusted for working days as well.

This Section discusses practical issues relating to seasonal and working day adjustments. Discussions are focused on their methods, on the stage in the ISP compilation process and on the frequency of the

[17] Definitions of the different forms of data are provided in the OECD's *Data and Metadata Reporting and Presentation Handbook* (2006). The Handbook also provides recommendations on the methodological information (metadata) that should be provided to users describing the significance of seasonally adjusted series.

adjustments. It is assumed in this Section that the seasonal and working day adjustments are performed on deflated series.

Method of adjustment

X12-ARIMA or TRAMO SEATS or combinations of both are the preferred methods of adjustment as they have become standard tools to perform seasonal and working day adjustments in the majority of statistical agencies of the OECD area as well as by analysts. Other nationally developed adjustment methods can also be used as an alternative, as a number of agencies have found that they produce very reliable results and are sometimes more useful for specific statistical environments.

Level of adjustment

It is theoretically preferable to have adjusted data (in addition to the corresponding raw data) for all detailed levels of aggregation. This means that data would preferably be adjusted at the lowest level before their aggregation into the adjusted ISP, i.e. seasonally and working day adjusted data. However, such a policy could raise a few practical problems due to the number of variables to be seasonally adjusted and whether series at the lowest level are of suitable accuracy to enable reliable seasonal adjustment to be performed over a longer period. A large amount of noise in the data may, indeed, result in large changes in seasonal parameters each time they are re-estimated causing unwanted revisions. This may often be the case at low levels of aggregation and therefore it may be preferable to aggregate to a higher level before performing the seasonal adjustment. This policy also raises the problem of the availability of suitable deflators at the lowest levels. In practice, deflators may not be available at 5 or 6-digit levels. Different approaches are currently used across the OECD area.

Statistics Canada, for example, carries out seasonal adjustment for the majority of industries at the lowest level in the industry classification, i.e. worksheet level. The United Kingdom ONS, however, compiles seasonally adjusted data from the group level (roughly 4-digit SIC), as the amount of seasonal adjustment to perform at the class level would be huge. The ONS assumes that "The components feeding into a SIC 4-digit classification are sufficiently homogeneous in their seasonality to make seasonally adjusting the group level aggregate the preferred method."

Table 10 below recommends seasonal and working day adjustments at the lowest level provided data have sufficient accuracy to enable reliable adjustment to be performed. If this is not plausible due to resource constraints and / or due to a lack of accuracy in the data, statistical agencies may determine the most optimal level, according to their assessment of the best balance between practicality and homogeneity.

Frequency of adjustment

Although it is a costly process, technically speaking it is preferable to perform seasonal and working day adjustments every month or quarter. However, such a process can be confusing to users if both recent and historical data are revised every month or quarter. Statistics Canada has adopted the following revision policy for their GDP by industry series. "With the addition of each new observation, concurrent seasonal factors are calculated from all of the available data. Revised seasonal factors are used in the most current period consisting of up to 18 months, while seasonal factors in the time period preceding this segment of the GDP series remain unchanged. Once a year, at the time of the incorporation of the benchmarks from the Input-Output tables, new revised seasonal factors are incorporated in the earlier years as well. This revision policy ensures that while all significant improvements are included, the number of times a given month gets revised is kept to a minimum." (Statistics Canada (2002), *Gross Domestic Product by Industry, Sources and Methods)*.

On the other hand, the Korean National Statistical Office revises the seasonal factors only once a year, in February, when all monthly data for the previous year becomes available. The principal reason for this approach is to avoid user confusion.

Table 10 below therefore recommends that the seasonal factor revision policy should lie between two approaches. Small revisions, e.g. use of concurrent seasonal factors method which should be performed every month, especially when options are used in the seasonal adjustment. However, this should only apply to the most recent values of the time series (e.g. up to 18 months as is the case at Statistics Canada). Larger revisions i.e. applying the latest seasonal factors to all the historical data, should be done only once a year.

Treatment of series with short historical data

When historical data for a time series is short, it is normally preferable not to attempt to compile seasonally adjusted data for the series until the length of historical data is sufficiently long. Four to five years of monthly or quarterly data is generally accepted as the minimum length to perform seasonal adjustment. This could, however, cause problems in the construction of seasonally adjusted ISP data for the whole services industry and its sub-groups if, for example, a few new component series become available due to a new survey. In such a case, it is preferable to estimate seasonally adjusted data for the series with short historical data from their imputed (backcasted) raw data (See previous Section for a detailed discussion).

Table 10: Seasonal and working day adjustments

	Preferred	Alternative	Others
Method	X12-ARIMA or TRAMO-SEATS	Other national methods	
Level of adjustment	4-digit level or higher, provided suitable accuracy of the data.	Any level for which reliable information for adjustment is available and for which a deflator is available.	Top level
Frequency of adjustment	Concurrent adjustments every month or quarter for recent period; and once a year for all period	Once a year	Ad hoc
Treatment of series with short historical data	Estimate seasonally adjusted data for the newly introduced series in order to produce seasonally adjusted ISP for whole services industry and its sub-groups	Do not perform seasonal adjustment until enough historical data become available.	

Note: Contents in Table 10 are sourced from various publications.

5.3 Consolidation

5.3.1 Weighting

Weights

Input variables can be aggregated into the ISP once all the necessary transformations at the individual series level, e.g. treatment of missing data points, deflation, indexing, etc., have been completed. Aggregation is carried out at each level from the lowest level of the ISIC. In other words, for a given level of the ISIC (e.g. a Group), the ISP for the level is derived from all the ISPs of the lower level (i.e. Class). An index for a sector is estimated by taking a weighted average of all the component industries in the sector, where the weights are derived from their relative contributions to total GDP.

As shown in Table 11 below, it is preferable to measure the relative importance of industries in GDP using gross value added. Such information is usually available in Input-Output tables. For most countries,

however, it requires the use of other comprehensive data sources for lower levels of ISIC groups to obtain weights for those levels. The sources also vary from one industry to another as the services industry is very heterogeneous in nature. It is therefore often necessary to use alternative weighting variables such as turnover data and quantity indicators, or indicators that measure input to an industry such as employment.

Missing variables or indices

If for some reason an index is not available for one of the lower level activities, the weight of that activity should be distributed proportionately amongst the other activities that also contribute to the same activity one level higher in the activity classification.

Missing weights

If no weights are available (e.g. disaggregated figures for value added do not cover the whole services sector), various methods can be used to consolidate the deflated variables or volume indices[18]. The only method which is base-period invariant and which gives individual volume representatives the same degree of representativeness calculating the average change in volumes[19], irrespective of the initial level or that of the rates of changes, is the Jevons index. The Jevons index is the ratio of geometric means of volume representatives (or equivalently the geometric mean of the volume relatives) and mathematically it can be expressed as follows:

$$J_t = \prod_{i-1}^{n} \left[\sqrt[n]{\frac{C_{i,t}}{C_{i,0}}} \right]$$

where $C_{i,0}$: volume for sector i at time 0

$C_{i,t\ \mathrm{t}}$: volume for sector i at time t

Frequency of weights revision

In the case of a Laspeyres index, weights for production indices are normally updated every five years, which is co-ordinated with base year changes. On the other hand, weights for Paasche and Fisher indices

[18] Problems such as this are discussed in detail in the price index literature (see *Consumer price index manual: Theory and practice*, ILO/IMF/OECD/UNECE/Eurostat/The World Bank, Geneva, 2004, pp. 355-371 and *Producer price index manual: Theory and practice*, IMF/ILO/OECD/UNECE/Eurostat/The World Bank, Washington D.C., 2004. pp. 508-524). The results developed there can be used in the context of volume indices if the word "price" in the literature is changed to "volumes".

[19] Noting that calculating average change in volumes is the key measurement task of the ISP

by their construction will have to be updated every year when reliable annual data for the year become available. For maintaining a coherent time series, Eurostat, in its *Methodology of Short-term Business Statistics: Interpretation and Guidelines* (Eurostat 2002) advocates the following:

> "When weights are updated there is a break in the series compiled under the previous system of weights and the series compiled under the new system. These series need to be spliced (linked) in order to maintain a coherent time series. In the standard case of a rebase every five years, the indices relative to a new weighting system have to be calculated retrospectively for several years, so that the point where the two series are spliced is between the two base years.
>
> Therefore, if for example weights relating to a new base year of 2000 were introduced in 2003, index series based on the new 2000 weights would be revised back to the beginning of 2000, which is also the point where the index would be linked (i.e. spliced) to the historical series. "

These guidelines from Eurostat equate to the use of a chain linked mid-year index (see Section 5.1.1) re-weighted and linked at five year intervals. This was presented as an alternative method in Table 7. Clearly the updating of weights must accord with the frequency of linking and as outlined in Table 7. This Manual recommends, as the preferred method, chain-linked Laspeyres indexes where weights are updated at either annual or 5-yearly frequency.

Another issue related to the frequency of weights revision is whether weights for different levels of ISIC categories should be revised with the same frequency. Due to resource and data constraints, it may be more practical to update weights for higher levels more frequently than those for lower levels. The ONS in their *Methodology of the Experimental Monthly Index of Services* (Fenton and Pike 2001) suggests the following practice:

> "The contributions, or 'weights' of indicators at class level (which is normally below the level of 4-digit SIC(92)) are updated every five years. The weights of indicators at group level (normally equates to 4-digit SIC) and above are updated every year."

Table 11: Weights

Methods	Preferred	Alternative	Others
Weighting variables	Gross value added	Turnover or quantity indicators	Indicators measuring inputs to the industry
Missing variables or indices	Proportional distribution of the weight of that activity		

	amongst the other activities in the same group[20]		
Missing weights	Consolidate the volume indices using the Jevons index		
Frequency of update	Once a year for higher levels and every five years for lower levels of ISIC groups	Every five years for all levels of ISIC groups	Ad-hoc

Note: Contents in Table 11 are sourced from various publications.

5.3.2 Comparability with GDP

As an analogy to the Index of Industrial Production (IIP), the Index of Services Production (ISP) can be considered to be a reasonable estimate of short-term change in Gross Value Added (GVA) for the services industry. This is because of the fact that the ISP is a weighted average of services sectors' output using GVA weights with an assumption of the ratio of Gross Value Added to Output being constant in the short-term. Thus the ISP and the IIP can be aggregated along with estimates of change in GVA for agriculture, forestry and fishing and for construction to arrive at an estimate of change in monthly (or quarterly) GVA for the whole economy or GDP.

As mentioned throughout this Manual, a monthly or quarterly ISP should be considered as an important input to the production of quarterly GDP. This is analogous to use of the index of industrial production as an input to the calculation of quarterly GDP which is the case in most OECD countries. The degree to which the ISP is directly used in production of quarterly GDP, or to which input data sources for the ISP are also used in the compilation of quarterly GDP, may differ across countries depending on the frequency and variety of input data sources available and resources available for compilation work. For the production measure of GDP, it is practical to collect annual data for both output (turnover) and intermediate consumption to achieve a direct measure of GVA. It is therefore likely that there will be some incoherence between monthly or quarterly ISP (i.e. an estimate of GVA produced as a short-term indicator) and quarterly or annual GVA (i.e. an estimate produced by balancing the three measures of GDP).

Although some discrepancy can be expected, users would prefer the presentation of a consistent message about the economy, and so it is preferable to 'benchmark' the monthly or quarterly ISP to the quarterly and annual estimates of GVA or GDP at constant prices. Where the estimate of headline GDP is quarterly, the

[20] This is the most realistic option and is recommended as preferred, though it was regarded as the 'other' option in Table 9 above in the context of missing data in input variables with the same frequency as the ISP.

benchmarking process may be used to impose seasonally adjusted quarterly GDP growth rates onto the monthly or quarterly ISP.

The benchmarking of the short-term ISP to the quarterly and annual estimates of GDP can be done by using actual statistical information such as reconciling components of the ISP with the corresponding components within a Supply-Use framework. Although this approach could eventually ensure the full consistency between the short-term ISP and the quarterly and annual national accounts at the corresponding levels and sectors, it is not realistic to expect the majority of OECD Member countries to develop their system to meet this requirement. This is because of the fact that this approach requires complete coherence in the statistics used in the short-term ISP and quarterly and annual GDP in terms of data sources and methods.

Thus, this Manual recommends utilising econometric benchmarking techniques to achieve comparability between the short-term ISP and quarterly and annual GDP. Specific methodologies for benchmarking techniques with their applications and discussions can be found in other fora such as the Workshop on Frontiers in Benchmarking Techniques and Their Application to Official Statistics (April 2005) at http://epp.eurostat.cec.eu.int/portal/page?_pageid=1853,1,1853_20488614&_dad=portal&_schema=PORTAL

As regard to the level at which benchmarking should be applied, it is theoretically preferable for theISP to have full consistency with quarterly and annual national accounts at all levels. However, it is not realistic in practice to adopt the theoretical preference because of various constraints such as the availability of required information at all levels in the short-run. This Manual therefore recommends, as a preferred method, applying a benchmarking technique at the level at which indices are disseminated to the general public in order to avoid user confusion. Alternatively, the technique should be applied at 1-digit level of ISIC.

Although frequent revisions in the data due to benchmarking could cause user confusion, it is still preferable to apply a benchmarking technique as soon as headline national accounts data become available, i.e. every quarter, and further revision of the ISP data subject to annual revision of national accounts data. Alternatively, the ISP should be revised once a year in line with annual national accounts.

5.3.3 Overall quality assessment of ISPs

Section 4.2 above discussed issues related to the evaluation of the suitability of specific input variables to be considered in the compilation of monthly or quarterly Index of Services Production. This Section did not attempt to deal with the overall quality of the resulting ISP. Most statistical institutions at national and international levels attempt to systematically evaluate the quality of their own statistical output using various tools and processes. Notable examples at the international level are the IMF quality framework, i.e. the General Data Dissemination System (GDDS) and Special Data Dissemination Standards (SDDS)[21].

The OECD has also developed tools to assess the quality of statistics stored and maintained by various Directorates within the Organisation. The OECD's quality framework[22] is therefore used in this Manual as a basis for discussing ways to ensure the overall quality for an ISP using input variables discussed in Section 4 above and recommendations for the compilation of an index outlined above in this Section.

In general terms quality is defined as "fitness for use" in terms of user needs. This definition is broader than has been customary used in the past when quality was equated with accuracy. It is now generally recognised that there are other important dimensions of quality. Even if data is accurate, they can not be said to be of good quality if they are produced too late to be useful or cannot be easily accessed or appear to conflict with other data. Thus, quality is viewed as a multi-faceted concept.

In the OECD's quality framework, the quality of a statistical product is assessed via the following seven dimensions:

- relevance;
- accuracy;
- credibility;
- timeliness;
- accessibility;
- interpretability; and
- coherence.

In addition to the seven criteria mentioned above, the OECD also recognises the cost to produce necessary statistics. When it comes to the production of short-term statistics such as a monthly or quarterly ISP, cost-efficiency is an indispensable criterion to assess the quality of statistics. The exact meanings of the seven dimensions are discussed in detail in the remainder of this Section.

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[21] Quality frameworks have also been developed by other institutions such as the European Commission's Eurostat, Statistics Canada, Statistics Finland, Statistics Denmark, etc.

[22] Detailed information on the OECD quality framework is available at www.oecd.org/statistics/qualityframework

Descriptions of quality dimensions

- *Relevance*: As described in the Introduction to this Manual (in Section 1), the ISP is compiled to meet the strong demands of analysts. According to the OECD quality framework, "Relevance depends upon both the coverage of the required topics and the use of appropriate concepts." Relevance is proportional to the number of sub-sectors covered in the index. Relevance is also positively correlated to the number of "preferred" methods adopted in comparison to the number of alternative or other methods.

- *Accuracy:* As the ISP is compiled by a bottom-up approach, the accuracy of the index is strongly dependent on the accuracy of the individual components. The OECD explains that "Accuracy refers to the closeness between the values provided and the (unknown) true values" and that "Accuracy has many attributes, and in practical terms there is no single aggregate or overall measure of it." The framework then advises assessment of accuracy via "the closeness between the initially released value(s) and the subsequent value(s) of estimates" in practice. It, however, also notes that "The absence of revisions does not necessarily mean that the data are accurate". According to the Eurostat's *Methodology of Short-term Business Statistics: Interpretation and Guidelines*, "Accuracy can be measured using several indicators: random sampling errors, non-random sampling errors, statistical frame errors, measuring errors, process errors, non-response errors, model errors".

- *Credibility:* According to the OECD "the credibility of data products refers to the confidence that users place in those products based simply on their image of the data producer, i.e., the brand image."

- *Timeliness*: Monthly ISP should preferably be as timely as the corresponding monthly Index of Industrial Production. But, as the services industries are much more complex than their industry counterpart, it is very difficult to collect all the necessary information in a timely manner. It is however still preferable to produce the monthly ISP within six weeks after the reference period, or within two weeks after the monthly IIP. If the ISP is compiled on a quarterly basis, it should be produced before the quarterly GDP so that it can be used to understand short-term economic fluctuations and as an input to quarterly GDP compilation.

- *Accessibility*: In the OECD quality framework, the accessibility of data products is described as "how readily the data can be located and accessed from within OECD data holdings. Accessibility includes the suitability of the form in which the data are available, the media of dissemination, and the availability of metadata and user support services. It also includes the affordability of the data to users in relation to its value to them and whether the user has reasonable opportunity to know that the data are available and how to access them." In addition, the Eurostat's *Methodology of Short-term Business Statistics: Interpretation and Guidelines* states that there is a "need for a catalogue system to allow users to find what information is available, and where to find it" and that "the SDDS therefore requires advance dissemination of release calendars and simultaneous release to all interested parties". Accessibility is discussed further below in Section 6 covering dissemination.

- *Interpretability:* The interpretability of data is closely related to the users' understanding of the data for their use. Thus the degree of interpretability depends on all aspects of information on the data such as adequacy of the definitions of concepts, target populations, variables and terminology, limitations of the data, etc. Thus the quality of metadata provided along with the ISP is indeed crucial to improve interpretability. Such metadata should, in particular, inform the user on how close to the target variable (i.e. the change in value added) the input variables used in the ISP are. When there is a significant difference, it should be explained to what extent this may cause a bias in the measure of the services production for particular services activities or the index as a whole.

- *Coherence:* The OECD states that "the coherence of data products reflects the degree to which they are logically connected and mutually consistent." The OECD distinguishes four important sub-dimensions for coherence:

    - coherence within a dataset;
    - coherence across datasets;
    - coherence over time; and
    - coherence across countries.

The ISP can be *coherent within a dataset* if all individual sub-indices that are components of an overall ISP are compiled based on the methodologies proposed in this Manual.

Coherence across datasets for the ISP cannot be ensured until its coherence with corresponding datasets is properly checked. As the ISP is designed to complement the IIP, coherence between these two indices will have to be examined by ensuring consistency in classifications, concepts and definitions. Comparability between the ISP and GDP is also an important consideration.

Coherence over time and *coherence across countries* are in theory achieved using the methodology recommended in this Manual. However, in practice, as described in the previous discussions in this Section, there are many reasons for these properties not to be respected for all services sub-sectors. When this is the case, it is advisable to clearly note the differences from the recommendations. Coherency across countries and amongst various sub-sectors of services activities may be dependent upon the degree of adoption of recommended methodologies presented in this Manual.

The OECD describes cost-efficiency as "A measure of the costs and provider burden relative to the output. Provider burden is a cost that happens to be born by the provider, but is a cost nevertheless." As mentioned earlier, the OECD does not include cost-efficiency as a dimension of the quality framework. However, the OECD views cost-efficiency as a factor that must be taken into account in any analysis of quality as it can affect quality in all dimensions.

The challenge is how to assess the quality of an ISP based on the criteria outlined above. It is not a simple task to assemble the seven criteria into an index through which the overall level of quality of an ISP can be evaluated. The main problems arise from the difficulties in quantifying the level of individual dimensions and in aggregating the levels of all dimensions. Any resulting score can be arbitrary as it to a large extent depends on the data compilers choice of quality measurement variables and weights used for their aggregation.

No attempt has therefore been made in this Manual to outline a method for deriving a single quantitative quality measure for an ISP. In the absence of such a single measure, it is sufficient that qualitative statements be made with respect to each quality dimension adopted by the statistical agency compiling the ISP. This would enable subsequent determination of priorities on the basis of an understanding of user needs.

It is recommended that a quality review of the ISP be undertaken every four or five years, or more frequently if significant new data sources become available

5.4 Procedures carried out at various compilation stages

This Section highlights key practical compilation steps described in this Manual, and guides users on how the recommendations, etc., can assist in identifying appropriate solutions if users wish to develop an ISP. It also offers remedies if compilers encounter any problems during ISP compilation. As only a limited number of countries are currently producing monthly ISPs, United Kingdom practices for the compilation of their monthly Index of Services (as explained in *Methodology of the Experimental Monthly Index of Services* (Fenton, T. and Pike, R., 2001)) are used extensively in this Section. Practices applied in other countries will be incorporated when they become available.

5.4.1 Overview of the compilation process

As described in this Manual, a number of procedures used at various stages are involved in the compilation of ISP. Sections 4 and 5 of this Manual advise that the lowest level at which basic information should preferably be collected is 4-digit level of the ISIC. Thus, as shown in the table below, there are five stages for the information to be integrated into an ISP for the whole services sector. This table also shows that detailed procedures are required for each ISIC level.

Table 12: ISP compilation processes to be carried out by ISIC level

ISIC levels	Recommended process
Pre-processing	Preparation of data (i.e. deflators; input variables; and weights) suited for an automated compilation program (e.g. estimation of missing information and treatment of series breaks at beginning or in the middle of historical series)
4-digit	Deflation; Indexing; Forecast missing data; Interpolation of higher frequency series from the lower ones; Seasonal and/or prior adjustment; Consolidation to 3-digit level
3-digit	Consolidation to 2-digit level by chain-linking
2-digit	Quality adjustment; Benchmark monthly or quarterly ISP to quarterly and annual GDP; Consolidation to 1-digit level by chain-linking
1-digit	Consolidation to overall ISP by chain-linking; Dissemination
Overall ISP for whole services sector	Dissemination

5.4.2 Pre-processing

As the compilation of short-term (i.e. monthly or quarterly) ISPs will need to be carried out in an automated program, it is important to ensure that all the basic information are transformed to a standard pattern. All input variables (e.g. turnover, volume indicators) should therefore be available for all 4-digit levels of services activities defined in ISIC Rev. 3 for the entire compilation period. At the same time, it is desirable to have all deflators (i.e. PPIs and CPIs) and weights for the corresponding services activities. If this condition is not initially met, the source data will need to be processed in advance of the actual ISP compilation. As Table 12 above shows, the types of problems that can be encountered are:

- treatment of series breaks at the beginning or in the middle of historical series;
- estimation of missing information at the beginning or in the middle of historical series; and
- no information.

These problems should be dealt with during the pre-processing stage. As regard to treatment of breaks, Table 9 in Section 5.2.1 proposes detailed remedies for various cases, which can be summarised as follows:

- If the breaks are errors, obtain the correct data from the data provider, or replace it by an estimate using interpolation or using imputation or implicit imputation.
- If the breaks cause level shift, modify data before the break by multiplying them with a factor based on the average of growth rates before and after the break; or with a factor computed using changes in series with clear correlation.
- If the breaks cause changes in level and slope, keep the data only after the break and estimate the data before by backcasting with information or backcasting with series information only; by imputation using information on other variables in the same ISIC group.

When data point(s) is(are) missing at the beginning or in the middle of a series, the missing information should be estimated. Table 8 in Section 5.2.1 recommends the following procedures to be used for the estimation of missing information at the beginning or in the middle of historical series:

- backcast (interpolate) with information on other variables in the same ISIC group or with series information only;
- impute using information from other variables in the same ISIC group and from variables with the same statistical behaviour; or
- backcast (interpolate) with a simple method, e.g. simple moving average; or use of implicit imputation.

A Sketch of Interpolation with Cubic Spline

The method used by the ONS to interpolate a smooth path through flows and index series is a cubic spline[23], Although it is quite a complex procedure, a non-technical description of the method can be explained in two stages:

- The first stage is to define the following five parameters:

- to identify the series to be interpolated. The function is run at the periodicity of the output series, so this identifier requires a suffix specifying the periodicity of the input series (annual or quarterly);
- to specify the periodicity of the output series (monthly or quarterly);
- to specify whether the interpolated series should sum (flows) or average (index) to the original series;
- to define the required end date of the interpolated series, which can be beyond the end of the original series due to the forecasting element of the function; and
- to define the type of Holt-Winters (refer below) to be used in the forecast. This can be additive, multiplicative or non-seasonal, to suit the nature of the data.

- The second stage is to apply a cubic spline whose basic concept is as follows:

- it takes the quarterly (or annual) data and tries to run a smooth, continuous line through all the points; and
- this line is made up of polynomials of the third order (cubics). The coefficients of each cubic are chosen such that the curve is as smooth as possible while still passing through the quarterly data.

Aside from the selection of five parameters in the first stage, there are other points that should be considered, such as types of data, forecasting, level shifts in series, outliers, seasonality, and revisions (detailed descriptions are given in the Section on Time series method, in Fenton, T. and Pike, R. (2001).

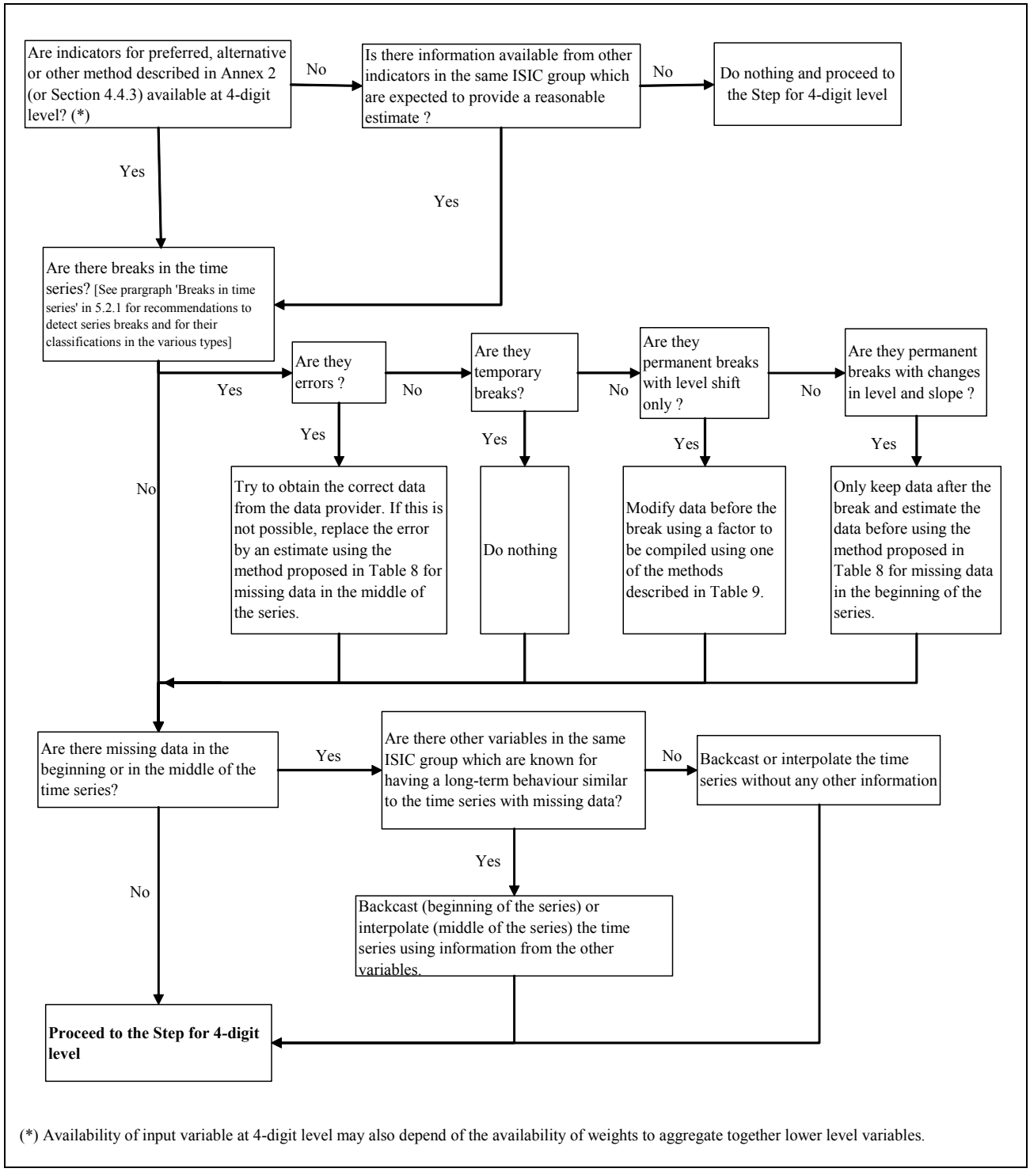
Table 8 in Section 5.2.1 also suggests that, for a sector with no data, a proxy can be created if some information is available for other indicators in the same ISIC group. The Manual therefore proposes the following procedures to cope with no (or only some) information being available:

- if some information is available for other indicators in the same ISIC group, then create a proxy with available information only, if these indicators are expected to provide a reasonable estimate for changes in output of the activities with no data; or
- if no information is available for any indicators in the same ISIC group, do nothing. This implies that the ISIC group will be implicitly imputed as the weighted average of other ISIC groups automatically as part of the aggregation procedure to the next level.

[23] A more technical description of a cubic spline used by the ONS can be found in Annex C of *Methodology of the experimental monthly index of services* (Fenton, T. and Pike, R. (2001)).

Tasks carried out during pre-processing stage is summarised in a flowchart in Figure 1.

Figure 1. Flowchart for pre-processing



(*) Availability of input variable at 4-digit level may also depend of the availability of weights to aggregate together lower level variables.

5.4.3 4-digit and 3-digit levels

Automated compilation processes begin at the ISIC 4-digit level. At this level, all the input data are to be converted into seasonally adjusted deflated indices with a base year = 100, which will then be consolidated into 3-digit ISIC categories. The procedures (as outlined in Table 12) to be carried out at this level in order of execution are:

- forecasting missing data;
- interpolation of higher frequency series from the lower ones;
- deflation;
- indexing;
- seasonal and/or prior adjustment; and
- consolidation to 3-digit level.

The first two tasks are concerned with problems in the data. Any missing information for the most recent period should be forecasted. Table 8 in Section 5.2.1 suggests the following procedures for forecasting Missing data (input variables, deflators and weights) for the most recent period:

- forecast with information on other variables in the same ISIC group; or forecasting with series information only;
- impute using information on other variables in the same ISIC group and with the same statistical behaviour; or
- forecast with simple method, e.g. simple moving average; or use of implicit imputation.

Forecasting is also useful for interpolation of a monthly or quarterly path from quarterly or annual information. Frequencies of deflators are often lower than the overall ISP, e.g., quarterly PPI for monthly ISP. For such cases, the problem should be treated by interpolating a monthly or quarterly path. Table 8 in Section 5.2.1 suggests the following procedures for estimating higher frequency data:

- forecast quarterly or annual data for three periods ahead and interpolating a monthly or quarterly path from the forecasted data; or
- impute using information on other variables in the same ISIC group and with the same statistical behaviour which are available at higher frequency;

A Sketch of Holt-Winters Forecasting Method

To forecast the ONS applies Holt-Winters24 method, which uses the historical path of a series to predict its future path. The basic concept is as follows:

- In the Holt-Winters methods, prediction of the level, slope, and seasonality of a series are updating exponential smoothing.
- Exponential smoothing is the process by which a predicted value is updated each time new information becomes available at the end of a series. It takes its name from the use of moving averages with exponential weights that ensure that the most recent and relevant data points in the series supply the most information to the predictions.
- These predictions are then combined to give a forecast of the next observation in the series.
- Holt-Winters has an additive and a multiplicative form that determines whether the seasonal component is combined in additive or multiplicative way with the level and slope components.

The ONS system advocates Holt's method if the series is truly non-seasonal.

Deflation is undertaken by dividing current price turnover (or proxy) data and deflators by price indices (i.e. PPI, CPI, combined index of PPI and CPI, or proxies). Other input series, e.g. volume indicators and proxies in constant price, are to be deflated using the same procedure with dummy deflators which have no effect (i.e. value of the deflator is set to 1). The deflated series is then converted into an index whose average value for a given reference year equals to 100.

The deflated indices are then adjusted for their seasonality. It is recommended that either X12-ARIMA or TRAMO SEATS or combinations of both are used for this adjustment , as these are the most common methods for the majority of statistical agencies in OECD Member countries as well as by analysts. Other nationally developed adjustment methods could also be used as an alternative. The final task to be carried out at 4-digit level is to consolidate the deflated turnover indices (both raw and seasonally adjusted series) to the 3-digit level with proper weights (i.e. while gross value added is preferred, turnover or quantity indicators, and indicators measuring inputs to industry can be used as alternative and other methods, respectively), using the chain-linked method presented in Section 5.1. If no weights are available, as it is recommended in Section 5.3, Jevons formula can be applied.

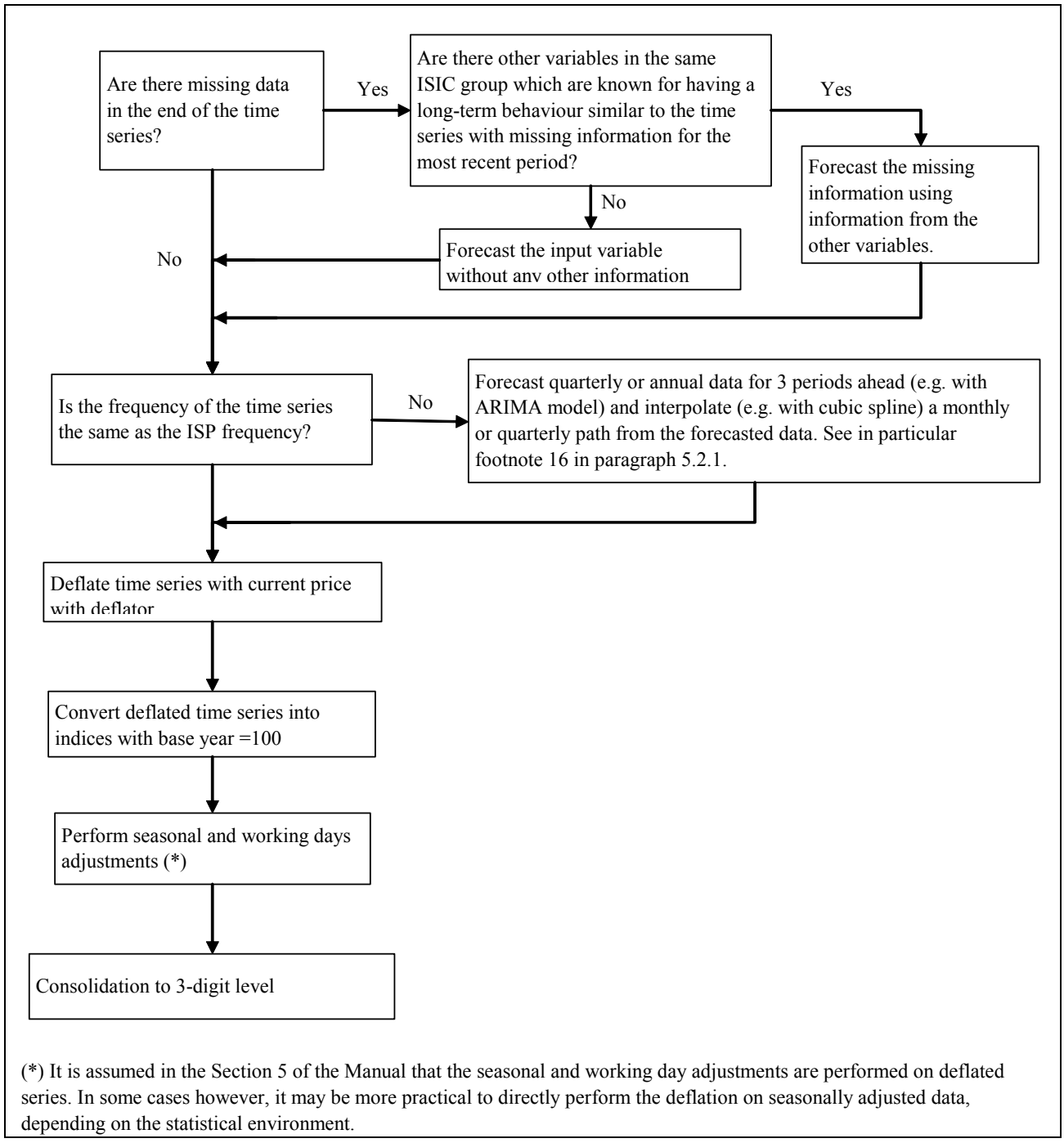
Only task required at 3-digit level is to create chain-linked 2-digit series by aggregating 3-digit series using the chain-linked method described in Section 5.1 of this Manual. The only other possible manipulation at the 3-digit level is seasonal adjustment if it can not be carried out at 4-digit level due to resource constraints or other data deficiencies. As a result of the aggregation process, twenty-seven chain-linked

[24] A detailed description of Holt-Winters method can be found Annex B of *Methodology of the experimental monthly index of services* (Fenton, T. and Pike, R. (2001)).

sub-components of ISPs are to be created (see Section 4.4.3 and Annex 2 for detailed lists of series) in both raw and seasonally adjusted forms.

Tasks carried out at 4-digit level is summarised in a flowchart in Figure 2.

Figure 2. Flowchart for 4-digit level



(*) It is assumed in the Section 5 of the Manual that the seasonal and working day adjustments are performed on deflated series. In some cases however, it may be more practical to directly perform the deflation on seasonally adjusted data, depending on the statistical environment.

5.4.4 2-digit and 1-digit levels

Sub-components of the ISP can be published at this level depending upon user needs. Thus, it is important to ensure that the all the sub-ISPs meet the desirable level of quality and move comparably with quarterly and annual GDP at this level in the medium- and long terms. Therefore, as mentioned in Table 12, the following tasks are to be carried out at this level:

- benchmark monthly or quarterly ISP to quarterly and annual GDP;
- quality adjustment; and
- consolidation to 1-digit level and to overall ISP by chain-linking.

Ideally, monthly or quarterly ISPs should measure the corresponding sectors in quarterly GDP using the same data. The only possible difference is the periodicity of the output. In reality, however, due to limitations in data, they may differ in many respects. In order to present coherent sets of information about the economy, 2-digit level ISPs should be benchmarked to the corresponding quarterly series in GDP. A number of methodologies have been proposed for benchmarking[25].

In order to provide users with an illustration of a benchmarking procedure, the basic version of the proportional Denton method presented in IMF QNA Manual (2001) is summarised as below:

A Sketch of Proportional Denton Benchmarking Method

The basic version of the proportional Denton benchmarking technique keeps the benchmarked series as proportional to the indicator as possible by minimizing (in a least-squares sense) the difference in relative adjustment to neighbouring quarters (months) subject to the constraints provided by the annual (quarterly) benchmarks. Mathematically, it is defined as the sum of the quarters (months) should be equal to the annual (quarterly) data for each benchmark year (quarter).

The proportional Denton technique implicitly constructs from the annual (quarterly) observed benchmark-to-indicator (BI) ratios a time series of quarterly (monthly) benchmarked estimates-to-indicator (quarterly BI or monthly BI) ratios that is as smooth as possible. Thus, the proportional Denton technique allows users to avoid distorted quarterly (monthly) pattern caused by introducing a step in the series by employing a basic distribution technique. In the case of flow series, the proportional Denton technique produces:

- the back series averages to the annual (quarterly) BI ratios for each year (quarter); and
- the forward series are kept constant and equal to the ratio for the last quarter (month) of the last benchmark

[25] Univariate methods without indicators can be found in Boot-Feibes-Lisman (1967) and Stam-Wei (1986)); univariate methods with indicators in Denton (1971), Chow-Lin (1971), Litterman (1983), and Santos-Cardoso (2001)); and multivariate methods with indicators and transversal constraints in Di Fonzo (1990, 2002).

year (quarter).

A numerical example to illustrate the proportional Denton method for a quarterly series is borrowed from Example 6.1 on p. 85 of IMF QNA Manual (2001):

	Indicator				Derived quarterly estimates			
	Quarterly data (1)	Period-to-period rate of change	Annual data (2)	Annual BI ratio (3)=(2)/(1)	Distributed data (1)	(3)	(4)=(1)x(3)	Period-to-period rate of change
Q1 1998	98.2				98.2	9.950	977.1	
Q2 1998	100.8	2.6%			100.8	9.950	1,003.0	3.0%
Q3 1998	102.2	1.4%			102.2	9.950	1,016.9	2.0%
Q4 1998	100.8	-1.4%			100.8	9.950	1,003.0	-0.5%
Sum	**402.0**		**4000.0**	**9.950**			**4,000.0**	
Q1 1999	99.0	-1.8%			99.0	10.280	1,017.7	-0.6%
Q2 1999	101.6	2.6%			101.6	10.280	1,044.5	3.5%
Q3 1999	102.7	1.1%			102.7	10.280	1,055.8	1.7%
Q4 1999	101.5	-1.2%			101.5	10.280	1,043.4	-0.9%
Sum	**404.8**	**0.7%**	**4161.4**	**10.280**			**4,161.4**	**4.0%**
Q1 2000	100.5	-1.0%			100.5	10.280	1,033.2	-1.0%
Q2 2000	103.0	2.5%			103.0	10.280	1,058.9	2.5%
Q3 2000	103.5	0.5%			103.5	10.280	1,064.0	0.5%
Q4 2000	101.5	-1.9%			101.5	10.280	1,043.4	-1.9%
Sum	**408.5**	**0.9%**	**?**	**?**			**4,199.4**	**1.6%**

The benchmarking method should:

- create a series that is consistent with the annual or quarterly benchmarks;
- as far as possible, preserve the growth rates of the indicator series;
- be able to deal with situations where the indicator series extends into a period for which there is no benchmark yet available; and
- be able to deal with benchmarking with any combination of frequencies, e.g. monthly data to quarterly benchmarks, quarterly and monthly to annual, quarterly to fiscal year annuals, etc.

Benchmarking is sometimes seen as a form of interpolation – the benchmark series is interpolated using an indicator series to provide information about short-term movements. Benchmarking and interpolation in these circumstances are identical. A complexity with benchmarking, however, occurs when estimating unobserved benchmarking series (UBS) beyond the period for which a related indicator (RI) is available. In this case forecasting and benchmarking methods need to be combined. Forecasting the RI then

benchmarking the extended series onto the benchmarks is a sensible solution.

In fact, because of the relative timeliness of annual and quarterly data, during the current year, the quarterly values will generally be available before the annual benchmark annual values are known. Therefore, the last few data points in the partial year at the end of the series UBS are estimated in the absence of an annual benchmark – an important aspect of any method of benchmarking is how it deals with this problem.

Section 5.3.3 explains the advantages of and dimensions used for quality adjustment. The Section recommends that a quality review of the ISP be undertaken every four or five years, or more frequently if significant new data sources become available. This Section, however, makes no attempt to recommend a single measure and leaves each statistical agency compiling the ISP to implement their own quality dimensions / quality procedures.

The final task to be carried out at the ISIC 2-digit level is to consolidate ISPs into 1-digit level by chain-linking[26] or other useful groups (e.g. Distribution services or ICT services) according to users' needs, so that the overall ISP can be compiled at the final stage.

[26] The formula for an annual chain-linked Laspeyres index is as follows:

$$L_t^C = \sum_i (w_{i,t-1} \frac{C_{i,t}}{C_{i,t-1}}) * \sum_i (w_{i,t-2} \frac{C_{i,t-1}}{C_{i,t-2}}) * \ldots * \sum_i (w_{i,0} \frac{C_{i,1}}{C_{i,0}}) * 100$$

where $w_{i,t}$: relative share of value added of sector *i* at time *t*

$C_{i,t}$: volume index for sector i at time *t*

Section 6: PRESENTATION AND DISSEMINATION

The issues briefly discussed in this Section for the transmission and dissemination of ISPs compiled by national statistical agencies cover two broad areas: the form of presentation of the ISP, and their dissemination to users.

6.1 Presentation of ISPs

The main issues touching on the presentation and reporting of ISPs relate to their type and form of presentation. The information provided below is drawn largely from guidelines and recommendations outlined in the *Data and Metadata Reporting and Presentation Handbook* (OECD 2006) published by the OECD in 2006. Particular attention is drawn in various parts of this Handbook (especially in Section 5) to the need to ensure that statistics disseminated to users via various media are accompanied by appropriate methodological information (or metadata) describing key concepts and terminology and practices used in the collection of basic data, etc.

6.1.1 Presentation as an index

As outlined in Section 5.2.2 above, the heterogeneous nature of the input variables used in the compilation of the indicator necessitates the presentation of the ISP as an index. Methodologies for the compilation of the indicator in index form are presented in Section 5, and the focus of this Section are recommendations for the presentation of appropriate information about the index to enable users to assess its relevance to their particular requirement(s).

The Statistics Canada Policy on Informing Users of Data Quality and Methodology (Statistics Canada 2000, p. 11) 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. Canadian recommendation as to the range of information (or metadata) that should be provided are also relevant to ISPs. Such information comprises:

- 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; 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 any 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 detail of information targeted to different kinds of users. The OECD data and metadata presentation Handbook emphasises the need to structure metadata appropriately for users with differing degrees of expertise and need. In this context the distinction is often made between the general public who require only a layperson's explanation of key aspects relating to index compilation and informed / analytical users who require more detailed technical information.

6.1.2 Form of presentation

The question of the most appropriate form of ISP presentation is however less clear-cut, with a range of possible options. Section 5.2.3. above emphasises that a variety of forms of ISP are required by various users depending on their need for economic analyses, the most requested forms being raw, working day adjusted and seasonally adjusted series. The same Section then outlines some of the practical issues relating to the actual compilation of working day adjustment and seasonal adjustment estimates.

The *OECD Handbook on data and metadata presentation* (OECD 2006, Section 4.2) outlines a set of terminology covering concepts related to time series analysis, working day adjustment and seasonal adjustment to which readers of the ISP Manual are referred.

It should be emphasised that working day and seasonally adjusted estimates represent an analytical massaging of the raw or original time series and are intended to complement the original data and can never replace them. The original series shows the actual changes that have taken place (subject to the impact of sampling and non-sampling errors) and the other forms of presentation represent an analytical elaboration of the data to help show underlying movements.

There is continuing debate among statisticians on which is the most appropriate form for the presentation of a time series to users – raw, seasonally adjusted or trend-cycle. The outcome of the discussion is that there is generally no absolute ideal, and the final choice depends on the media for the dissemination of data and the main focus or intent of the series. Dissemination of detailed data via an on-line database could 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, perhaps in addition to original series.

The recommendations provided in the OECD Handbook on data presentation relevant to the presentation of working day adjusted or seasonally adjusted ISPs (OECD 2006, Section 4.6) are summarised below.

- 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.

- 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.

- 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. 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.

- For the benefit of informed users requiring information about the validity of the seasonal adjustment method applied, statistical agencies should provide a minimum standard of information that would facilitate an assessment of the reliability of each seasonally adjusted series.

- For analytical users, the availability of metadata is of paramount importance. The main elements of this metadata could include the following: a short standardized 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 analytic 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.

6.2 Dissemination to users

The dissemination of ISPs will be undertaken by statistical agencies in accordance with existing dissemination strategies and practices involving the release of statistics in a variety of media. These range from the release of key aggregates in press releases and summary tables on websites, the use of paper publications, CD-ROMs and finally, providing user access to more detailed data through on-line databases.

As mentioned above in the introduction in Section 1, the main aim of this Manual is to provide economic analysts with information on short-term movements in the service sector that would complement existing indices of industrial production (IIP). The introduction also mentions that such services indicators, where they exist at the national level, tend to receive less attention by users than other key indicators, often being regarded more as supplementary indicators. Possible reasons for this are outlined in Section 1.2.

In order to overcome the inertia of existing user practices, national agencies therefore need to devise strategies for placing any new output indicators for services both in the context of existing key short-term indicators (such as IIPs, price indices, employment and unemployment indicators, external trade, etc.) and in terms of the importance of the services sector and how short-term movements in services may differ from those for other sectors such as manufacturing and agriculture.

Ideally, the “promotion” of the ISP should be undertaken within a broader strategy for the development of a range of short-term indicators for services. For example, each of the short-term indicators listed above have a services “component” that should be developed and where possible sector disaggregations provided that highlight differences in short-term evolution.

The obvious targets for this information and strategies are government and non-government analysts themselves, however, there is also a need to develop a targeted approach to the media.

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ANNEXES

Annex 1

A list of proposed deflators (using UK practice as an example)

	Code	CPI	PPI
50	5010	New and used cars; other new vehicles	New cars; new and used lorries and trailers
	5020	Car maintenance and repairs	Car maintenance and repairs; lorry and truck maintenance and repairs
	5030	Motor vehicle parts and accessories	Motor vehicle parts and accessories
	5040	Motor cycles; motorcycle maintenance and repairs	Motor cycles; motorcycle maintenance and repairs
	5050	Petrol; diesel; lubricants and cooling products	None
51	511	None	None
	512	None	Agricultural raw materials; food and beverages; tobacco product excluding duty
	513	None	Textile, clothing and footwear; household furniture and appliances; other household goods
	514	None	Coal and petroleum products; metals and metal ores; wastes and scrap
	515	None	Computers and software; electronic and telecommunication equipment; office machinery and equipment
	519	None	Various miscellaneous goods
52	521	Food and beverages; cigarettes and tobacco; pharmaceutical and medical goods, cosmetic and toilet articles; textiles, clothing, footwear and leather goods; household appliances; hardware, paints and glass	None
	522	Fruit and vegetables; meat and meat products; fish seafood products; bread and cakes; cigarettes and tobacco	None
	523	Pharmaceutical and medical goods; textiles, clothing, footwear and leather goods; household appliances; hardware, paints and glass	None
	524	Antiques; second-handed books; other second-handed goods	None
	525	Food and beverages; pharmaceutical and medical goods, cosmetic and toilet articles; textiles, clothing, footwear and leather goods; household appliances; articles and	None
	526	equipment Repair of household appliances; repair of leather goods; repair of clocks and watches	None
55	5510	Hotels; domestic holidays; camping sites; restaurant meals; beer on sales; wine and spirits on sales	Conference rooms
	5520	Restaurant meals; beer on sales; wine and spirits on sales; self-service meals; burgers to eat-in; take-aways and snacks; night clubs admission; canteens and catering	Catering for functions
60	6010	Rail fares	Rail freight changes

	Code	CPI	PPI
	6021	Underground railways; other metro fares; bus and coach fares	None
	6022	Taxi and minicab fares	Non-local bus and coach journeys all hiring
	6023	None	Road haulage
61	6110	Sea travel	Sea freight (import; export)
	6120	River and canal excursions; inland ferries and water taxis	Inland waterways freight (internal and seagoing traffic)
62	6210	Internal air travel; trans-continental air travel; inter-continental air travel	Air freight (import; export)
	6220	Carter air fares ; other non-scheduled air fares	Charter air fares; other non-scheduled air fares
63	6301	None	Cargo handling
	6302	None	Storage and warehousing
	6303	None	Miscellaneous transport activities
	6304	Holidays	Travel agents and tour operators
	6309	None	Freight forwarding; freight logistic
64	6411	Letters and parcels	Letters and parcels
	6412	None	Domestic letters and parcels; trans-continental letters and parcels; inter-continental letter and parcels
	6420	Telephone services	Telephone services; transmission of radio and television programme
65	6519	Retail back fees; savings bank fees; investment fund management fees, overall CPI, general GDP deflator	Retail back fees; merchant bank fees; investment fund management fees; security transaction fees
	6592	Retail back fees; savings bank fees; investment fund management fees, overall CPI, general GDP deflator	Retail back fees; merchant bank fees; investment fund management fees; security transaction fees
66	6601	Life insurance premiums, life insurance set up fees	None
	6602	Employees' contributions	Employees' contributions
	6603	Car insurance premiums; house insurance premiums; health insurance premiums	Building insurance premiums; pecuniary loss and liability premiums
67	6711	Financial services	Financial service
	6712	Financial services	Financial service
	6719	Financial advice fees; mortgage advice fees; bureau de change commission fees	None
	6720	Insurance premium	Insurance premium
70	7010	Residential rent	Residential rent; non-residential rent
	7020	Residential rent; management fees	Non-residential rent; management fees
71	711	Car and van rental	Car and van rental; truck and trailer rental; boat rental (passenger; freight); air transport rental (passenger; freight)
	712	None	Agricultural machinery rental; construction material rental; office machinery rental
	713	Furniture and appliance rental; do-it-yourself equipment rental; records, video etc. rental	Furniture and appliance rental; flowers and plants rental
72	721	None	Consultancy (hardware; software)
	722	Software packages	Software (publishing; consultancy; production; maintenance)
	723	None	Data processing; operation of data processing facilities
	724	Internet services	Database service; online publishing
	725	None	Maintenance of (computing equipment; photocopiers; other office machinery)
	729	None	Computer disaster recovery; software installation services

	Code	CPI	PPI
73	7310	None	Research charges out rates
	7320	None	Research charges out rates
74	741	Legal services; financial services	Services (legal; financial); market research; consultancy (business; management); management holding companies
	742	Architectural services	Services (architectural; engineering); other technical consultancy; technical testing
	743	None	Advertising services; advertising space
	749	Film processing	Recruitment agencies; security services; contract cleaning; film processing; contract packaging; stenographic services
75		None	None
80	8010	Education fees (pre-primary; primary)	None
	8021	Secondary education fees (day schools; boarding schools)	None
	8022	Secondary education fees (day schools; boarding schools)	None
	8030	Degree fees; non-degree fees	None
	8090	Day and evening class fees; driving school fees; fees for vocational courses	Training course fees
85	8511	Health services	Health services
	8512	Health services; dental charges	Health services
	8519	Physiotherapy; eyesight test fees; chiropody fees; chiropractic fees	Health services
	8520	Veterinary fees	Veterinary fees
	8531	Residential care	Residential care
	8532	Non-residential care	Non-residential care
90	9000	Waste disposal	Waste disposal; contaminated waste; decontamination
91	9111	None	Legal fees; publishing of journals and periodicals
	9112	Examination fees	Legal fees; publishing of journals and periodicals
	9120	None	Legal fees; publishing of journals and periodicals
	9191	None	Building insurance; contents insurance
	9192	Alcohol	Hire of conference facilities; publishing of journals and periodicals
	9199	Alcohol; legal fees	Publishing of journals and periodicals
92	921	Tickets (cinema; theatre tickets; concert)	Advertising (cinema; television)
	922	None	News agencies
	923	Entrance fees to (museums; historical sites; botanical gardens; zoological gardens)	None
	924	Health clubs; football matches; bowling alleys; golf club membership	None
93	9301	Services (laundry; dry cleaning); carpet and rug shampooing	Services (laundry; dry cleaning); carpet and rug shampooing
	9302	Cutting (men; women); permanent; colouring; beauty treatments	None
	9303	Funeral services; grave and gravestones; crematorium fees	Maintenance of grave and gravestones
	9309	Turkish bath; escort services; coin-operated personal service machines; pet grooming and boarding	None
95	9500	Domestic service	None
96	9600	Domestic service	None
97	9700	Domestic service	None

Annex 2

Recommended variables and deflators and their sources

[Please refer the separate Excel file attached]

[This part will be removed in the final version of the manual]