METHODS AND NOMENCLATURES

1999 EDITION

Handbook on quarterly national accounts

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FOREWORD

To achieve the objectives of the European Monetary Union, we need high-quality short-term statistical instruments which provide the Community Institutions, government, the European Central Bank, National Central Banks and economic and social operators with a set of comparable and reliable short-term statistics on which to base their decisions.

The handbook on quarterly national accounts, explicitly required in the European System of Accounts (ESA 1995) and highly demanded by Member States, represents a first manual on harmonisation of quarterly national accounts as an integral part of the system of national accounts.

In agreement with the principles of the European System of Accounts (ESA 1995) and of the System of National Accounts (SNA 1993), this handbook will provide, firstly to Member States, but also to candidate countries and to non-European countries interested in the development of quarterly national accounts, a harmonised approach and a set of recommendations to be followed.

Significant progress has been achieved in the analysis and treatment of some specific features of quarterly accounts, such as accounting rules, estimation methods, treatment of seasonality and consistency between quarterly and annual accounts. Moreover some innovative concepts, like flash estimates and monthly estimation of GDP, are analysed in order to stimulate the supply to users of a more timely macro economic information. This handbook intends to provide users with a more comprehensive and accurate description of short-term behaviour of the economic system from both financial and non-financial points of view.

The handbook on quarterly national accounts is the fruit of intensive work drawing on the best experience of Member States and international organisations as well as of other experts on the subject, who worked together in a task force co-ordinated by Eurostat.

Yves Franchet

Director-General

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The manual is the result of the work of a task force initiated by *Marco DE MARCH*, co-ordinated by *Gian Luigi MAZZI* and *Roberto BARCELLAN* and chaired by *Brian NEWSON*.

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Finally, the co-ordinators accept the sole responsibility for all remaining errors in the text.

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LIST OF ABBREVIATIONS AND ACRONYMS

5BPM	Balance of Payment Manual, fifth edition
c.i.f.	cost, insurance, freight
COFOG	Classification of the Functions of Government
COICOP	Classification Of Individual COnsumption by Purpose for households
EC	European Communities
ECB	European Central Bank
ECM	Error Correction Model
ESA	European System of Accounts
EU	European Union
FD	First Difference
FISIM	Financial Intermediation Services Indirectly Measured

f.o.b.	free on board
GDP	Gross Domestic Product
GDPM	Gross Domestic Product at Market Prices
GFCF	Gross Fixed Capital Formation
ILO	International Labour Organisation
IMF	International Monetary Fund
INDS	Industries
INSEE	Institut National de la Statistique et des Etudes Economiques
ISTAT	Istituto Nazionale di Statistica
KAU	Kind-of-Activity Unit
MFI	Monetary Financial Institutions

PART I

CHAPTER 1

INTRODUCTION AND OVERVIEW

This chapter gives a broad introduction to quarterly national accounts, some history of the work in this field, the reasons for compiling quarterly accounts, a description of the uses of quarterly accounts and the principles to be followed in their compilation. It emphasises the need for harmonisation of the methods, but recognises the specific aspects of the particular economic and institutional situation in the individual countries. The aims of the handbook are therefore defined in terms of the pragmatic application of general principles. This introductory chapter is completed by the description of the structure of the handbook.

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Introduction and overview

1.01. The European System of National and Regional Accounts, 1995 (ESA 1995) states: "Quarterly economic accounts form an integral part of the system of national accounts. The quarterly economic accounts constitute a coherent set of transactions, accounts and balancing items, defined in both the non-financial and financial domains, recorded on a quarterly basis. They adopt the same principles, definitions and structure as the annual accounts" (see ESA 1995, § 12.01).

1.02. The publication further states: "The importance of quarterly accounts derives essentially from the consideration that they are the only coherent set of indicators, available with a short time-lag, able to provide a short-term overall picture of both non-financial and financial economic activity" (see ESA 1995, § 12.02).

1.03. As an integral part of the system of national accounts, using the same principles and definitions, quarterly national accounts aim to provide a measure of quarterly changes in macroeconomic aggregates. They allow economic agents to study business cycles, to statistically measure lags in the effects induced by economic shocks and to analyse dynamics.

1.04. The increasing role that the quarterly accounts have assumed in recent years demonstrates their importance for short-term economic analysis and justifies the increasing effort devoted to compiling them. Since for many countries the national accounts were and are mainly, compiled on an annual basis, the compilation and diffusion of quarterly national accounts have started relatively recently. In some countries, quarterly national accounts have quite a long tradition while in other countries their compilation started quite recently. The different consideration given to quarterly accounts shows the different role that they play in national systems of accounts. For some countries quarterly accounts represent the main national accounts activity. Great importance is attached to them and they are used to derive the annual accounts. In this case, annual accounts play a secondary role, at least in the compilation process. In other countries quarterly accounts are considered to varying degrees as a complement of the annual national accounts system.

1.05. Since the importance of quarterly accounts is quite recent, the main text references concerning national accounts did not pay much attention to the quarterly dimension. For this reason, the first versions of the United Nations System of National Accounts (SNA 1968), and of the European System of Accounts (ESA, versions 1970 and 1978) did not address any of the problems specifically associated with quarterly accounts. It should be noted that

Eurostat tried in 1972 to harmonise quarterly accounts in a document entitled SEC-TRI. This document, which contained a simplified scheme of quarterly accounts, was very interesting and innovative for that time.

Despite this simplification, the SEC-TRI was still too detailed, with respect to the existing situation of quarterly accounts, and Eurostat's proposal did not find any direct application. It should however be noted that in the early 1980s a few European Union Member States who began to produce quarterly accounts did partly follow the first draft of SEC-TRI.

1.06. Following SEC-TRI, the interest in quarterly accounts has increased and in ESA 1995 a chapter concerning quarterly national accounts was introduced (see Chapter 12, ESA 1995). This chapter is a prologue to the present handbook. It affirms the fundamental principles to use in the compilation of quarterly accounts, the reasons for their compilation and highlights the typical problems related to quarterly accounts. Its aim is to identify the accounting consequences of working to a quarterly frequency.

1.07. The two main principles developed in Chapter 12, ESA 1995 are:

- a system of national accounts should include fully integrated quarterly accounts;
- definitions, methods and principles used in quarterly accounts should be the same as those used in annual accounts.

The second principle implies that quarterly accounts should fully fit into the general system of national accounts.

1.08. Chapter 12, ESA 1995 laid the groundwork for a more detailed discussion of the issues involved in compiling quarterly accounts and anticipated this handbook. The present handbook has then to be considered as the natural extension of ESA 1995 in the field of quarterly accounts. It presents the characteristics and the principles of compilation, it suggests how to handle the particular problems related to the quarterly nature of the accounts and how to achieve good and, as far as possible, harmonised standards of quality in production of quarterly accounts.

1.09. Till now, the absence of a precise regulation regarding the production of quarterly accounts has allowed countries to choose different policies for their compilation and diffusion. In particular, countries could choose:

- whether to produce quarterly accounts or not;
- methods, norms and accounting system to be used;
- the level of breakdown and the nomenclature to be used in the compilation;
- the treatment of seasonal fluctuations and the methods of seasonal adjustment;
- the timing of publication of quarterly data.

These differences have reduced the completeness of quarterly information, and particularly the comparability of the aggregates among different countries, causing delays in the production and availability of information.

The importance of quarterly accounts, as an instrument for short-term economic analysis and for comparison between the countries, requires a common harmonised methodology to achieve good results. The harmonisation can be pursued if an agreement is reached on the guidelines to be followed in the compilation of quarterly accounts. This handbook seeks to recommend or at least suggest such guidelines.

1.10. Quarterly accounts are, as stated above, part of the system of national accounts. So they have to be coherent and consistent with the other parts of the system, particularly with the annual accounts.

Clearly the compilation of quarterly accounts has to respect the accounting principles that underlie the system of accounts of which they are a component. The principles that characterise ESA 1995 and SNA 1993 represent the main ideas and the guidelines to which quarterly accounts practices should refer.

This handbook accordingly uses these principles as the basis of the guidelines it recommends to national compilers. Specifically, the ESA 1995 principles should be considered the basis to which this handbook adds the quarterly interpretation. If something is not explicitly covered by the handbook, the compiler should refer to ESA 1995 and SNA 1993 to find the guidelines to handle the specific problem.

1.11. The ESA 1995 is an internationally compatible accounting framework consistent with the world-wide guidelines on national accounting. These guidelines, which are reported in the System of National Accounts 1993 (see SNA 1993), are the result of a co-operation between Eurostat, the OECD, the IMF, the World Bank and the United Nations.

Paragraph 1.03 of ESA 1995 establishes the principles for producing national accounts in order to measure consistently, within a framework of accounting rules:

a) the structure of the total economy;
b) some parts or specific aspects of the total economy;
c) the development of the total economy over time;
d) the total economy in relation to other total economies.

1.12. Paragraph 1.05 of ESA 1995 states that “In order to establish a good balance between data needs and data possibilities, the concepts in the ESA 1995 have eight important characteristics:

a) internationally compatible (see ESA 1995, § 1.06);
b) harmonised with those in other social and economic statistics (see ESA 1995, § 1.07);
c) consistent (see ESA 1995, § 1.08);
d) operational (see ESA 1995, § 1.09);
e) different from most administrative concepts (see ESA 1995, § 1.10);
f) well-established and fixed for a long period (see ESA 1995, § 1.11);
g) focused on describing the economic process in monetary and readily observable terms (see ESA 1995, § 1.12);
h) flexible and multi-purpose (see ESA 1995, § 1.13, 1.14, 1.15)”.

1.13. The SNA 1993 is a coherent, consistent and integrated set of macroeconomics accounts. The SNA framework has been created to cover all types of economies, spanning newly emerging market economies, economies in early stages of development and the developed economies of industrialised countries.

In this framework, the handbook of quarterly accounts derives its principles and formulates its recommendations.

1.14. In order to understand the evolution of quarterly accounts and their compilation, their possible uses and the general principles that they should respect, the remaining part of this chapter is devoted to a synthesis of the main characteristics of quarterly accounts. First of all, a brief history of the quarterly accounts is presented with reference in particular to the evolution of the conception of the quarterly accounts. The different reasons for which countries compile quarterly accounts are then analysed before presenting the possible uses of them. Finally, the general principles, derived from the ESA 1995, are presented and analysed in the quarterly framework at a detailed level.

A brief history

1.15. Quarterly accounts originated mainly because of the need for monitoring and analysis of the short-term movements of the economy. Each country needs information about the state of the economy to take economic policy decisions. Quarterly accounts can supply this kind of information in a coherent accounting framework.

Many countries started to produce national accounts after the second world war, motivated by the desire to monitor their economies. Several countries chose an annual basis for their accounts whilst some countries such as the United Kingdom and the United States of America very early stressed also the quarterly accounts. The system of accounts was developed in each country according to national concerns and accounting traditions. Comparability and harmonisation were not the main characteristics of the accounts compiled. For these reasons, the need for a harmonised set of rules for the compilation of national accounts led to the compilation of the SNA 1968 and, subsequently, of the ESA 1970. These two national accounting guidelines were mainly devoted to annual accounts.

1.16. The current situation of quarterly accounts has arisen as the consequence of a chain of events started in 1971 with the release of ESA 1970 by Eurostat. As a complement to ESA 1970, Eurostat released a document commonly referred to as SEC-TRI (1973), that drew up a simplified scheme of accounts as a suggestion to the Member States for the compilation of quarterly accounts. Since it did not supply methodological rules and it provided for an extremely detailed breakdown, it was never applied, even though it has remained an important reference for Eurostat till now.

1.17. After this first attempt, an agreement between Eurostat and OECD mainly left the compilation of quarterly accounts to OECD and the compilation of regional accounts to Eurostat.

During this period, OECD published the first edition of “Quarterly National Accounts: A Report on Sources and Methods in OECD Countries” (1979). This book was a very complete overview of the statistical sources and accounting methodologies used by OECD Member States in the compilation of quarterly accounts. However, since the book was mainly devoted to the sources used in the compilation of quarterly accounts, some specific quarterly accounts features, like the statistical methods of compilation, the treatment of seasonality, the process of revision, etc., were not discussed.

1.18. Starting from the second half of the 1980s, Eurostat was again involved in quarterly accounts themes, due to the increasing interest of the European Union Member States in this field. The first result of this new commitment was a questionnaire sent to the Member States in which all the main methodological aspects were investigated.In the last few years Eurostat has increased its engagement mainly in two areas:

- methodological support for those Member States which wanted to set up or improve their system of quarterly national accounts;
- encouraging and leading discussion of the theoretical aspects so as to achieve a satisfactory and harmonised system of European quarterly accounts.

Chapter 12, ESA 1995 represents the first step in this direction and this handbook on quarterly national accounts is the next step. Eurostat intends that quarterly national accounts should be the principal framework for short-term economic statistics, taking data from and complementing the other short-term indicators resulting from the initiatives of Eurostat in business statistics and other areas.

1.19. Most of the main subjects included in the handbook were discussed during the “Workshop on Quarterly National Accounts” (Paris, 5-6 December 1994), organised by Eurostat and INSEE.

During 1995, a Eurostat questionnaire about quarterly accounts methods was sent to the Member States and the European Union main economic partners. The information collected from the questionnaire has to be viewed as an essential starting point in the compilation of this handbook.

1.20. The last event to be mentioned in this brief history is the publication of the second edition of the OECD’s book “Quarterly National Accounts: Sources and Methods used by OECD Member Countries” (1996). This new edition updates the 1979 version and represents a very useful complement and source for this handbook.

Why do countries compile quarterly national accounts?

1.21. An increasing number of countries world-wide are interested in setting up a system of quarterly national accounts or in improving their existing ones. The reasons for this interest are:

- to provide a timelier picture of the economy;

- to recognise that quarterly accounts, as a part of national accounts, constitute the only coherent and consistent set of aggregates, accounts and balancing items able to provide a comprehensive and detailed picture of both the financial and non-financial aspects of economic activity;
- to have an instrument able to detect the phase of the economical cycle, highlighting positive and negative peaks;
- to supply a scheme of information useful for monitoring the economy and to suggest the policies to be taken with respect to the main short-term target variables.

1.22. In the past, national accounts were largely developed on an annual basis. Unfortunately, annual data have several shortcomings that make them unsuitable for purpose of short-term analysis:

- ongoing economic policy decisions, which require prompt information on short-period economic developments are inadequately supported, especially for the current year;
- business cycle fluctuations are not adequately captured because the average period of the cycle is generally not coincident with a multiple of years;
- there is a long delay after the end of the reference period before the figures are published.

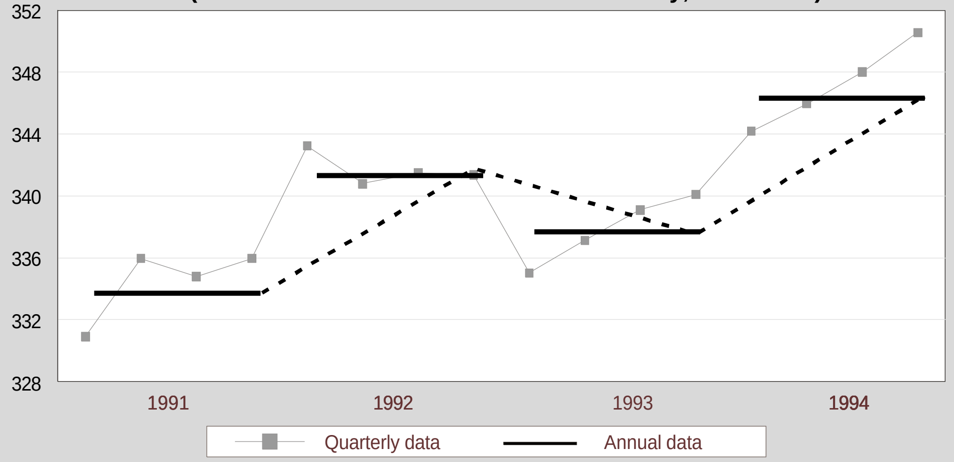
1.23. There are many readily available short-period statistics (production indices, prices, employment, external trade, business surveys) that are extensively used for short-term economic analysis. Nevertheless it must be said that:

- these statistics do not represent a coherent system;
- the statistics are often incomplete, covering only a specific aspect or sector of the economic activity;
- the classification used for the statistics in the different areas they cover is often not the same;
- the ways in which the statistics are disseminated vary considerably.

1.24. Quarterly national accounts represent a good compromise solution for the construction of a coherent and consistent system of information. Information can be recorded at high frequency and it can be based on other sub-annual statistics while remaining fully consistent with annual accounts.

The choice of the quarterly frequency for infra-annual accounts is mainly due to the need for *reliable* short-term information. The use of higher frequency (e.g. monthly) data would increase the impact of revisions and also lead to some reduction in the quality of the data. Studies concerning monthly estimates of some national accounts aggregates are discussed further in Chapter 17. These GDP indicators are in essence coincident indicators because they are not strictly produced within an accounting framework.

Figure 1.1: Comparison of monitoring business cycle turning points by annual and quarterly accounts data (volume index of GDP for Western Germany, 1991 = 100)



The use of quarterly national accounts

1.25. The use of quarterly national accounts becomes more and more important in many areas. Quarterly accounts provide an important tool for taking economic policy decisions, particularly the management of monetary and fiscal policy at national level and co-ordination at international level especially within the Economic and Monetary Union. A set of reliable quarterly figures improves macro-economic decision-making and speeds up monitoring of actions taken by economic agents.

Quarterly accounts also provide a sound basis for business cycle analysis and forecasting and in particular for a modern system of leading indicators.

In all cases, quarterly data should meet some important criteria:

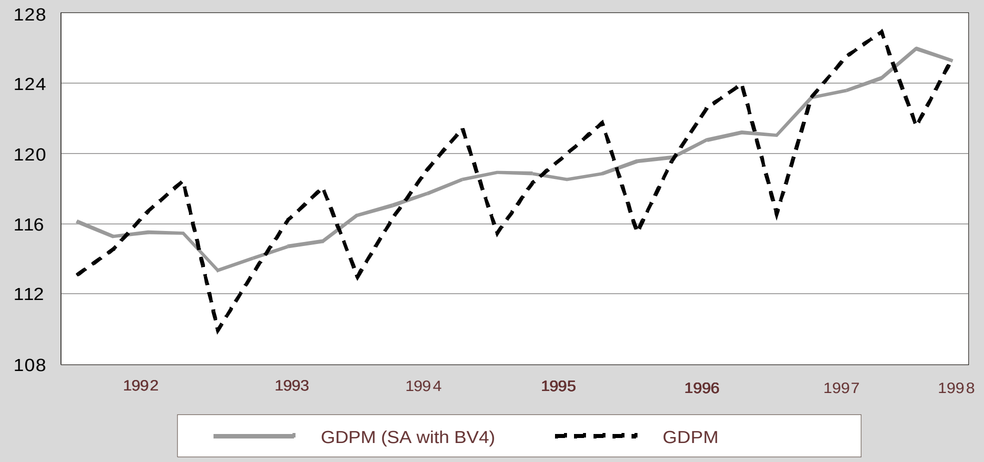
- early availability after the end of the reference period;
- high reliability of the figures (small revisions and good accuracy of the estimates);
- availability of both raw and seasonally adjusted data (see Chapter 8).

The first two criteria are clearly in conflict. The earlier we compile quarterly estimates, the greater will be the revisions, on average. It is necessary to reach a compromise between timeliness and accuracy, depending on the features in which we are mainly interested.

Some monthly statistics such as the index of industrial production, external trade statistics, and qualitative business surveys, can supplement the information coming from quarterly accounts. They can represent a good way of improving the quality of the quarterly estimates and they can be useful for the construction of a system of flash estimates (see Chapter 4 for the description of monthly available information, and Chapter 17 for flash estimates).

The availability of both seasonally adjusted and raw data (see Chapter 8) is important too. A "descriptive" short-term analysis should preferably be carried out using seasonally adjusted figures; in fact for quarterly data, the seasonal component often hides the cyclical one, obscuring and making difficult the identification of the turning points.

Figure 1.2: Comparison between raw and seasonally adjusted quarterly volume indices of GDP (Western Germany - 1991=100, data seasonally adjusted using BV4 method)



1.26. Unadjusted data is also needed for other purposes, such as econometric modelling. This is another important field where quarterly accounts are becoming more widely requested and used. These models often need unadjusted data because they can use efficiently the information contained in the seasonal component of the series, so as to improve both the calculation of the structural parameters of the models and their forecasting performance. Econometric modelling is a rather wide field, including better structural econometric models and multivariate time-series models.

These models represent a tool for economic policy making and for business cycle evaluation, as well as an instrument for structural economic analysis and simulation. Without exploring differences between the two main types of models, it should be emphasised that the use of quarterly accounts data is important for both of them.

1.27. Quarterly models may be preferred to annual models because they allow the use of more data so that the statistical inference on the parameters of the model is more reliable, and because some aspects of economic activity cannot be adequately captured using annual data. Moreover the use of annual data may prevent the analysis of dynamic relationships between economic variables.

1.28. The use of models based on quarterly accounts figures, rather than on other high-frequency data, takes full advantage of better coherence of the data set (e.g. building sector models overcomes the aforementioned classification problems between different statistical sources, etc.).

1.29. Another important point is that quarterly data may be used by the National Statistical Institutes (NSIs) for internal purposes. In fact, the data provide a convenient way to produce and/or check provisional estimates of annual accounts, avoiding the long delay before production of the final annual figures.

1.30. Finally the availability of high-frequency information on the non-financial aspects of the economy makes possible a further integration between non-financial and financial statistics (see Chapter 18).

The need for harmonisation and the steps towards it

1.31. At present there is inadequate harmonisation of quarterly national accounts, in particular at the European Union level. Starting from this point, Chapter 12 of ESA 1995 and the present handbook on quarterly national accounts suggest harmonisation practices to reduce or eliminate the differences between quarterly accounts compiled by different countries, especially the Member States. Moreover the handbook aims to define a common theoretical and empirical scheme to be followed by countries, especially European Union Member States, that intend to compile quarterly accounts. In particular, the aim of Eurostat is to offer guidelines in the fields of:

- accounting aspects;
- methods of compilation;
- seasonality and seasonal adjustment;
- the coherence of quarterly accounts;
- the process of revision;
- flash estimates;
- quarterly financial accounts.

Furthermore Annex B of the ESA 1995 Council Regulation (N^{o} 2223/96 of 25 June 1996) requires the Member States to supply a minimal data set of aggregates and accounts on a quarterly basis, which must be delivered within a fixed deadline.

Principles for the compilation of quarterly accounts

1.32. The principles used for the recommendations in this handbook derive directly from the basic principles of ESA 1995 and SNA 1993. These are clearly the general principles to which quarterly accounts compilers should refer. Some are general principles which have been adapted for particular quarterly accounts contexts and others have been explicitly re-stated to cover specific quarterly requirements.

The principles used in this handbook can be regarded as the ideal ones for the compilation of quarterly accounts. They therefore provide the handbook’s recommendations with their theoretical structure but practical considerations will often mean that solutions recommended for particular problems may differ from those which the general principles might imply.

The recommendations in these cases correspond to “second best solutions” motivated by possible practical difficulties in the compilation of quarterly accounts. However, these recommendations still contribute towards realisation of an ideal compilation methodology.

1.33. The principles for the compilation of quarterly accounts are as follows:

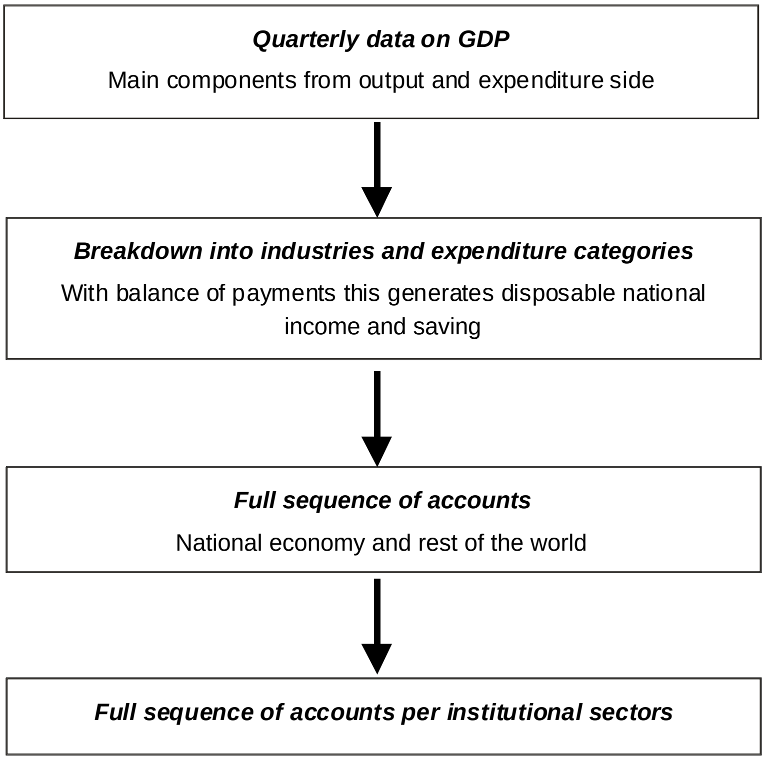
- base concepts and definitions on ESA 1995, in particular, incorporating adjustments for exhaustiveness, and deriving estimates which are on an accrual basis and meaningful;
- use quarterly data as the main basis for the accounts;
- ensure quarterly figures are meaningful by compiling them from at least some actual data;
- derive current and constant price data on a consistent basis;
- compile both unadjusted and seasonally adjusted data;
- endeavour to estimate a single, definitive figure of GDP from independent measures based on production and expenditure, and, if possible, income;
- validate estimates of GDP obtained from the two or three measures and also their components independently. Use for this purpose data from both government and non-government sources;
- balance the separate estimates in a supply-use or input-output framework, if possible simultaneously for current and constant prices, and for unadjusted and seasonally adjusted data;
- use as much detail as possible for balancing, although a broader disaggregation may be used for current prices than for constant prices. In the balancing process, all variables, including prices and seasonal adjustment factors, should be open to adjustment;
- annual estimates and the sum of the four quarterly estimates should be the same. This applies for both unadjusted and seasonally adjusted data;
- preserve the time series nature of the estimates to satisfy interest in changes as well as levels;
- monitor and endeavour to anticipate revisions;
- establish sensible compilation and publication timetables;
- consult and educate users;
- consider the importance of operational and organisational aspects to the process of improvement.

Towards a programme for compiling quarterly accounts: recommended steps

1.34. As recommended in the previous sections, quarterly accounts should be the main basis for national accounts. This means that quarterly national accounts should ideally include a full set of accounts with a sectoral breakdown. Building such a broad system of quarterly accounts is not an easily achievable objective for many countries, particularly for those with no tradition of quarterly compilation. It may therefore be helpful to set out a programme for reaching the objective in steps as follows:

a) start by having at the minimum quarterly data on GDP preferably based on the main components of the output and the expenditure measures;

Figure 1.3:
A milestone program for the compilation of quarterly national accounts



b) in the short-term, produce breakdowns into industries and expenditure categories (which together with balance of payments data would also generate data on important variables such as disposable national income and national saving);

c) define the full sequence of accounts for the national economy and the rest of the world;

d) provide the full sequence of accounts by institutional sector.

These steps lead to the compilation of a complete system of quarterly accounts and can represent the natural path for setting up or improving quarterly national accounts according to the recommendations which follow in this handbook.

Aims of the handbook

1.35. The aims of this handbook can be described as follows:

- to propose a simplified accounting scheme to be followed in compiling quarterly accounts;

- to supply a set of methodological rules to deal with those accounting aspects which are specific to quarterly accounts and are caused by their higher frequency of compilation than that of annual accounts;
- to recommend to the Member States, as well as to all the countries that need to improve their system of national accounts, a set of voluntary quarterly tables to add to the set of compulsory tables required by Annex B of the ESA 1995 Council Regulation;
- to suggest an appropriate set of basic statistics and their use in particular areas of quarterly accounts;
- to make suggestions concerning the statistical methodologies used in the compilation of quarterly accounts and in the seasonal adjustment of quarterly series;
- to supply a set of rules for time consistency and balancing of quarterly accounts in a coherent accounting framework, in order to ensure full consistency between annual and quarterly account;
- to discuss the issues related to the production of flash estimates and monthly estimates.

The primary objective of this handbook is to supply to the Member States with a common set of rules to build a harmonised system of quarterly accounts. Even though the handbook has been mainly conceived for the European Union Member States, as recommended in ESA 1995, its application is quite general and it can be used by other countries which intend to improve their existing quarterly accounts or to establish a system of quarterly accounts. This handbook is the first publication proposing in-depth harmonisation of quarterly accounts and for this reason it can be considered as an essential reference source by all the countries which are or will be involved in the compilation of quarterly accounts.

The structure of the handbook

1.36. The structure of the handbook has been designed to give the reader a logical path to be followed when compiling quarterly accounts. The framework is represented by ESA 1995 and SNA 1993 and their principles. Starting from this point the main quarterly issues are treated in the eight parts of the handbook:

I. Introduction
II. Accounting aspects
III. Methods of compilation
IV. Seasonality and seasonal adjustment
V. Coherence of the quarterly accounts
VI. The process of revision
VII. Flash estimates
VIII. Financial accounts

1.37. Part I corresponds to the present introduction to the handbook. It helps the reader to understand the context which has generated the handbook, the relations with ESA 1995 and SNA 1993, the history, the reasons and the principles for the compilation of quarterly accounts.

1.38. Part II provides a set of accounting rules derived from ESA 1995 and SNA 1993 and adapted to the quarterly context. Chapter 2 illustrates a simplified scheme for the compilation of quarterly accounts. With this scheme as the starting point, some accounting rules, which allow for the specific character of quarterly accounts are defined in Chapter 3. The basic statistics commonly used in the countries for the compilation of quarterly accounts are then presented in Chapter 4. In this chapter Eurostat draws on theoretical knowledge and empirical experience as well as European statistical legislation to propose an optimal set of short-term harmonised statistics to be used in compiling quarterly accounts.

1.39. Part III deals with compilation methods and puts forward algorithms which relate the available information to the choice of the best compilation method (see Chapter 5). The use of basic statistics in the accounting framework is illustrated in Chapter 5. Chapter 6 presents the mathematical and statistical methods which are currently used to compile quarterly accounts and/or to improve the quality of the basic information. Some examples and suggestions concerning the use of the basic statistics according to the different methods are illustrated in Chapter 7.

1.40. Part IV discusses the problems of the treatment of seasonal fluctuations in quarterly accounts, giving a theoretical assessment (see Chapter 8) and an overview of the more common methods for seasonal adjustment. Chapter 9 presents a set of optimal practices proposed by Eurostat in the field of seasonal adjustment, the aim of which is to work towards a consensus on seasonal adjustment practices.

1.41. Part V analyses the consistency of quarterly accounts. Time consistency between quarterly and annual accounts is discussed in Chapter 10. The accounting consistency is then examined along with the different approaches that can ensure it (see Chapter 11). The quarterly estimation in the current year and the optimal estimation of the preliminary annual figures is analysed in Chapter 12. This part ends with a detailed analysis of the validation procedures for quarterly estimates (see Chapter 13).

1.42. Part VI is devoted to the analysis of the revision process and its repercussions on quarterly accounts. Chapter 14, deals with the analysis of the causes and the effects of revisions on a quarterly basis and proposes a standard scheme of revision. Chapter 15 discusses how past revisions can help in improving future reliability.

1.43. Part VII proposes some advanced techniques to produce high quality flash estimates of quarterly accounts (see Chapter 16) and some suggestions to construct monthly estimates of the main national accounts aggregates (see Chapter 17).

1.44. Part VIII illustrates a simplified scheme of quarterly financial accounts (see Chapter 18).

1.45. The handbook concludes with Annex A which reproduces the compulsory tables taken from Annex B of the ESA 1995 Regulation and also a set of voluntary tables which Eurostat is proposing specifically for quarterly accounts. A set of explanatory guidance notes is also included.

PART II

CHAPTER 2

THE COVERAGE OF QUARTERLY ACCOUNTS

Quarterly national accounts are a quarterly application of the standard ESA 1995/SNA 1993 system of national accounts, using the same accounting framework, definitions of institutional units, transactions and accounting rules. But the short-term quarterly data follow a simplified scheme because the purpose of quarterly accounts is to track movements in key macroeconomic aggregates, not to provide the same structural detail of the economy as annual accounts, and to aid rapid compilation, recognising that there are less data available quarterly. These results are useful for a variety of analytical and policy economic purposes.

The quarterly accounts are a subset of annual accounts. They follow the same principles and scheme of annual accounts, are fully coherent with the latter but less detailed concerning institutional sectors, industry grouping and the sequence of accounts. They give up-to-date and reliable information on the structure and development of the economic situation of a country. The statistical methods used for compiling quarterly accounts may differ quite considerably from those used for the annual accounts. There are three ways, usually called approaches, of calculating GDP. The output approach is based on the calculation of output and intermediate consumption of the various industries of the economy. The expenditure approach is based on estimates of the components of final demand. The income approach calculates GDP from separate estimates of the components of income generated in production. There are several methods of integration of the three approaches: integration at the micro level, at the macro level and a third method of integration is based on the relationship between the current and capital accounts and the financial accounts, through the analysis by institutional sector.

The importance of quarterly economic accounts derives essentially from the fact that they are the only coherent set of indicators, available with a short time-lag which can provide a short-term overall picture of both non-financial and financial economic activity.

The coverage of quarterly accounts

2.01. The quarterly accounts can be regarded as a simplified system of the annual accounts. This chapter clarifies the set and the structure of data to be collected in order to establish quarterly national accounts and discusses the scheme for quarterly national accounts. From quarterly national accounts data it is possible to monitor the movements of major economic flows such as output, GDP, private consumption, government consumption, gross fixed capital formation, change in stocks, exports, imports, wages, profits, taxes, lending and borrowing. These results are useful for a variety of analytical and economic policy purposes. The flows of goods and services are recorded at both current and constant prices. Key aggregates like gross domestic product are widely used as indicators of economic activity at the level of the total economy. It should be mentioned that there are problems in obtaining quarterly data, in particular that businesses have less detailed information, while there is a need to keep the form-filling burden to manageable levels.

2.02. According to ESA 1995, § 12.01 “the quarterly economic accounts form an integral part of the system of national accounts”. “The quarterly economic accounts constitute a coherent set of transactions, accounts and balancing items, defined in both non-financial and financial domains, recorded on a quarterly basis. They adopt the same principles, definitions and structure as the annual accounts, subject to certain modifications, due to the period of time covered”.

2.03. Quarterly national accounts are a quarterly application of the standard ESA 1995/SNA 1993 system of national accounts using the same accounting framework, definitions of institutional units, transactions and accounting rules. For quarterly accounts most of the standard classifications apply at a higher level of aggregation. This is because the purpose of quarterly accounts is to give an overall picture of the short-term macroeconomic situation and evolution, rather than to provide the same structural detail of the economy as annual accounts. Moreover, quarterly accounts track movements in key macroeconomic aggregates and so need to be compiled quickly. It is also the case that data is usually available in less detail at a quarterly frequency.

Therefore the main variables compiled are:

- GDP;
- main expenditure components;
- value added and compensation of employees by broad industry groups;
- employment;
- employment by broad industry groups;
- population;
- main income aggregates
  - for total economy;
  - for the rest of the world;
- simplified non-financial sector accounts;
- financial accounts variables.

System of quarterly accounts

2.04. The quarterly accounts constitute a totally coherent subset of the annual accounts (see Chapter 12 of the ESA 1995). The statistical methods used for compiling quarterly accounts may differ quite considerably from those used for the annual accounts. The methods are described and discussed in Part III of this handbook. Since quarterly accounts adopt the same framework as annual accounts, they have to be consistent with them over time. This implies, in the case of flow variables, that the sum of the quarterly data is equal to the annual figures for each year (see Chapter 10). In addition, the accounting identities should be respected for each quarter (see Chapter 11).

2.05. There are three ways, usually called approaches, of calculating GDP:

- Output approach;
- Expenditure approach;
- Income approach.

Each approach is based on a different view of the economic system using and measuring different aggregates. Together they give a summary of the logical relationships within the

Gross value added (basic prices)	=	Output (basic prices)	-	Intermediate consumption

system of national accounts, and they should all give the same result for GDP if each item is estimated correctly.

2.06. The output approach is based on the calculation of output and intermediate consumption of the various industries of the economy. Gross value added of an industry is defined as the

Gross value added (market prices)	=	Gross value added (basic prices)	+	Taxes on products	-	Subsidies on products

difference between output (basic prices) and intermediate consumption (basic prices)

Gross value added (basic prices)
= Output (basic prices)
- Intermediate consumption

GDP at market prices is then calculated as the sum of gross value added (basic prices) of all industries/branches plus taxes on products less subsidies on products.

Gross value added (market prices)

GDP	=	Final consumption expenditure (households, NPISHs)	+	Final consumption expenditure (government)	+	Gross fixed capital formation
	+	Changes in inventories	+	Exports	-	Imports

= Gross value added (basic prices)
+ Taxes on products
- Subsidies on products

2.07. The expenditure approach is based on estimates of the components of final demand:

GDP	=	Compensation of employees	+	Gross operating surplus/mixed income	-	Taxes on production and imports	-	Subsidies

GDP

= Final consumption expenditure (by households, non-profit institutions serving house holds -NPISHs- and the government, in purchasers' prices)
+ Final consumption expenditure by the government
+ Gross fixed capital formation (purchasers' prices)
+ Changes in inventories (purchasers' prices)
+ Exports (f.o.b.[1])
- Imports (c.i.f.[2]).

2.08. The income approach calculates GDP from separate estimates of the components of the value added of industries, branches or sectors:

GDP
= Compensation of employees
+ Gross operating surplus/mixed income
+ Taxes on production and imports
- Subsidies.

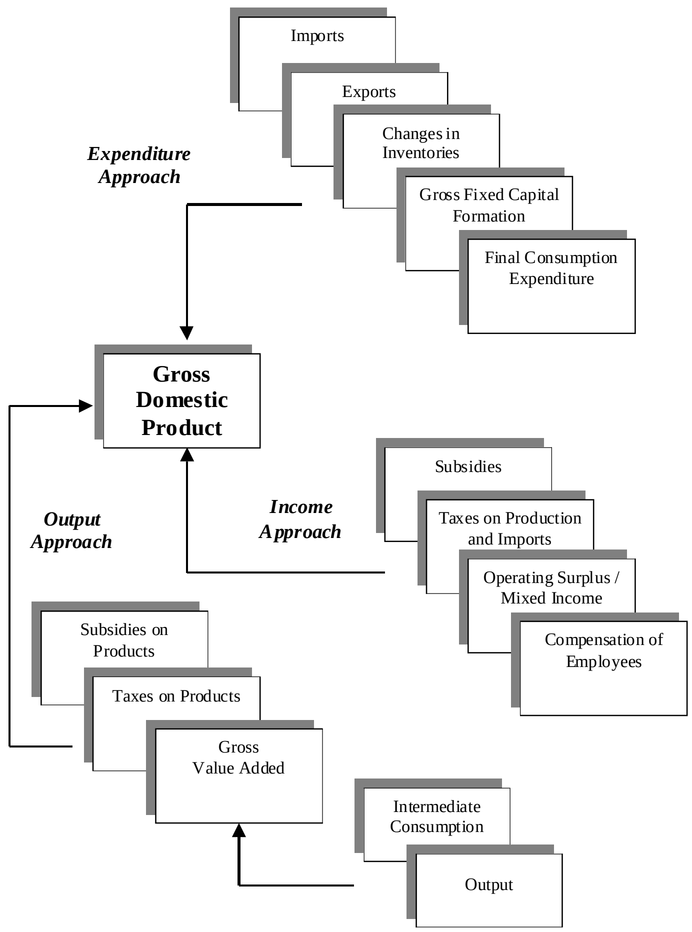
2.09. The logical equality of the outcomes of the three approaches makes it possible to validate the reliability of the estimates resulting from the three approaches (see Chapter 13). Usually in practice the outcomes of the three calculations are not the same. That can be put down to the fact that, different concepts applied in surveys, sample sizes, periodicity, time of questioning, registers, variables, statistical units etc. lead to estimation differences. This, however, assumes that the estimates of the various variables in the three approaches are made independently of each other.

The three approaches to the compilation of GDP have to be considered independent from a theoretical point of view. If the same sources are used in the three approaches the achievement of their independence is clearly more difficult. The independence of the three approaches is thus mainly about the independence of the sources. It is not always the case however that independence in this sense guarantees better estimates.

The best results for GDP are obtained if estimates from independent sources are available for each of the components of the three approaches. In that case, a real comparison of the information originating from different sources becomes possible. In practice, several items will be estimated from the same sources, making the estimates less independent. For example, the estimates of household consumption are often based to a large extent on output data. This reduces the independence of the output and the expenditure approaches. Also, estimates of the operating surplus of industries are often based on data on production, intermediate consumption and compensation of employees. In that case, the output and income approaches are not independent either. In addition, some variables are, in many cases, computed as a residual: this is often the case with the changes in inventories in the expenditure approach or of the gross operating surplus in the income approach (see OECD,

1 f.o.b. = free on board
2 c.i.f. = cost insurance freight

Figure 2.1: The three approaches to the calculation of Gross Domestic Product



Quarterly National Accounts - Sources and Methods in OECD Countries). It will usually not be possible to compile completely independent estimates of the three GDP approaches.

2.10. It cannot be said in general which of the three approaches is the most reliable approach. This depends on the quality of the sources underlying the variables in each of the three approaches and the institutional settings in the various countries. In many countries the output estimates are considered to have the highest reliability in the short-term. At present reliable estimates from the income side are available in only a few countries. It is the aim of the integration process to determine the most reliable sources, the most reliable approach, and, in the end, what is the best estimate of GDP and other national accounts variables.

2.11. There are basically three methods of integration of the three approaches:

- integration at the macro level;
- integration at the product or industry level;

- integration in the institutional sector accounts.

2.12. *Integration at the macro level*

The simplest of the three methods involves making different estimates of GDP using output, expenditure and income approaches, which are compiled independently and the three results are only compared at the last stage to reconcile them or identify the best estimate. There is only a limited comparison of the sources which underlie the different approaches,

which makes the results of the three approaches more independent, but does not guarantee a fully consistent system, and causes of errors are not determined. Supply and use tables (or input-output tables) are compiled afterwards, sometimes long afterwards, that is after the GDP has been determined.

2.13. *Integration at the product or industry level*

All sources of information are compared at a detailed product level, usually in a supply/use framework. The key characteristic of this system is a common product classification for all purposes (i.e. for output, intermediate consumption, household consumption, capital formation, foreign trade, etc.). All data on macro variables are broken down in this product classification, which enables analysis at this detailed level, using the fact that supply and use of each product group should be equal. Countries are therefore urged to carry out the reconciliation at the greatest level of disaggregation compatible with the available information. This level can differ between countries due to the development of national statistical systems and to delays in the availability of the information. All the same, the level of disaggregation for reconciliation purposes has to be higher than the one published.

2.14. *Integration in the institutional sector accounts*

The starting point of this method is the difference between the capital and the financial account by institutional sector. These are calculated quite independently, from totally different sources, and typically give very different estimates of what should in principle be the same balancing item the net lending/borrowing for each sector.

2.15. The three approaches themselves are not kept separate, but an attempt is made to find an independent estimate for each item of the supply and use balances. It is impossible to determine independent levels of GDP from the three approaches: there is only one GDP, resulting from a system that is made consistent on the most detailed level. In practice of course, most methods are between these extremes. From the point of view of the reliability and exhaustiveness of the national accounts estimates, the method of integration at the product level is the preferred one and countries are strongly recommended to adopt it.

Of course, most methods are in between these extremes. For example, in the aggregate method one may align sources beforehand; this does however reduce the independence of the resulting estimates. Also, one can compare two or more sources for the same variable without analysing the product detail. Furthermore, the level of detail of the product classification in the supply/use framework is of importance for the possibilities of the analysis: insufficient detail may prohibit valid comparison of data. For the income approach an integration at industry level is often used.

Eurostat recommends compilation of GDP according to the three approaches because this results in a more complete picture of the economy. A mere reconciliation at micro level only allows a balancing of the output and the expenditure approach but does not include the income side. This procedure would be regarded as insufficient. To include the income side, there is additional need for integration in the institutional sector accounts and also at the macro level.

In the system, the balancing item of the financial account is identical with the balancing item of the capital account. In practice, a discrepancy will usually be found between them because they are calculated on the basis of different statistical data. The financial account (see Chapter 18) is the final account in the full sequence of accounts that records transactions.

2.16. As with the annual accounts, the quarterly ones are broken down by both:

- institutional sectors;
- industries.

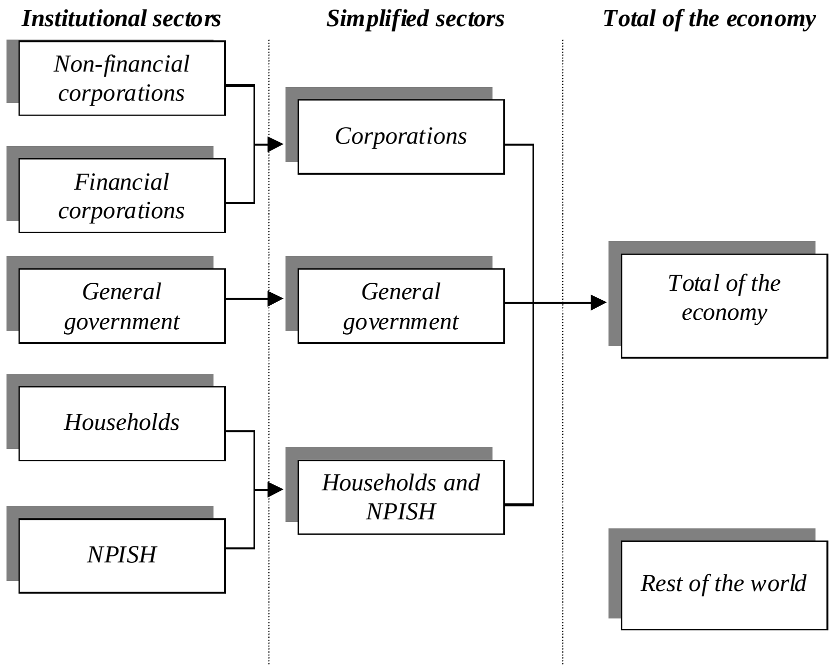
Taking into account the limited set of information used in compiling quarterly accounts, the recommendation is to simplify the disaggregation scheme used for annual accounts.

Institutional sectors

2.17. *Definition*

Institutional units are economic entities that are capable of owning goods and assets, of incurring liabilities and of engaging in economic activities and transactions with other units in

Figure 2.2: Institutional sectors, quarterly simplification



their own right (see ESA 1995, § 1.28; SNA 1993, § 4.02).
For the purposes of the system, the institutional units are grouped together into six mutually exclusive institutional sectors composed of the following types of units:

- non-financial corporations;
- financial corporations;
- general government;
- households;
- non-profit institutions serving households (NPISHs);
- rest of the world.

The first five sectors together make up the total economy.

2.18. For our purposes in quarterly accounts we simplify this breakdown into four macro-sectors defined as follows:

- corporations;
- general government;
- household sector (including NPISHs);
- rest of the world.

2.19. Definition: Corporations

Table 2.1: NACE Rev.1 A60

Code	Description		Code	Description
1	Agriculture, hunting and related service activities	->	AA	Agriculture, hunting and forestry
2	Forestry, logging and related service activities			
5	Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing	->	BB	Fishing
10	Mining of coal and lignite; extraction of peat	->	CA	Mining and quarrying of energy producing materials
11	Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction excluding surveying			
12	Mining of uranium and thorium ores			
13	Mining of metal ores	->	CB	Mining and quarrying except energy producing materials
14	Other mining and quarrying			
15	Manufacture of food products and beverages	->	DA	Manufacture of food products; beverages and tobacco
16	Manufacture of tobacco products			
17	Manufacture of textiles	->	DB	Manufacture of textiles and textile products
18	Manufacture of wearing apparel; dressing and dyeing of fur			
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwea	->	DC	Manufacture of leather and leather products
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	->	DD	Manufacture of wood and wood products
21	Manufacture of pulp, paper and paper products	->	DE	Manufacture of pulp, paper and paper products; publishing and printing
22	Publishing, printing and reproduction of recorded media			
23	Manufacture of coke, refined petroleum products and nuclear fuel	->	DF	Manufacture of coke, refined petroleum products and nuclear fuel
24	Manufacture of chemicals and chemical products	->	DG	Manufacture of chemicals, chemical products and man-made fibres
25	Manufacture of rubber and plastic products	->	DH	Manufacture of rubber and plastic products
26	Manufacture of other non-metallic mineral products	->	DI	Manufacture of other non-metallic mineral products
27	Manufacture of basic metals	->	DJ	Manufacture of basic metals and fabricated metal products
28	Manufacture of fabricated metal products, except machinery and equipment			
29	Manufacture of machinery and equipment n.e.c.	->	DK	Manufacture of machinery and equipment n.e.c.
30	Manufacture of office machinery and computers	->	DL	Manufacture of electrical and optical equipment
31	Manufacture of electrical machinery and apparatus n.e.c.			
32	Manufacture of radio, television and communication equipment and apparatus			
33	Manufacture of medical, precision and optical instruments, watches and clocks			
34	Manufacture of motor vehicles, trailers and semi-trailers	->	DM	Manufacture of transport equipment
35	Manufacture of other transport equipment			
36	Manufacture of furniture; manufacturing n.e.c	->	DN	Manufacturing n.e.c.
37	Recycling			
40	Electricity, gas, steam and hot water supply	->	EE	Electricity, gas and water supply
41	Collection, purification and distribution of water			
45	Construction	->	FF	Construction
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	->	GG	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods
51	Wholesale trade and commission trade services, except of motor vehicles and motorcycles			
52	Retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods			
55	Hotel and restaurant services	->	HH	Hotels and restaurants
60	Land transport and transport via pipeline services	->	II	Transport, storage and communication
61	Water transport services			
62	Air transport services			
63	Supporting and auxiliary transport services; travel agency services			
64	Post and telecommunication services			
65	Financial intermediation services, except insurance and pension funding services	->	JJ	Financial intermediation
66	Insurance and pension funding services, except compulsory social security services			
67	Services auxiliary to financial intermediation			
70	Real estate services	->	KK	Real estate, renting and business activities
71	Renting services of machinery and equipment without operator and of personal and household goods			
72	Computer and related services			
73	Research and development services			
74	Other business services			
75	Public administration and defence services; compulsory social security services	->	LL	Public administration and defence; compulsory social security
80	Education services	->	MM	Education
85	Health and social work services	->	NN	Health and social work
90	Sewage and refuse disposal services, sanitation and similar services	->	OO	Other community, social and personal service activities
91	Membership organisation services n.e.c.			
92	Recreational, cultural and sporting services			
93	Other services			
95	Private households with employed persons	->	PP	Private households with employed persons
99	Services provided by extra-territorial organisations and bodies	->	QQ	Extra-territorial organisations and bodies

Code	Description	Code	Description
A	Agriculture, hunting and forestry	1	Agriculture, hunting and forestry;fishing and operation of fish hatcheries and fish farms
B	Fishing		
C	Mining and quarrying	2	Industry, including energy
D	Manufacturing		
E	Electricity, gas and water supply		
F	Construction	3	Construction
G	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	4	Wholesale and retail trade, repair of motor vehicles and household goods, hotels restaurants; transport and communications
H	Hotels and restaurants		
I	Transport, storage and communication		
J	Financial intermediation	5	Financial, real-estate, renting and business activities
K	Real estate, renting and business activities		
L	Public administration and defence; compulsory social security	6	Other service activities
M	Education		
N	Health and social work		
O	Other community, social and personal service activities		
P	Private households with employed persons		
Q	Extra-territorial organisations and bodies		

The corporate sector includes corporations producing goods, market non-financial services and financial services (see ESA 1995, § 2.21 and 2.32; SNA 1993, § 4.07 and 4.08); i.e. it includes both the non-financial corporations and financial corporations sector.

2.20. Definition: General government

The general government sector includes all institutional units which are other non-market producers whose output is intended for individual and collective consumption, and mainly financed by compulsory payments made by units belonging to other sectors, and/or all institutional units principally engaged in the redistribution of national income and wealth (see ESA 1995, § 2.68; SNA 1993, § 4.113).

2.21. Definition: The household sector

This macro-sector includes households and non-profit institutions serving households. The personal sector consists of the individuals or groups of individuals as consumers and possibly also as producers of market goods and non-financial and financial services

provided that, in the latter case, the corresponding activities are not those of separate entities treated as quasi-corporations. The non-profit institutions serving households (NPISHs) sector consists of non-profit institutions which are separate legal entities, which serve households and which are private other non-market producers (see ESA 1995, § 2.75 and 2.87, 4.10, 4.151 and SNA 1993, § 4.161-162).

2.22. This simplified classification of the institutional sectors is totally coherent with the ESA 1995 and SNA 1993. The ‘rest of the world’ sector is described in ESA 1995, § 2.08 and in SNA 1993, § 4.163. It is important to emphasise the relevance of simplified quarterly accounts for institutional sectors for example in the perspective of European Economic and Monetary Union, in particular because they provide a quarterly computation of the net lending of general government.

Industry groupings

2.23. *Definition*

An industry consists of a group of local KAUs (Kind of Activity Unit) engaged in the same, or similar, kind of activity. At the most detailed level of classification, an industry consists of all the local KAUs falling within a single class (4 digits) of NACE Rev.1 and which are therefore engaged in the same activity as defined in the NACE Rev. 1 (see ESA 1995, § 2.108; SNA 1993, § 5.40).

2.24. For present purposes, the industries are broken down into six industry groupings according to classification A6 (NACE Rev.1 sections). On a voluntary basis, consideration can also be extended to two more detailed groupings of industries: at the one-letter and two letter levels of NACE Rev.1. Table 2.1 will describe the aggregation process starting from the two digit level of NACE Rev.1. Industries are classified into the following six subdivisions:

- agriculture, hunting and forestry, fishing;
- industry, including energy;
- construction;
- wholesale, retail trade; repair; hotels and restaurants; transport, communication;
- financial, real-estate, renting and business activities;
- other service activities.

Trade, transport and communication can be separately identified.

The sequence of accounts

2.25. The sequence of accounts is composed of:

- production account;
- distribution and use of income accounts;
- capital account;
- financial account.

They can be used to obtain the most important balancing items:

- value added;
- operating surplus;
- mixed income;
- disposable income;
- saving;
- changes in net worth, due to saving and capital transfers;
- net lending/net borrowing.

Vital aggregates included are:

- domestic product;
- national income;
- national disposable income;
- national saving.

2.26. Tables 2.2 and 2.3 are abbreviated versions respectively of the Goods and Services Account and the Aggregated accounts for Institutional Sectors. In comparison with the sequence of accounts for annual results the accounts here are in some cases grouped together, and only the items available on a quarterly level appear. The Goods and Services Account shows, by product group and for the total economy, how the products available are used. It therefore shows the resources (output and imports) on the left-hand side and the uses of goods and services (intermediate consumption, final consumption, capital formation and exports) on the right. The Goods and Services Account is by definition in balance and therefore has no balancing item. The accounts II.1.2.1 Entrepreneurial income and II.1.2.2 Allocation of other primary income are merged in the II.1.2 Allocation of primary income account. There is no Redistribution of income in kind account (II.3) at quarterly level. The II.4.1 Use of disposable income account and II.4.2 Use of adjusted disposable income account are replaced by II.4.1 Use of Income Account. The III.1.1 Change in net worth due to saving and capital transfers account and III.1.2 Acquisition of non financial assets account are merged in the III.1 Capital Account. The III.2 Financial account is presented in a compressed form.

2.27. There is a check on the flows of goods and services in the **goods and services account** (see ESA 1995, § 8.78-82; SNA 1993, § 2.154-159). The **production account** (see ESA 1995, § 8.10-14; SNA 1993, § 6.01-04) is the first in the sequence of accounts compiled for industries, institutional sectors and the total economy, with the three basic elements: output, intermediate consumption and consumption of fixed capital. The balancing item in the production account is value added. Total GDP can be estimated from the production account.

2.28. The balancing item is carried forward to the **generation of income account** (see ESA 1995, § 8.15-20; SNA 1993, § 7.01-05), which is the first account of the **primary distribution of income accounts**. It analyses the extent to which value added can cover compensation of employees and other taxes less subsidies on production. It measures the operating surplus/mixed income, which corresponds to the income which the units obtain from their own use of their production facilities. It is the last balancing item which can be calculated for the industries, the institutional sectors, and the total economy.

2.29. The operating surplus/mixed income is then carried forward to the **allocation and distribution of income accounts** (see ESA 1995, § 8.16-8.35; SNA 1993 Chapters 7 and 8). These accounts show how primary incomes are distributed among institutional sectors, and the redistribution of these incomes. The balancing item at the end of the accounts is disposable income.

Table: 2.2: Goods and services account

	Output	Imports	Total	Intermediate consumption	Final consumption of households	Final consumption expenditure govt.	Capital formation	Exports
prod 1								
prod 2								
...								
...								
...								
...								
...								

Table 2.3: Aggregated accounts for Institutional sectors

Corporation	Households	Govt.	ROW[1]		Corporation	Households	Govt.	ROW[1]
				I. Production Account				
				Output	1855	1306	434	
910	700	246		Intermediate consumption				
945	606	188		Gross value added				
147	45	30		Consumption of fixed capital				
798	561	158		*Net value added*				
				II.1.1 Generation of income account				
560	62	140		Compensation of employees				
89	3	2		Taxes on production				
-35	-1			*less* Subsidies on production				
184	497	16		*Operating surplus/mixed income*				
				II.1.2 Allocation of primary income account				
				Compensation of employees		766		2

				Taxes on production			235	
				less Subsidies on production			-36	
				Operating surplus/Mixed income (net)	184	497	16	
283	51	46	66	Property income	238	139	30	39
91	1351	191		*Balance of primary incomes/Net nat. inc.*				
				II.2 Secondary Distribution of income account				
34	178		1	Current taxes on income and wealth			213	
	322			Social contributions	53	1	268	
42	1	289		Social benefits (o/t[2] soc.transf.in kind)		332		
57	73	139		Other current transfers				
70	1182	352		*Disposable income (net)*				
Corporation	**Households**	**Govt.**	**ROW[1]**		**Corporation**	**Households**	**Govt.**	**ROW[1]**
				II.4.1 Use of Income Account				
	1009	362		Final consumption expenditure				
11	0	0	0	Adj. net equity pension funds		11		0
59	184	-10		*Saving (net)*				
				III.1 Capital Account				
				Capital transfers	10	15	-28	5
-147	-45	-30		Consumption of fixed capital				
259	80	37		Gross fixed capital formation				
26	2			Changes in inventories				
2	5	3		Valuables				
-7	5	2		Acquisition non-produced, non-finan. assets				
-64	152	-50	-38	*Net lending(+)/net borrowing(-)*				
				III.2 Financial account				
-1			1	Monetary gold and SDRs				
32	80	7	11	Currency and deposits	130		2	-2
71	41	26	5	Securities o/t[2] shares	59		64	20
194	5	45	10	Loans	71	52	94	37
5	3	36	2	Shares and other equity	39	4		3

	36			Insurance technical reserves	36			
7	48	6	21	Other accounts receivable and payable	37	5	10	30

[1] ROW = rest of the world

[2] o/t = other than

2.30. The purpose of the **use of income account** is to show how the household sector and general government allocate their disposable income between final consumption and saving (see ESA 1995, § 8.36-43; SNA 1993, § 9.01-05). The use of income account leads to the balancing item 'net saving'.

2.31. The purpose of the **capital account** (see ESA 1995, § 8.46-47; SNA 1993, § 10.20-31) is to record the values of the non-financial assets that are acquired, or disposed of, by resident institutional units by engaging in transactions and to show the change in net worth due to saving and capital transfers. The resources side of the account records the resources available for the accumulation of assets. These consist of net saving, the balancing item carried forward from the use of income account, and net capital transfers. The uses side of the account records the values of the non-financial assets acquired, or disposed of, in transactions of various kinds. Some categories of changes in assets are distinguished in the capital account: gross fixed capital formation, and changes in inventories (including acquisitions less disposals of valuables, and acquisitions less disposals of non-produced non-financial assets). The balancing item of the capital account is net lending or borrowing.

2.32. The **financial account** (see ESA 1995, § 8.50-51; SNA 1993, § 11.01-04) records transactions that involve financial assets and liabilities and that take place between institutional units, and between institutional units and the rest of the world. The left side of the account records acquisitions less disposals of financial assets, while the right side records incurrence of liabilities less their repayment. Net incurrence of liabilities less net acquisition of financial assets is equal in value, with the opposite sign, to net lending/borrowing, the balancing item in the capital account. The conceptual identity between the balancing items provides a check on the numerical consistency of the set of accounts as a whole, although the two balancing items are likely to diverge significantly in practice because of errors of measurement.

Price concepts

2.33. This section is about the different price concepts used: market prices, purchasers' prices and basic prices.

Market prices are ESA's basic reference for valuation (see ESA 1995, § 1.51; SNA 1993, § 2.68). Because of transport costs, trade margins and taxes less subsidies on products, the producer and the user of a given product usually perceive its value differently. In order to keep as close as possible to the views of the transactors, the system records all uses at purchasers' prices, which include transport costs, trade margins and taxes less subsidies on products, while output is recorded at basic prices, which exclude these elements (see ESA 1995, § 1.54; SNA 1993, § 3.83).

At the time of purchase, the **purchasers' price** is the price the purchaser actually pays for the products;

- including any taxes less subsidies on the products (but excluding deductible taxes like VAT on the products);
- including any transport charges paid separately by the purchaser to take delivery at the required time and place;
- after deductions for any discounts for bulk or off-peak-purchases from standard prices or charges;
- excluding interest or service charges added under credit arrangements;
- excluding any extra charges incurred as a result of failing to pay within the period stated at the time the purchases were made (see ESA 1995, § 3.06; SNA 1993, § 6.215).

The **basic price** is the price receivable by the producers from the purchaser for a unit of a good or service produced as output minus any tax payable on that unit as a consequence of its production or sale (i.e. taxes on products), plus any subsidy receivable on that unit as a consequence of its production or sale (i.e. subsidies on products). It excludes any transport margins charged by the producer on the same invoice, even when they are included as a separate item on the invoice (see ESA 1995, § 3.48; SNA 1993, § 6.205).

The transaction categories

2.34. The following sections give definitions of essential bookkeeping items which occur in the accounts and tables. (Note: some items are identified by codes of letters and numbers which refer to their designations in ESA 1995).

2.35. **Final consumption expenditure** may take place on the domestic territory or abroad (see ESA 1995, § 3.75; SNA 1993, § 9.93). All household final consumption expenditure is individual. By convention, all goods and services provided by NPISHs are treated as individual (see ESA 1995, § 3.84; SNA1993, § 9.90). For the goods and services provided by government units, the borderline between individual and collective goods and services is drawn on the basis of the Classification Of the Functions Of Government (COFOG) (see ESA 1995, § 3.85). Total actual final consumption is equal to the sum of household actual final consumption and actual final consumption of general government (see ESA 1995, § 3.87). Corporations have no final consumption expenditure: their purchases of the same kind of goods or services as used by households for final consumption are either used for intermediate consumption or provided to employees as compensation of employees in kind, i.e. income which is then consumed by households (see ESA 1995, § 3.80). Actual final consumption consists of the goods or services that are acquired by resident institutional units for the direct satisfaction of human needs, whether individual or collective (see ESA 1995, § 3.81).

2.36. **Gross capital formation** consists of:

- gross fixed capital formation (P.51);
- changes in inventories (P.52);
- acquisitions less disposals of valuables (P.53).

Gross capital formation (P.5) is measured gross of consumption of fixed capital. Gross fixed capital formation consists of resident producers' acquisitions, less disposals, of fixed assets during a given period plus certain additions to the value of non-produced assets realised by the productive activity of producer or institutional units. Fixed assets are tangible or intangible assets produced as outputs from processes of production that are themselves used repeatedly, or continuously, in processes of production for more than one year (see ESA 1995, § 3.103; SNA 1993, § 10.07).

2.37. **Changes in inventories** are measured by the value of the entries into inventories less the value of withdrawals (valued at current prices) and the value of any recurrent losses of goods held in inventories (see ESA 1995, § 3.117; SNA 1993, § 10.28). Inventories consist of the following categories:

- material and supplies;
- work-in-progress;
- finished goods;
- goods for resale (see ESA 1995, § 3.119; SNA 1993, § 10.07).

2.38. **Acquisitions less disposals of valuables (P.53)** relate to non-financial goods that are not used primarily for production or consumption, do not deteriorate (physically) over time under normal conditions and are acquired and held primarily as stores of value (see ESA

1995, § 3.125; SNA 1993, § 10.116). Output of valuables is valued at basic prices. All other acquisitions of valuables are valued at the purchasers' prices paid for them, including any agents' fees or commissions. They also include trade margins when bought from dealers. Disposals of valuables are valued at the prices received by sellers, after deducting any fees or commissions paid to agents or other intermediaries. Disregarding the production of valuables, in aggregate, acquisitions less disposals between resident sectors cancel out, leaving only agents' or dealers' margins (see ESA 1995, § 3.127; SNA 1993, § 10.117).

2.39.

Exports and imports of goods and services consist of transactions in goods and services (sales, barter, gifts or grants) between residents and non-residents (see ESA 1995, §3.128-129; SNA 1993, § 14.88). Imports and exports of goods are to be valued "free on board" (f.o.b.) at the border of the exporting country. This value consists of:

a) the value of the goods at basic prices;

\+ b) the related transport and distribution services up to that point of the border, including the cost of loading on to a carrier for onward transportation;

\+ c) any taxes less subsidies on the goods exported; for intra-EU deliveries this includes VAT and other taxes on the goods paid in the exporting country (see ESA 1995, § 3.138-139; SNA 1993, § 14.37).

2.40. **National disposable income** is the sum of the disposable incomes of the institutional sectors. National disposable income equals national income (at market prices) minus current transfers (current taxes on income, wealth etc., social contributions, social benefits and other current transfers) payable to non-resident units, plus current transfers receivable by resident units from the rest of the world (see ESA 1995, § 8.95; SNA 1993, § 8.01).

2.41. **Aggregate saving** measures the portion of national disposable income that is not used for final consumption expenditure. Gross (or net) national saving is the sum of the gross (or net) savings of the various institutional sectors (see ESA 1995, § 8.96; SNA 1993, § 9.17).

2.42. The **net lending (+) or borrowing (-) of the total economy** is the sum of the net lending or borrowing of the institutional sectors. It represents the net resources that the total economy makes available to the rest of the world (if it is positive) or receives from the rest of the world (if it is negative). The net lending (+) or borrowing (-) of the total economy is equal but of opposite sign to the net borrowing (-) or lending (+) of the rest of the world (see ESA 1995, § 8.98; SNA 1993, § 10.30).

CHAPTER 3

THE QUARTERLY ACCOUNTING RULES

This chapter is about accounting rules for quarterly national accounts, excepting financial accounts. Its approach is to identify problems, discuss possible solutions and then recommend the rules to be followed. The bulk of the chapter deals with specific issues and accounting variables. Problems are sorted into those relating to all or many variables and those relating to specific variables. Separate sections of the chapter are devoted to the special topics. A concluding section summarises the main points from discussion and in particular emphasises the need to compile accounts on the accrual basis and the importance of consistency in compilation with respect to time, variable and sector.

The chapter is organised into the following sections:

1. *Introduction*
2. *Some general issues*
3. *Exhaustibility and the non-recorded economy*
4. *Problems for specific variables*
    - *A. Transactions in products*
    - *B. Distributive transactions*
    - *C. Their flows*
5. *Population and employment*
6. *Constant price estimates*
7. *Summary of main points*

The quarterly accounting rules

Section 1 - Introduction

3.01. This chapter of the handbook sets out some accounting rules for the quarterly national accounts. The chapter covers certain conceptual and definitional issues, clarifying and elaborating on what appears in ESA 1995 and SNA 1993, and also considering problems of quarterly estimation for certain variables within the accounts. This aspect is briefly discussed in ESA 1995: "If, in principle, most of the operations and balancing items are distributed with a certain regularity on all the quarters, there are anyway some operations that appear concentrated in one or two quarters of the year. This is the case for taxes on income, dividend interests, etc. The treatment of these cases depends essentially on the underlying generation process." (see ESA 1995, § 12.08). This chapter deals not only with the variables mentioned in ESA 1995, § 12.08, but, more generally, with all the variables of interest for compiling quarterly accounts.

Generally, these problems will also affect the annual estimates. However, reflecting the shorter recording period and also the lower reliability of the data, the impact of these various problems on the quarterly accounts will be relatively larger than for the annual figures. Where problems are identified, including the need to make estimates because quarterly data are not available or are not meaningful, recommendations are made on how the figures might be compiled. A summary of the main points from discussion is included at the end of the chapter.

3.02. The variables being considered relate to transactions in products and the distributive transactions. The financial accounts are not covered. This raises an important issue and, for this reason, they are treated in a specific chapter of this handbook (see Chapter 18). Where modifications are made to the recorded figures for the transactions and distributive variables, for example to put cash figures on to an accrual basis, corresponding adjustments may be necessary to the 'other accounts receivable and payable' financial accounts to maintain consistency of recording.

3.03. In some cases, it will be seen that the same problem arises for different variables, for example, the measurement of work-in-progress affects output and changes in inventories. Where this occurs, the issue is discussed for the first variable covered, with a brief explanation and cross-reference included for the later variables. In addition to the position for individual variables, there are three issues that could impact on most variables within the accounts. These will be covered first, as separate topics. The special topic of exhaustibility and the non-recorded economy is also treated separately.

3.04. The bulk of this chapter considers specific issues and variables largely in the order of their presentation in ESA 1995. Presentation here is organised as follows:

Section 2: Some General Issues

- Time of recording (§ 3.07-3.09)
- Consistency in recording (§ 3.10-3.12)
- Meaningfulness of quarterly data (§ 3.13-3.15)

Section 3: Exhaustibility and the non-recorded Economy

- Discussion (§ 3.16-3.19)

Section 4: Problems for Specific Variables

A. Transactions in Products

- Work-in-progress (§ 3.23-3.34)
- Agriculture production (§ 3.35-3.51)
- Employment indicators (§ 3.52-3.54)
- Imputed rent (§ 3.55-3.58)
- Financial Intermediation Services Indirectly Measured (FISIM) (§ 3.59-3.63)
- Intermediate consumption (§ 3.64-3.74)
- Value added (§ 3.75-3.84)
- Final consumption expenditure of households (§ 3.85)
- Government final consumption expenditure (§ 3.86-3.88)
- Final consumption expenditure of Non Profit Institutions Serving Households (NPISHs) (§ 3.89-3.90)
- Gross fixed capital formation (§ 3.91-3.93)
- Valuables (§ 3.137-3.141)
- Changes in inventories (§ 3.94-3.96)
- Holding gains/losses (§ 3.97-3.103)
- Exports and imports of goods and services (§ 3.104-3.105)

B. Distributive Transactions

- Compensation of employees (§ 3.107-3.114)
- Taxes on production and imports (§ 3.115-3.126)
- Subsidies (§ 3.127-3.129)
- Property income (§ 3.130)
- Interest (§ 3.131-3.133)
- Dividends (§ 3.134-3.136)
- Current taxes on income, wealth etc. (§ 3.142-3.152)
- Capital transfer (§ 3.153-3.155)

C. Other Flows

- Consumption of fixed capital (§ 3.157-3.159)

Section 5: Population and employment

- Population (§ 3.163-3.165)
- Employment (§ 3.166-3.173)

Section 6: Constant price estimates

- Discussion (§ 3.174-3.198)

3.05. There are some other aspects of the presentation, which should be mentioned at this stage. First, for each of the items covered, brief definitions, as appearing in ESA 1995 or SNA 1993, are given, together with references to the paragraphs in the appropriate manuals. Secondly, the text gives an indication as to whether the issue being raised is one of concept or measurement. In many cases, both aspects are relevant. In respect of the former, while the concepts and definitions of the national accounts are the same for annual and quarterly data, there are certain aspects of the quarterly accounts which require clarification and elaboration of what appears in the annually-oriented ESA and SNA manuals. On the second issue, reflecting data availability and recording practices, the measurement of certain variables on a quarterly basis poses different problems from what might arise for the corresponding annual data. Thirdly, for each variable considered, where appropriate, the recommendations on measurement practice are of two kinds - first, the theoretical or best practice is given, and secondly an alternative, second best solution is proposed. It should be noted that the latter is put forward largely as an interim suggestion before the ideal approach can be adopted.

Section 2 - Some general issues

3.06. As mentioned above, consideration will first be given to three general issues. These are (i) the time of recording, (ii) consistency in recording and (iii) the meaningfulness of the quarterly data. All three issues, which have certain inter-relationships, are likely to impact on, to a greater or lesser extent, most, if not all, of the variables appearing in the accounts. As elsewhere, these issues also affect the annual estimates, but will generally be of greater significance for the quarterly figures.

Time of recording

3.07. The time of recording for the national accounts is defined and analysed in ESA 1995, § 1.57 and SNA 1993, § 2.63-2.66.

Definition

The system records flows on an accrual basis: that is when economic value is created, trans - formed or extinguished, or when claims and obligations arise, is transformed or is cancelled (see ESA 1995, § 1.57).

3.08. *Problem and discussion*

In a number of cases, difficulties arise in following the accrual basis of recording. Where this happens, different practices are adopted, most generally the use of the payments-receipts (or cash) basis. The issue is one of measurement. Perhaps the main area where this problem occurs is in respect of transactions for the government accounts, covering both spending and receipts. These particular problems are dealt with separately later in this chapter. Outside the government sector, there are some well-known examples where recording may not be on an accrual basis. One example - interest payments - is also considered separately. However, the full extent of recording, which is not on the accrual basis and how the accounts might be affected, is difficult to assess. It is, however, pertinent to note that the accrual approach underlies much of commercial accounting practices. Thus, the basis of statistical information collected from businesses, which makes up a large part of the national accounts, is broadly consistent with the national accounts requirements.

3.09. *Solution*

In addition to the particular variables mentioned above, where there is evidence of figures being recorded other than on an accrual basis, all data (with the exception of dividends see § 3.134-3.136, and compensation of employees see § 3.107-3.114) should be adjusted to the required accrual basis. It should be noted that, for taxes, particularly on the profits of corporations (and possibly mixed income), the annual figures are likely to be on a cash basis (see § 3.151). This can be attempted using one of the solutions suggested for the specific variables as appearing later in this chapter. These are to relate the variable to an 'explanatory' variable, for example, taxes to economic activity, or to use interpolation. Where specific solutions cannot be followed, judgmental adjustments are likely to be better than no adjustments. As mentioned in § 3.02, corresponding adjustments may also be necessary to the financial variables.

Consistency in recording

3.10. *Problem and discussion*

There are two problems under this head. The first arises where information recorded in the accounts from the two parties to a transaction appears in different periods; the second is the need to ensure that consistent data, for the same variable, are included in the accounts of different sectors. Again, both issues, while also affecting annual data, will have a relatively greater impact on the quarterly estimates. In general, the shorter the period of recording, the greater the likelihood of inconsistency. On the first, the main areas of concern often referred to as the 'pipeline' effect are likely to be in respect of the timing of transactions related to (i) exports or imports of goods and their exclusion from or inclusion in inventories, and (ii) the import of fixed assets and their recording in gross fixed capital formation. The extent to which this might be a more general problem is unclear. Other possible examples might include tax and interest transactions. It might be noted, in passing, that these problems are not peculiar to the accrual method of accounting, but would also obtain under a cash-based system of recording. For the second problem, particular examples might be estimates of tax payments in the accounts of corporations, and of tax receipts in the government accounts.

3.11. *Solution*

In respect of the first problem, the prime solution should involve attempting to track the recording of major assets in the accounts, such as ships, aircraft and large building projects, to ensure that they are included in the same quarter for different parts of the accounts. For other transactions of this kind, and for the more general problem, it might be possible to get some idea of what transactions might be affected and the likely importance of the problem from discussion with firms. However, it should also be noted that, if timing problems occur broadly uniformly during the year, their effect may largely cancel out, and the impact on the quarterly figures may not be too great. Further, seasonal adjustment will tend to smooth out regular timing differences, while the use of supply and use tables for the balancing process will also help to overcome some of the timing problems. However, these procedures should not lessen the extent to which adjustments are made to non-seasonally adjusted figures or to the basic data prior to balancing. Finally, note the need for adjustments to the financial accounts (see § 3.02).

3.12. For the second issue, the problem of consistency, in both timing and across sectors, is resolved by defining the payments or receipts figure for one party as being the same as the receipts or payments figure as recorded by the other party. Thus in the example mentioned above, accrued tax receipts may be measured in the government accounts and the taxes paid in the corporate accounts brought into line with this measure, or vice-versa depending on the data available. In either case an accruals adjustment will be necessary in the financial accounts.

Meaningfulness of quarterly data

3.13. *Problem and discussion*

The need to establish meaningful quarterly data is a vital part of the whole exercise of determining quarterly national accounts. A particular issue is how to determine the quarterly profile for GDP using data from production, expenditure and, possibly, incomes in a meaningful way.

The issue considered here concerns the meaningfulness of the quarterly data, particularly those variables where the transactions occur infrequently and irregularly during the year. The problems will largely reflect the absence of accruals recording, and are a special case of the issue of timing of recording (see § 3.07-3.09). This is both a definitional and measurement problem, which will largely reflect the administrative and other arrangements that exist for making payments. For example, interest payments may occur half-yearly or annually; payments of taxes on operating surplus may be made, predominantly, in one or two quarters of the year; or recurrent taxes on land and building, which may be seen as an annual tax, may also be paid irregularly during the year. As mentioned above, similar, but lesser, problems may arise where information is recorded on cash, rather than on accrual, basis. Where this occurs, the pattern exhibited by the figures, particularly on a non-seasonally adjusted basis, may not be seen as meaningful or having much economic significance.

3.14. *Solution*

In considering how to try to establish more meaningful quarterly figures, it is important to make this distinction between non-seasonally adjusted and seasonally adjusted series. For the latter, for series with an erratic quarterly, but regular annual, pattern, the seasonal adjustment process should provide quarterly figures that will be deemed sensible. The problem may be seen therefore as relating to other erratic series, and to the non-seasonally adjusted data. Following § 3.09, with the exception of dividend payments and compensation of employees, all series, in both non-seasonally adjusted and seasonally adjusted form, should, as far as possible, appear on an accrual basis.

3.15. Two possible solutions might be considered. First, and ideally, in some cases, it will be possible to relate the variable of interest to an ‘explanatory’ variable. One example here would be to determine the quarterly non-seasonally adjusted profile for taxes on operating surplus by using an appropriate tax rate applied to the corresponding series of the operating surplus. Where this method is not possible, the quarterly non-seasonally adjusted series can be determined by interpolation, using one of the well-known techniques, or by equal allocation of the annual figure over all four quarters. The choice of approach, the latter may involve a ‘step’ change between the fourth quarter and the first quarter of the following year, will depend on the nature of the variables being considered. In particular, while the step change should generally be avoided, it may be appropriate where structural or fiscal changes have occurred. Again, the need for adjustments to the financial accounts should not be overlooked (see § 3.02).

Section 3 - Exhaustiveness and the non-recorded economy

3.16. One of the essential requirements for quarterly accounts to be an integral part of the system of national accounts is the exhaustiveness of the estimates. The necessity of producing exhaustive national account estimates has been stressed in many documents of the Gross National Product (GNP) committee. In those documents the attention is focalised on annual accounts but it is clear that a complete consistency between quarterly and annual accounts requires that quarterly estimate should be built with respect to the exhaustiveness principles. This is particularly complicated for quarterly accounts since the information set used for producing the data is quite small and, in some cases, different from the set used for compiling annual accounts.

Until now many countries decided to ignore this problem, solving it implicitly in the context of the statistical procedure of adjustment that ensure the time consistency between quarterly and annual accounts. For the current year the solution has been, in many cases, to use extrapolation techniques from the last quarter of the previous year, which is considered as correct after the adjustment.

This solution cannot be considered as totally satisfactory from both a theoretical and an empirical point of view. This solution entails two assumptions:

a. the quarterly accounts are compiled from an information system that can be judged sufficiently exhaustive so that the discrepancies between quarterly and annual account are quite small

b. the business cycle of the non-recorded economy is similar to that which characterises the normal economy.

The experiences of some countries seem to contradict this hypothesis. In particular many studies have established that illegal activities are a cyclical phenomenon.

In some countries, the discrepancies between quarterly and annual accounts can be quite big (about 20% of the total GDP because of the differences between quarterly and annual sources). In this case it is not possible to make a proportional redistribution of the discrepancies following a purely mathematical approach (see Chapter 10).

A more reasonable approach is represented by the study of the non-recorded economy in order to be able to devise some measures of this phenomenon

3.17. Procedures for the measurement of the non-recorded transactions are still being developed, particularly in respect of illegal activity. As elsewhere, quarterly practices should be developed in line with what is being done annually. The size of the non-recorded transactions is likely to vary widely amongst different countries, reflecting economic and social structures and the stage of development of the statistical system. For this chapter, some preliminary thoughts only are presented on the issue of quarterly measurement. This will focus on the likely quarterly incidence of, and possible movement in, the extent of the non-recorded economy, rather than on endeavouring to derive a level directly. For this brief exposition, the non-recorded economy will be considered as being made up of three parts.

(i) evasion;
(ii) statistical under-recording;
(iii) illegal activities.

3.18. Of these, the first represents tax evasion or similar fraud that takes place in the legal economy. The importance of this component is likely to depend, among other things, on policing policy and the fiscal environment. Changes will be similarly influenced. It is unclear whether the economic cycle will have any impact on its size, although, in a recessionary phase, there may be more 'moonlighting', an activity whose importance might vary during the year.

Statistical under-recording will be reduced, principally as statistical registers improve, and likely improvements should be capable of some quantification.

Illegal activities are a particularly grey area both in relation to level and quarterly movement. Both will depend much on policing activities.

3.19. In the absence of directly measured data, the quarterly movement in the non-recorded economy might be based on projections for the three components. The most appropriate indicators for the first and third items will require some assessment of the recent annual figures against possible explanatory variables such as employment, earnings and GDP. In the absence of any information, a view should be taken on the likely level for the current year and the quarterly figures should be derived by interpolation. The movement in the statistical under-recording element should be based on assessment of the general quality of the information in the light of changes to registers and other collection and recording practices.

Section 4 - Problems for specific variables

A. TRANSACTIONS IN PRODUCTS

3.20. Transactions in products are defined and analysed in Chapter 3 ESA 1995 and in various places in SNA 1993.

Definition

Products are all goods and services that are created within the production boundary (see ESA 1995, § 3.01).

Output (P.1)

3.21. Output is defined and analysed in ESA 1995, § 3.14-3.68, and in SNA 1993, § 6.38-6.146.

Definition

Output consists of the products created during the accounting period (see ESA 1995, § 3.14).

3.22. The problem areas of the quarterly estimates considered here are:

(i) work-in-progress;
(ii) agricultural production;
(iii) the use of employment as an indicator of output;
(iv) Imputed rent;
(v) FISIM.

Work-in-progress

3.23. Work-in-progress is defined and analysed in ESA 1995, § 3.50-3.51 and in SNA 1993, § 6.72-6.79.

Definition

Output is to be recorded and valued when the production process (see ESA 1995, § 3.46) generates it. However, when it takes a long time to produce a unit of output, it becomes necessary to recognise that output is being produced continuously and to record it as work-in-progress.

3.24. *Problem and discussion*

There are various kinds of activity where the recording of work-in-progress might be a problem. These are the growing of crops within agriculture (which is considered as a separate issue in § 3.35-3.51) and, for certain industries, the construction of major capital items such as heavy machinery, ships and buildings, and also certain service activities such as the development of computer software or the making of a film. In such cases, it would distort economic reality to record the output as if it were all produced at the moment of time when the process of production happens to terminate.

3.25. The problem, as discussed here, has two parts. The first is the general application of the principles of measurement to the quarterly accounts, embracing, in particular, limitations of data availability and lower accuracy of the quarterly information. The second concerns possible inconsistencies as between the figures going into the output and expenditure parts of the accounts.

3.26. In considering the consistency between estimates for output and expenditure, it is useful to distinguish three cases. The first relates to goods which are produced for a specific contract for a known purchaser: the second to activity which is for own account, and the third to 'speculative' production. The problem of consistency is likely to arise mainly in the first case because the information going into the output and expenditure sides of the account will come from two different sources. In other words, the purchaser's estimate of what should be recorded as Gross Fixed Capital Formation (GFCF) will be different from what the producer evaluates as constituting output. For own account and speculative production, the problem will exist only if output and expenditure are estimated from different sources, and not from the same own-account producer.

3.27. The producer can determine a reasonable estimate of the work-in-progress undertaken in the given period, using the recommended 'cost-allocation' methodology (see § 3.30-3.31). The purchaser's own figure is most likely to be based on progress payments, since he will not know the cost-allocation adopted by the producer. Two estimates going into GFCF and work-in-progress will, therefore, be different. It should be noted that the amounts going into the expenditure measure of GDP should be based on the information provided by the purchaser; the producer should not record progress payments in inventories, otherwise there will be double counting.

3.28. *Solution*

In respect of the measurement issue, given that the problem also affects annual figures ESA 1995 already describes how work-in-progress should be recorded. It is stated that additions to work-in-progress are valued in proportion to the estimated current basic price of finished products (see ESA 1995, § 3.50). Further, if the value of output treated as work-in-progress is to be estimated in advance, it should be based on the actual costs incurred, plus a mark-up for the estimated operating surplus or an estimate of mixed income. The provisional estimates should subsequently be replaced by those obtained by distributing the actual value (when it becomes known) of the finished products (see ESA 1995, § 3.51). Thus, although the recommendation is the use of cost allocation, rather than progress payments, for the reason mentioned above, in practice expenditure and output will be different. It is suggested that, for major projects, attempts are made to ensure that the GFCF and work-in-progress figures are made consistent, on the cost-allocation basis.

3.29. Two features of this process might be noted. First, the mixed income component should also include imputed income, for example where own-account production is involved. The imputation can be based on estimates of earnings and hours worked. Secondly, the estimates made for each period of time need to be valued at the expected sale price at that point of time, thus matching the values of inputs and outputs.

3.30. The proposed methodology can be described as follows. Assuming that the basic price of the finished product remains unchanged over the periods during which it is produced and that the basic price is known, the value of the addition to work-in-progress in a given period must be proportional to the cost of inputs used in the production process. Then in each period the value of output is proportional to the cost incurred. Where the basic price is not known, the estimate needs to take account of operating surplus/mixed income as well as costs. Thus for the example where basic costs are known:

$$O_t = \frac{I_t}{I_T} O_T$$

Where

- O_T represents the value of total output;
- O_t represents the value of output in the period (quarter);
- I_T represents the total cost of inputs;
- I_t represents the cost of inputs in the period (quarter).

3.31. Further, in the period in which the production activity ends, the following movements in the accounts take place:

- the output of the period (quarter) is $O_t = O_T - \sum_{i=1}^{t-1} O_i$
- a withdrawal of $\sum_{i=1}^{t-1} O_i$ from work-in-progress takes place.
- the finished goods inventories are augmented by the value O_T.

3.32. Without undertaking some detailed analysis of how estimates are made for individual projects, it is difficult to determine how important inconsistencies arising from these recording practices might be. Some discussions with contributors on existing practices might throw light on the magnitude of the problem, and it may be possible to ensure that, for some assets at least, the purchaser and producer use the same method of recording. Further, as mentioned in the section on timing differences, it may be possible to ensure consistency of recording for major capital goods.

3.33. As with other possible distortions to the figures, if the differences are generally uniform throughout the year, the recording discrepancies for a particular quarter will tend to cancel out. Further, any regular distortions will be smoothed out as part of the seasonal adjustment process. Finally, relating estimates of supply and use for different products in the balancing process will help to iron out inconsistencies of this kind, although any adjustments considered necessary should be made in advance of balancing.

3.34. The problems of estimating work-in-progress described above will also affect the measurement of changes in inventories. This subject is discussed in § 3.94-3.96.

One other important problem related to work-in-progress is estimation at constant prices. This issue, in particular the estimation of holding gains within the estimates for changes in inventories.

Agricultural production

3.35. The measurement of the output of agriculture is defined and analysed in ESA 1995, § 3.58, and in SNA 1993, § 6.94-6.100.

Definition

The growth of crops, trees, livestock and fish which is organised, managed and controlled by institutional units constitutes a process of production in an economic sense (see SNA 1993, § 6.94).

3.36. *Problem and discussion*

The various problems of measuring output (and other variables) for agriculture on an annual basis are exacerbated for the quarterly statistics. To consider the problems and how they might be solved, it is useful to sub-divide the estimation process into two parts. The first part relates to measurement of activity, such as the production of milk or eggs, where output is essentially produced and sold in the same quarter. The other, more problematic area, concerns those parts of the production process which extend over a number of quarters - crop production is an example. This section will focus on the problems that arise with measuring this latter activity, although mention is made later of some issues relevant to the estimation of the regular production.

3.37. Where the production processes cross the year-end, the annual estimates are also affected. Thus, some broad principles of recording are already included in ESA 1995. The ESA states that growing crops, standing timber and stocks of fish or animals reared for the purposes of food should be treated as inventories of work-in-progress during the process, and transformed into inventories of finished products when the process is completed (see ESA 1995, § 3.58). This section endeavours to expand on these principles to provide a possible practical approach to quarterly measurement.

3.38. Before looking at the problem of measuring long-term production, it will be useful to set out, briefly, the principles involved. In doing so, it is helpful to distinguish between two types of production which might span a number of quarters. One concerns the ‘one-off’ production, such as annual crops, trees for timber and livestock for consumption; the second relates to ‘continuing’ production, covering, for example, fruit trees, vines, breeding and dairy cattle, which provide the basis for annual output. For the former, all unfinished output, such as a growing crop, is classified as work-in-progress. For continuing production, unfinished output, for example growing fruit trees which have not yet reached maturity, is classified to work-in-progress (becoming GFCF when completed), except where it is on own account. In this latter case it is classified to GFCF from the outset.

3.39. *Solution*

For convenience, the explanation of how quarterly measurement might be undertaken will be discussed in terms of crops, although the principles apply equally to other long-term production within agriculture. The ESA 1995/SNA 1993 recommends that output of crop and similar production is considered in the same way as for other industries where production spans a number of quarters. In essence, in respect of crop production, this involves distributing the total value of the output of the crop over the whole period of production, in proportion to the costs incurred in each quarter. The production process will run from the initial work of preparing the land right through to final sale. Costs will need to be estimated for each quarter during this period. In addition, an estimate will be needed at the start of the year of the likely value of the crop when sold. In line with the measurement principles outlined above, the quarterly amounts estimated (total value multiplied by proportion of costs) would appear in either GFCF or work-in-progress in changes in inventories in the expenditure account, and as contributions to output for the production measure. It should be noted that allocation on the basis of costs, which will embrace labour costs, is likely to have some consistency with the wage and salary components which go into the income measure.

3.40. As mentioned above, costs are estimated for all quarters in which the production process takes place. In the initial quarters, this will reflect preparation of the land and sowing of the seed; in subsequent quarters the estimates relate to harvesting, storage, distribution and final sale. Costs should include estimated compensation of employees and self-employed, and material inputs. The estimates will need to make some assumption about the likely movement in prices over the whole period. These prices will be relevant for deflation to constant prices. The value of the crop to be spread over the quarters will, initially, be only an estimate. When the actual value of sales is known, the quarterly estimates can be revised, as appropriate. At that stage, it will also be sensible to look again at the cost estimates used for quarterly allocation. It should be noted that, since estimates of work-in-progress are being made directly, rather than from book value data, there are no adjustments for holding gains.

3.41. The methodology proposed in the SNA of allocating crop output over all the quarters relevant to its production raises two major problems. The first, as has been stated above, results from the need to estimate a value for the crop before the harvest is sold. In practice, this would be at least two quarters in advance of sale. With farm output varying markedly with the weather, such estimation is far from easy. Secondly, the imputation of a value for activity (or income) at least two quarters before it actually takes place (or is received), is at variance with economic reality and is often difficult to explain to the general public and users.

3.42. There are a number of possible ways of getting round the these two problems. One possible approach (to be called, for convenience, the ‘alternative’ approach) is considered in the handbook. The principle underlying this approach is that, in those quarters where preparatory work is being undertaken for the harvest and the crop is reaped, output is taken to be equal to the input costs, covering, as mentioned above, materials, and employment and self-employment incomes. In the quarter(s) in which crop is sold, output is taken as the difference between receipts in the quarter(s) and the costs incurred in the previous quarters.

3.43. A theoretical assessment of the two approaches is made below. First, it will be useful to explain and compare them in a worked example. For both approaches, activity for a given 'annual' harvest is assumed to span the four quarters of the calendar year. In Q1 and Q2 the land is prepared and the crop is sown and tended; the harvest occurs in Q3, and the crop is stored and sold in Q4. Two harvest years are covered in order to compare, better, the two approaches. For convenience, only final values (200 and 300) for the two crops will be assumed. The figures in the example are direct estimates of changes in inventories, rather than book values. The calculation for both methods can be adapted to take account of certain departures from the simple assumptions of the example, in particular that the production process extends over more than four quarters.

Recommended approach

3.44. Column (1) gives the figures of costs associated with the activity. This is assumed to be the same for both years. The value of sales (200 and 300) is spread over the four quarters of the appropriate years, in proportion to costs, in column (2). For the first year, when the crop is reaped in Q3, its value (140) at that time then can be regarded as a finished good, while the build up of work-in-progress is unwound (by an entry of minus 140). Sales made in Q4 will include the value of output associated with storage and distribution. The sales values in these two quarters - column (6) - should be offset by negative entries in finished goods - column (5). In addition, for this quarter, positive entries should be included in finished goods - column (4) - to be offset by negative figures in column (3). Similar estimates are made for the second year.

Table 3.1: Recommended approach

Quarters/years		Costs	Work-in-progress		Finished goods		Sales	Output
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Year 1:	Q1	10	20					20
	Q2	20	40					40
	Q3	40	80	-140	140			80
	Q4	30	60	-60	60	-200	200	60
Year 2:	Q1	10	30					30
	Q2	20	60					60
	Q3	40	120	-210	210			120
	Q4	30	90	-90	90	-300	300	90

Alternative approach

3.45. In the alternative approach, the figures of costs are the same as above. Then, for the first year, reflecting the principles of estimation given above, for the first three quarters the work-in-progress (and output) is simply equal to the costs. In Q4, the work-in-progress of the previous three quarters is unwound, and the receipts from the sale of the harvest are recorded under sales. There is no recording in finished goods. Similar estimates are made for the second year.

Table 3.2: Alternative approach

Quarters/years		Costs	Work-in-progress		Finished goods		Sales	Output
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Year 1:	Q1	10	10					10
	Q2	20	20					20
	Q3	40	40					40
	Q4	30	0	-70			200	130
Year 2:	Q1	10	10					10
	Q2	20	20					20
	Q3	40	40					40
	Q4	30	0	-70			300	230

3.46. For both approaches, the quarterly information to be recorded in the accounts is shown below, respectively for the production, expenditure and income measures. This essentially relates to non-seasonally adjusted data, and will need to be seasonally adjusted.

- *Production measure*

  Output: columns (2)+(3)+(4)+(5)+(6).
  Intermediate consumption: cost of materials component of column (1).

- *Expenditure measure*

  Inventories (work-in-progress): the sum of columns (2) and (3);
  (finished goods): the sum of columns (4) and (5).
  Inventories (raw materials): column (6), if sales are for intermediate consumption.
  Household or government consumption or exports: column (6), if sales are to a final buyer.

- *Income measure*

  Wages and salaries and mixed income: ”income” cost component of column (1),
  Operating surplus: column (7) - column (1).

3.47. There are a number of obvious points which emerge from a consideration of the two approaches. First, the alternative method clearly avoids the two problems, the need for imputation and the economic reality of the estimates, which were raised, above, as difficulties with the recommended approach. Further, in the alternative approach, there would not be problems with the impact of price changes over the quarters, and revisions to the estimates would be fewer. On the other hand, the approach would seem to be at variance with commercial accounting practices, which would follow more closely the principles of the recommended approach.

3.48. On the tables, caution is needed in interpreting the figures, which are purely for illustrative purposes. In particular, the profile of output is arbitrary, as is the relationship between the level of costs and receipts. Thus, only broad conclusions may be drawn from the data. It would seem, however, that the alternative approach could result in an unduly high peak (or dip) in output in Q4 as a result of an abnormally good (or bad) harvest. This would be evident even in the seasonally adjusted data, unless further ‘smoothing’ adjustments were undertaken.

Regular production

3.49. Mention was made earlier of the measurement of output of the regular activities such as production of milk and eggs. A good deal of quarterly information on values, volumes and prices is normally available for the agriculture industry. Many current price estimates can usually be derived directly or readily estimated, and it will be adequate to use estimates of output of these variables as indicators to extrapolate base year value added.

3.50. It should be remembered that, in relation to the constant price figures, estimation of value added for agriculture is normally undertaken using double deflation (i.e. components in the calculation are deflated separately). The quarterly estimates emerging from the above practices will need to be made consistent with the firmer annual figures.

3.51. There is a further problem for agriculture which needs to be considered. This relates to how to treat, in the deflation process, prices of seemingly identical products, which are sold at different times of the year and which exhibit seasonal variation. One example of this is potatoes, where old and new varieties are produced and sold in different months of the year. As a general rule, and within the accuracy of the available data, deflation should be undertaken in as much detail as possible. Thus the aim should be to treat these seemingly identical items as different products, and to derive constant price estimates for them separately. Where constant price estimates are obtained by revaluing current year quantities by base year prices, the revaluation should be undertaken for short time periods, say on a monthly basis. Thus, for each month of the current year, quantity is revealed by the price in that same month in the base year. The estimate for the current quarter is then obtained by summing the appropriate revealed monthly data and relating it to the (quarterly) average of similarly estimated base year figure. A broadly similar approach is followed where deflated values are used. Thus, for each month of the current year, the value is deflated by the price index for that particular month. The constant price figures are then summed, as above.

The treatment of agriculture production will also have implications for the recording of information on changes in inventories in the expenditure account, and also for components of the income account.

Employment indicators

3.52. *Problem and discussion*

Two problems might arise where employment is used as an indicator for measuring output, for example for the government sector. The first relates to the impact of holidays; the second to the treatment of productivity.

The first issue is that, where the level of employment is used to measure output, this will relate to staff ‘on the books’, rather than those actually undertaking productive activity in the period. Thus the estimates will not include any allowance for the impact of holidays. The main impact is for Q3 and for non-seasonally adjusted data (seasonal adjustment will largely deal with the problem for the seasonally adjusted figures).

The issue of productivity in the accounts has been extensively debated. One aspect is that the use of employment indicators does not allow for any change in productivity in output. There is also the question of whether productivity adjustments should be made for the non-market sector.

3.53. *Solution*

In respect of the first problem, where employment data are used to estimate output, ideally, figures should be based on actual hours worked and not on the level of employment. Where this is not possible, some estimated reduction should be made from the non-seasonally adjusted figures to reflect the incidence of holidays. The adjustment will predominantly affect the Q3 figure, but might also be relevant for other quarters. Other adjustments may be possible, for example in the distribution of overtime, but these are likely to be of secondary importance and difficult to measure.

3.54. On the second issue, a distinction needs to be made for market and non-market output. For market output, where employment-based indicators levels or hours worked are used, the series should incorporate some adjustment for productivity. The adjustment might be based on estimates of productivity derived from similar activity where employment indicators are not used. Alternatively, a more widely based estimate might be used. This will be better than no adjustment at all.

For all these reasons, if reasonable output measures can be compiled directly they should be preferred.

Finally, it should be noted that adjustments for estimated changes in productivity and profitability may also be relevant where a wage and salary index is used as a basis for deflation.

There will also be implications for the measurement of expenditure and incomes.

Imputed Rent

3.55. The methodology for estimating imputed rent (for the provision of owner-occupied housing services) was determined for the countries of the EU by a Commission Decision made at the end of 1994. The approach to be adopted involves establishing base year estimates of imputed rent which are then extrapolated using information on changes in the stock of owner-occupied dwellings and in estimated rents for such properties. The base year figure is to be determined by the so-called 'stratification' method, in which estimates of rent levels are applied to numbers of owner-occupied dwellings, using a detailed stratification of dwellings, for example by region and type of property. As it is unlikely that information will be available to enable the compilation of estimates in this degree of detail each year, the Decision suggests that the detailed calculation be carried out every five years, with annual extrapolation to be used up to the next 'benchmark'.

3.56. The approach for deriving quarterly estimates of imputed rent will depend, in large part on, the methodology which is used for annual extrapolation, as well as the short-period information available. The volume measure to be used should be based on the series for the stock of dwellings, perhaps adjusted by a small upward increment to allow for improvements made to existing properties. The information on the stock of dwellings should be used in as much detail as possible, although it is unlikely that anything approaching the full analysis detail of the stratification method can be employed. At the other extreme, an overall total of the number of owner occupied dwellings might need to be used, with no breakdown. An alternative volume measure could be based on the movement in the capital stock of dwellings, at constant prices.

3.57. The price series would be represented by information on the movements in rents, again ideally as close as possible to the concept and classification being used in the base year or annual estimates. Where only limited information on rents is available, particular care will need to be taken to ensure that it is appropriate to use for the owner-occupied sector. Thus, if only public rents were available quarterly, it would be necessary to look at the long-term relationship between the movements in these rents and the estimates made for owner-occupied rents. This relationship, together with any other relevant factors, can then be used to establish the appropriate quarterly estimates for the rent series for the owner-occupied sector.

3.58. In the absence of direct data on the stock of dwellings, it may be possible to make some approximate estimates using information about construction activity. If no data are available at all, then the annual series should be extrapolated to provide a figure for the latest year, which can then be interpolated on a quarterly basis. The volume data will tend to move comparatively smoothly, so the estimate of the annual level is likely to be more important than the quarterly profile. However, any errors in the forecast will have a comparatively small effect on the derived estimates of imputed rent. In contrast, the absence of information on rents, which could well exhibit large and erratic movements, is a much more serious problem. Fortunately, some information on rents is usually collected for inclusion in the consumer price index. However, as mentioned above, the appropriateness of the data for making estimates of the movement in owner-occupied rents does need to be closely assessed. If no quarterly information on rents is available, an estimated series should be derived, perhaps in discussion with experts in the private sector housing market.

Financial Intermediation Services Indirectly Measured (FISIM)

3.59. Financial intermediation services are defined and analysed in ESA 1995, § 3.63, and in SNA 1993, § 4.78. Further, Financial Intermediation Services Indirectly Measured (FISIM) are treated in Annex 1, ESA 1995 and Annex III, SNA 1993.

Definition

Financial intermediation may be defined as productive activity in which an institutional unit incurs liabilities on its own account for the purpose of acquiring financial assets by engaging in financial transactions on the market (see SNA 1993, § 4.78).

Definition

Financial Intermediation Services Indirectly Measured (FISIM) refer to estimation of the value of the services provided by financial intermediaries for which no explicit charge is made (see Annex III, SNA 1993)

3.60. The treatment of 'Financial Intermediation Services Indirectly Measured' (FISIM) in the accounts is one of the more important changes introduced by ESA 1995. As already the case with imputed rent, the methodology for deriving such estimates is likely to be established in due course as a Council Decision. Broad agreement has been reached for the current price estimates. However, arrangements for the constant price series have not been finalised. In respect of the measurement of output at current prices, annual and quarterly estimates will both require appropriate information on levels of various types of bank and building society deposits and advances. In addition, a 'reference rate' will need to be determined to allocate the total between intermediate and final consumption. Any problems which arise are likely to reflect the generally sparser nature of quarterly data.

3.61. However, there are potential difficulties with the derivation of constant price data, for both the quarterly and annual accounts. Although still to be finalised, the broad principle underlying the measurement of say value added at constant prices is likely to involve extrapolation of base year estimates by appropriate volume indicators. The main components of the estimation process are, as with the current price figures, the levels of bank and building society deposits and advances, and in addition certain price indices to put these figures on a constant price basis. If such data exist annually and quarterly then there should be no problems. If, however, no information is available at all, and new collection needs to be introduced, then it is clearly desirable to try to obtain the kind of data needed for quarterly estimation, as well, of course, for the annual series.

3.62. One likely situation is where, although annual data are available, there is no adequate quarterly information. Here it will be necessary to resort to the practice of estimating the annual figure for the current year and determining the most appropriate quarterly profile. The profile may be determined mechanically, or might follow the series for employment for the appropriate industries.

3.63. There will also be a need to establish quarterly estimates at current and constant prices for the relevant components of final use and also for imports. By far the largest component is likely to be in respect of household consumption, the estimate for which can be based on the appropriate levels of deposits and advances for the sector, and relevant price data, as appropriate. Other analyses which might be needed quarterly, for example by sector or the industry breakdown of intermediate consumption, will again largely use the stock of deposits and advances, together with, for constant prices, appropriate deflators.

Intermediate consumption (P.2)

3.64. Intermediate consumption is defined and analysed in ESA 1995, § 3.69-3.73, and in SNA 1993, § 6.147-6.178.

Definition

Intermediate consumption consists of the value of the goods and services consumed as inputs by a process of production, excluding fixed assets whose consumption is recorded as consumption of fixed capital. The goods and services may be either transformed or used up by the production process (see ESA 1995, § 3.69).

3.65. *Problem and discussion*

The measurement of intermediate consumption requires that products should be recorded and valued at the time they enter the process of production. In practice, producers do not usually record the actual use of goods in production directly. They record the value of purchases of materials and supplies intended to be used as inputs and the changes in the amounts of such goods held in inventories. Intermediate consumption has therefore to be estimated as a residual item, by subtracting from the value of purchases made the change in inventories of materials and supplies (see ESA 1995, § 3.72-3.73; SNA 1993, § 6.151).

3.66. The problem considered under this head is essentially how to estimate intermediate consumption on a quarterly basis. It arises because, while information on purchases is collected on an annual basis, such data are unlikely to be available quarterly. It is necessary to distinguish between estimates at current and at constant prices. While there is a requirement for quarterly estimates of intermediate consumption at current prices, no similar need exists at constant prices. However, the latter estimates might be used in the context of deriving estimates of constant price GDP from the production side. This section will concentrate on the estimation of intermediate consumption at current prices. The constant price issue is considered below in the section on value added.

3.67. *Solution*

Where intermediate consumption is not measured directly from data on purchases and inventories, estimates might be made in two broad ways. In both cases, the estimates would be made at a suitably disaggregated level of industry. First, it may be possible to base the estimate on the movement in an ‘indicator’ series which is deemed to represent the movement in intermediate consumption. In the second approach, which will be the main one considered, the ratio of intermediate consumption to output is estimated for the latest quarters, and is applied to the latest output figures.

3.68. For the first of these approaches, the main issue is obviously that the movement in the particular indicator is a satisfactory proxy for the movement in intermediate consumption. Possible indicators which might be used include production or deliveries of particular products although some allowance may be needed for changes in inventories. The use of such series will depend on the availability and suitability of the data in the various countries.

3.69. For the second approach, the use of an estimated ratio of intermediate consumption to output raises a number of issues. The main one is clearly how such estimates might be made. It is very unlikely that any direct information will be available for this purpose. However, one possible source may be the VAT system, although this would require, in addition to the usual data on outputs, that some information on inputs is also collected. If no direct information is available, the approach to estimating the quarterly ratios for each industry should be to derive an annual estimate of the ratio for the current year as a whole, and then to establish an appropriate quarterly profile for the series. The annual estimate should be made on the basis of the time series of ratios for earlier years, which should be fairly firmly based. It will also be necessary to take account, as far as possible, of developments in the economy in the current year and the likely impact of other relevant events, such as technological change.

3.70. Once an estimate of the ratio for the present year, for each industry, has been determined, a quarterly profile needs to be established. In the absence of any other information, this might be achieved by using one of the conventional interpolation techniques for deriving a quarterly series when only annual data are available. The quarterly profile which emerges from this approach will generally be a smooth series. However, an important issue to be addressed is whether the ratio is likely to vary significantly over the quarters to such an extent that some attempt should be made to reflect this variation in the figures used.

3.71. Changes in the ratio will arise for several reasons, in particular, changes in the product mix, in the type, quality and source of inputs, and in the production process, including contracting out intermediate processes and technological change. There may also exist a modelable relationship for the effects of 'economies of scale' on the technical coefficients. Specifically, in respect of quarterly data, the impact is likely to be greater for those industries where output is seasonal and contains a changing mix of high and low margin products. Thus the ratio will be more variable for the non-seasonally adjusted than the seasonally adjusted data. There may also be differences reflecting the domestic/import mix of inputs. Where these factors exist, the variation in the quarterly ratio may be significant. At the other extreme, for an individual industry making a single product or largely homogeneous group of products, it is unlikely that the ratio will change significantly over the quarters of the year (unless economies of scale are significant). In respect of the technology factor, generally, change is likely to occur comparatively slowly and should not influence unduly the ratio in the short-term. There may, however, be specific changes which will have a more immediate effect.

3.72. The importance of this issue will vary from country to country, reflecting, principally, the nature and dynamics of the industrial structure. In all countries there are likely to be some industries for which the possibility of variation in the quarterly ratio needs to be considered. One obvious example is agriculture, for which the problems of estimation are discussed separately in § 3.35-3.51. A second potential problem area is the electricity industry, where changes in the mix of fuels used for generating electricity, and also possibly in the customer mix, may lead to non-insignificant quarterly movements in the ratio. For other industries, seasonality in household consumption, together with changes in commodities sold, might suggest some variability in the ratio for distribution.

3.73. There are certain other aspects of estimating intermediate consumption in aggregate which need to be borne in mind. First, if the analysis is undertaken in a reasonable amount of industry detail, the effect on the quarterly ratio of a changing product or industry mix is likely to be very small. Clearly, however, a balance will need to be struck between the benefits of greater detail and the reduction in accuracy of data. Secondly, problems may arise where intermediate processes are contracted out by one industry to another. However, it is worth noting that, even if account cannot be taken of the effect of the change, the "error" in the assumed ratios for the two industries will, in practice, tend to cancel out. Thirdly, if quarterly estimates are derived through an input-output framework allowance is made, implicitly, for possible short-term variability in the ratio. Although balancing can thus be seen as providing some resolution of the ratio problem, this should not preclude an examination of the position for individual industries, and, where appropriate, the incorporation of independently estimated ratios. Any ratios which have been estimated in this way should then be compared with the implied ratios which emerge from the balancing exercise and a view taken on what the most appropriate figures should be.

3.74. Taking all this together, it is recommended that, where thought necessary, and in the light of the structure of industry in the individual countries, consideration should be given to making some allowance for quarterly variation in the ratio required to establish the estimates of intermediate consumption. In addition to agriculture, which is being considered separately, quarterly variability in the ratio might be important for the electricity industry and distribution. Attention will need to be paid to the different problems with non-seasonally adjusted and seasonally adjusted data. Where there is deemed to be a need to make adjustments, the plausibility of any adjustments can be assessed as part of the balancing process.

Value added (B.1)

3.75. Value added is defined and analysed in ESA 1995, § 8.10-8.14 as the balance of the production account, and in SNA 1993, § 6.4-6.5.

Definition

Value added is the balancing item in the production account. Gross value added is defined as the value of output less the value of intermediate consumption. Net value added is defined as the value of output less the values of both intermediate consumption and consumption of fixed capital (see SNA 1993, § 6.4).

3.76. *Problem and discussion*

The issue considered here is the estimation of value added at constant prices, by industry, as a basis for estimating GDP. One of the main problems which arises in deriving quarterly estimates of GDP (or value added) on the basis of production data is that much less information is available than for the corresponding annual figures. This will mainly reflect practical considerations, but also the fact that less information is required quarterly. For the production measure, annual information will generally be available on sales, purchases, inventories and prices, from which direct estimates of output and intermediate consumption, and hence constant price value added, can be derived. However, for the quarterly estimates, as mentioned in the section above on intermediate consumption, information on purchases is not usually collected, while less firm data may be available for the other variables.

3.77. *Solution*

As a consequence of the position on data availability, the methodology for compiling quarterly production-based estimates of value added generally uses one or other (or some combination) of three broad approaches namely (i) direct measurement, (ii) indirect estimation and (iii) extrapolation, using 'indicators' which serve as proxies for the movement in these variables to project the particular latest year or base year estimates. All three methods are undertaken at an appropriate level of industry detail.

3.78. Where information is available on output, intermediate consumption and prices to enable direct measurement, the issue is one of the quality of the available data. This is not considered further here. The focus of attention is on the second and third methods. The second, as defined here, uses output data as a basis for estimation, and requires the derivation of estimates of the ratio of value added to output for the latest period. In the third, more widely-used, approach, the prime requirement is the establishment of suitable indicators usually sales or output series, although input information or employment may also be used for some industries to represent the movement in value added.

3.79. In relation to the second method, the problems of deriving ratios of value added to output are broadly the same as those existing for the estimation of intermediate consumption (see § 3.64-3.74). They are repeated only briefly below. There is, though, one important difference, namely that the issue there concerned current price data, while here it relates to constant price estimates. Different assessments of the ratio obtain for these two situations. In the short-term, movements in the ratio will, most generally, be less for constant price than current price information.

3.80. The estimation of the quarterly ratio of value added to output should be based on the projection of the ratio for previous years. This should involve, first the establishment of an annual ratio for the current year, then a quarterly path through the year. If possible, this should take account of developments in the economy in the current year and the likely impact of other relevant events. The quarterly profile might be derived from one of the conventional interpolation techniques for deriving a quarterly series when only annual data are available. As for intermediate consumption, such a profile will generally be a smooth series, and it is important to consider whether, in practice, the ratio is likely to vary over the quarters.

3.81. As mentioned in § 3.71, changes in the ratio will arise for various reasons, and the relevance of this factor will vary from country to country. However, in addition to agriculture, which is being considered separately, quarterly variability in the ratio might be important for the electricity industry and distribution.

3.82. For the third approach, the extrapolation of value added by indicators, the main issue is that the movement in the particular indicator is a satisfactory proxy for the movement in value added. The question of the suitability of different indicators for estimating value added has been widely discussed in the literature on output measures (for example in the United Nations manual M64, "Manual on National Accounts at constant prices"), and will not be further pursued here. The assumptions, which are often more implicit than explicit, are similar to those obtaining above. Their precise form will depend on the nature of the indicators used, for example, whether they relate to output or inputs.

3.83. There are a number of other features relevant to estimation of value added which might be considered here. These are broadly similar to the issues raised in § 3.65 in respect of the estimates of intermediate consumption. They will not be repeated here.

3.84. The broad conclusion on the derivation of ratios for estimating constant price value added is also similar to the position on intermediate consumption. This conclusion is that consideration should be given to making some allowance for quarterly variation in the ratio required to estimate value added at constant prices. In addition to agriculture, the main industries where problem might exist are the electricity industry and distribution. Attention will need to be paid to the different problems with non-seasonally adjusted and seasonally adjusted data. Where there is deemed to be a need to make adjustments, the plausibility of any adjustments can be assessed as part of the balancing.

Final consumption expenditure (P3)

3.85. Final consumption expenditure is defined and analysed in ESA 1995, § 3.75-3.80, and in SNA 1993, § 9.93-9.99.

Definition

Final consumption expenditure consist of expenditure incurred by resident institutional units on goods or services that are used for the direct satisfaction of the individual needs or wants or the collective needs of members of the community. Final consumption expenditure may take place on the domestic territory or abroad.

For this specific item there are not particular problems concerning the final consumption of households. By contrast, some problems are raised by the cases of general government and Non Profit Institutions Serving Households (NPISHs).

Government final consumption expenditure (P.3)

3.86. Government final consumption expenditure is defined and analysed in ESA 1995, § 3.79, and in SNA 1993, § 9.75-9.89.

Definition

Government final consumption expenditure consists of expenditure, including imputed expenditure, incurred by general government on both individual consumption goods and services and collective consumption services, net of sales of goods and services. The expenditure may be divided into government expenditure on individual consumption goods and services and government expenditure on collective consumption services (see SNA 1993, § 9.94).

3.87. *Problem and discussion*

As mentioned in § 3.08 on the issue of the time of recording, government consumption (both individual and collective) is likely to be recorded on a cash rather than an accrual basis. One consequence of the cash basis is that certain estimates of spending in the government account may not be consistent with the output and income recorded by producers. The degree of potential inconsistency is likely to vary for different countries, reflecting government recording practices and the nature of the spending. Within final consumption, the main problems are likely to be in the areas of spending on defence and health.

3.88. *Solution*

It is suggested that compilers should examine the series for government consumption to see whether they appear erratic or otherwise implausible (for example where expenditure is much higher in the last quarter of the budget year), and are thus unlikely to be consistent with the associated figures in the production and income accounts. Where inconsistencies are thought to exist, attempts should be made to put the figures more on an accrual basis. Ideally, this should be achieved by ensuring that the government figures are compiled on the proper basis. Until this can be done, compilers should consider, together with the providers of the information, how best they should be modified. In the absence of any related information for doing so, one possibility would be simply to put an interpolated quarterly path through the estimated annual figure. This should be done for both non-seasonally adjusted and seasonally adjusted data. The particular areas for concern might be earmarked for special attention in the balancing process, which may also highlight the extent of any inconsistencies and help to improve the series. It is important to note that, where cash figures are modified in this way, adjustments are also needed to the financial accounts to ensure consistency with the cash based figures.

There will also be implications for the measurement of output and income for the government accounts.

Final consumption expenditure of Non Profit Institutions Serving Households (NPISHs)

3.89. The final consumption expenditure of NPISHs is defined and analysed in ESA 1995, § 3.78, and in SNA 1993, § 9.75-9.89.

Definition

Final consumption expenditure of NPISHs includes two separate categories:

a. The value of the goods and services produced by NPISHs other than own-account capital formation and other than expenditure made by households and other units;

b. Expenditures by NPISHs on goods or services produced by market producers that are supplied-without any transformation-to households for their consumption as social transfer in kind.

3.90. The inclusion of information for NPISHs in a separate sector is an innovation in ESA 1995. Previously, estimates for final consumption, for example, had been mostly incorporated within household consumption. The concept of final consumption to be included in the accounts is essentially defined as compensation of employees plus expenditure on goods and services less receipts from goods and services (this last component will be covered indistinguishably in household consumption). As before, the quarterly series should endeavour to use the particular methodology used for the annual data. Where this is not possible, the quarterly series for consumption might be based on extrapolation using the movements in 'indicator' series such as compensation of employees, for current prices, and employment for constant prices. In both cases, the recent relationship between the actual figures and the indicator series should be assessed for the annual figures. If appropriate, this relationship can be continued for the current quarters, in the form of adjustment factors applied to the indicator series. A similar approach can be followed for estimating quarterly production estimates, where, possibly, a different set of adjustment factors will be necessary.

Gross fixed capital formation (P.51)

3.91. Gross fixed capital formation (GFCF) is defined and analysed in ESA 1995, § 3.102-3.116, and in SNA 1993, § 10.33-10.95.

Definition

Gross fixed capital formation consists of resident producers' acquisitions, less disposals, of fixed assets during a given period plus certain additions to the value of non-produced assets realised by the productive activity of producer or institutional units. Fixed assets are tangible or intangible assets produced as outputs from processes of production that are themselves used repeatedly, or continuously, in processes of production for more than a year. (see ESA 1995, § 3.102).

3.92. *Problem and discussion*

There are two inter-related issues considered here. These are (i) the measurement of GFCF on a quarterly basis and (ii) the consistency of measurement with other parts of the account.

The first problem arises where GFCF is recorded on a cash rather than an accrual basis. This may be compounded where recorded spending is unduly high (or low) in the final quarter of the year as attempts are made to use up financial allocations or meet spending targets. The issue of accruals recording has been discussed in § 3.07-3.09.

The second issue relates to the consistency of the estimates of GFCF with other parts of the accounts. There are three possible areas of concern-consistency with (i) imports of goods, within the expenditure measure of GDP, (ii) output in the production measure, and (iii) operating surplus (if independently estimated) in the income measure. The consistency problem will be increased the greater the extent of recording on a cash basis. The first two issues have been discussed, in general terms, in the sections on the time of recording (§ 3.07-3.09) and consistency problems in recording (§ 3.10-3.12). The third problem reflects very much the way corporations record GFCF and operating surplus in their commercial accounts, the adjustments necessary to put these onto a national accounts basis where they are derived from the same source, and the reconciliation necessary when they are from different sources.

3.93 *Solution*

Solutions for most of these problems have been suggested in the relevant sections referred to above. For the issue of consistency with the income figures, it will be necessary to examine with corporations the basis of their recording practices, and make what adjustments are needed to put the figures on a national accounts basis, ensuring consistency of measurement.

Valuables

3.94. Valuables are defined and analysed in ESA 1995, § 3.125-3.127, and in SNA 1993, § 10.116-10.117.

Definition

Valuables are produced assets that are not used primarily for production or consumption, that are expected to appreciate or at least not to decline in real value, that do not deteriorate over time under normal conditions and that are acquired and held primarily as stores of value. Valuables consist of precious metals and stones, antiques and other art objects and other valuables, such as collections and jewellery of significant value fashioned out of precious stones and metals (see annex ESA 1995, § 7.01). Transactions in valuables are recorded in the capital account.

3.95. These type of goods are to be recorded as acquisition or disposal of valuables in case of: (i) acquisition or disposal of non-monetary gold, silver, etc. by banks and other financial intermediaries; (ii) acquisition or disposal by enterprises whose activity does not involve the production or trade of such types of goods (so they are not included in intermediate consumption or gross fixed capital formation; (iii) acquisition or disposal by households (they are not included in final consumption expenditure).

3.96. Acquisitions and disposals of valuables are recorded in the capital account and are valued at the actual or estimated prices payable by the units acquiring the asset to the units disposing of the asset plus any associated costs of ownership transfer incurred by the units acquiring the assets such as fees payable to expert valuers, agents, auctioneers, etc (obviously, prices includes dealers' margins).

3.97. Estimating the volume of transactions in valuables on a quarterly basis may not be easy, due to the lack of quarterly basic data at current and constant prices.

3.98. Clearly the direct estimation according to the rules above is the best solution from a theoretical point of view also on a quarterly basis. Since it is not easy to implement however, alternative solutions can be suggested. The easier strategy is to start from the annual value of valuables, which is evaluated on a more accurate base, and then estimate quarterly figures by means of interpolation and extrapolation of annual data. Some additional market information can be used to improve the estimation and to trace the path for specific items (i.e., we can use price lists for precious stones and metals, data on the values at which are insured works of art, antiques, jewellery, etc.).

Changes in inventories (P.52)

3.99. Changes in inventories are defined and analysed in ESA 1995, § 3.117-3.124, and in SNA 1993, § 10.96-10.115.

Definition

Changes in inventories are measured by the value of the entries into inventories less the value of withdrawals and the value of any recurrent losses of goods held in inventories (see ESA 1995, § 3.117).

3.100. *Problem and discussion*

There are three problems here concerning the estimates of changes in inventories on a quarterly basis. These are (i) the measurement of work-in-progress, (ii) the consistency of the estimates with other parts of the accounts, and (iii) the estimation of holding gains, where estimates are based on book value data.

The measurement issue concerns, essentially, the application of the general principles for measuring work-in-progress, and the specific problem related to the estimation for agriculture. These have been discussed in § 3.23-3.34 and 3.35-3.51.

The second problem relates to the so-called 'pipeline' effect. In any period, certain goods are 'in transit'. That is they may have been recorded as having left inventories, but are not yet included in some other component of demand; alternatively, they may have been recorded in imports, but not yet in inventories. This issue has been discussed in § 3.10-3.12.

The third issue is how holding gains are estimated for the accounts in order to derive the figures for change in inventories (see § 3.97-3.103). The point should be made that, given the way inventories need to be revalued in the estimation approach, the quarterly information should, as far as possible, form the basis for the derivation of the annual estimates.

3.101. *Solution*

Solutions for these problems have been suggested in the relevant sections referred to above. These also embrace the implications for the output and income parts of the accounts.

Holding gains/losses

3.102. The holding gains (losses) that are primarily relevant to quarterly accounts are those on inventories.

They insure that holding gains (losses) do not distort the estimate of value added during the period. Withdrawals of inventories are valued at price prevailing the day the goods are withdrawn, not at the historic price at which they were acquired. So, if data available, e.g. from company accounts, values stocks at historic cost, any nominal holding gain (loss) between the historic book value and the price at the time of withdrawal has to be estimated and removed.

3.103. Holding gains are defined and analysed in ESA 1995, § 6.35-6.58, and in SNA 1993, § 12.63-12.115.

Definition

The nominal holding gain (K.11) on a given quantity of an asset is defined as the change in value for the owner of that asset as a result of a change in its price. The nominal holding gain on a liability is defined as the change in value of that liability as a result of a change in its price, but with the sign reversed (see ESA 1995, § 6.35).

Hence, a positive holding gain is due to an increase in the value of a given asset or a reduction in the value of a given liability whilst a negative holding gain, i. e. a holding loss, is due to a reduction in the value of a given asset or an increase in the value of a given liability (see ESA 1995, § 6.37).

Holding gains include gains on all kinds of assets: non-financial produced and non-produced assets, and financial assets. Thus, holding gains on inventories of all kinds of goods held by producers, including work in progress, are also covered (see ESA 1995, § 6.39).

Holding gains are recorded in the revaluation account.

The holding gains (losses) that are primarily relevant for quarterly accounts are those on inventories.

3.104. The quarterly treatment of holding gains strictly derives from the treatment of holding gains on an annual base. The principles of recording are clearly expressed in ESA 1995, § 6.41, and in SNA 1993, § 12.73 and can easily be extended to the quarterly case:

a) the holding gain on an asset held throughout the accounting period is equal to the closing balance sheet value minus the opening balance sheet value. These values are the estimated values of the assets if they were to be acquired at the time the balance sheets are drawn up.

b) the holding gain on an asset held at the beginning of the period and sold during the period is equal to the actual or estimated disposal value minus the opening balance sheet value.

c) the holding gain of an asset acquired during the period and still held at the end of the period is equal to the closing balance sheet value minus the actual, or estimated, acquisition value of the asset.

d) the holding gain on an asset acquired and disposed of during the accounting period is equal to the actual, or estimated, disposal minus the actual, or estimated, acquisition value.

Since holding gains are recorded on an accrual basis, the distinction between realised (a and c) and unrealised in (b and d), has no relevance in the accounting framework.

3.105. Holding gains may accrue on assets held for any length of time during the accounting period and not merely on assets that appear in the opening and/or closing balance sheets. In this case, the holding gain value is equal to the current value of the asset at the later point of time minus the current value of the asset at the earlier point of time, assuming that no qualitative or quantitative changes take place meanwhile.

3.106. Real holding gains may be obtained residually by subtracting neutral to nominal holding gains. The neutral holding gain on an asset over a given period of time is equal to the value of the asset of the beginning of the period multiplied by the proportionate change in some comprehensive price index selected to measure the change in the general price level.

3.107. The measurement of nominal holding gains on inventories may be difficult because of lack of data on transactions or other volume changes in inventories. The principles of recording are stated in SNA 1993, § 12.104-12.106 including the particular case of working progress. If the transactions to which the holding gains refer to are properly valued, nominal holding gains on inventories are given by the value of the closing inventories at the end of the period prices, minus the value of the opening inventories at the beginning of the period prices, minus the resulting value of entries/withdrawals and losses at the prices prevailing at the times that they took place, minus the value of other volume changes (i.e., good destroyed due to exceptional events, etc.). The direct measure of change in inventories is unusual, so it must be estimated according to balance sheet data and to the hypothesis that both prices and quantities of the asset change at constant linear rates in the period (arithmetic progression). Clearly, if there is evidence of different path, it must be kept into account in estimating holding gains.

3.108. To ensure that holding gains (losses) do not distort the estimate of value added during the period, withdrawals of inventories are valued at the price prevailing the day the goods are withdrawn, not at the historic price at which they were acquired. So, if data available, e.g. from company accounts, values stocks at historic cost, any nominal holding gain (loss) between the historic book value and the price at the time of withdrawal has to be estimated and removed.

Exports and imports of goods and services (P.6 and P.7)

3.109. Exports and imports of goods and services are defined and analysed in ESA 1995, § 3.128-3.146, and in various places in SNA 1993.

Definition

Exports of goods and services consist of transactions in goods and services (sales, barter, gifts or grants) from residents to non-residents (see ESA 1995, § 3.128).

Imports of goods and services consist of transactions in goods and services (purchases, barter, gifts or grants) from non-residents to residents (see ESA 1995, § 3.129).

3.110. *Problem and discussion*

The problem identified is that of the pipeline effect, discussed in § 3.10-3.12.

Solution

A solution for this problem has been suggested in the relevant section referred to above. More discussion of this can be found in the IMF Balance of Payments Manual (5th Edition).

B) DISTRIBUTIVE TRANSACTIONS

3.111. Distributive transactions are defined and analysed in Chapter 4 ESA 1995 and in Chapters 7 and 8 in SNA 1993.

Definition

Distributive transactions consist of transactions by means of which the value added generated by production is distributed to labour, capital and government, and of transactions involving the redistribution of income and wealth (see ESA 1995, § 4.01).

Compensation of employees (D.1)

3.112. Compensation of employees is defined and analysed in ESA 1995, § 4.02-12, and in SNA 1993, § 7.21-7.47.

Definition

Compensation of employees is defined as the total remuneration, in cash or in kind, payable by an employer to an employee in return for work done by the latter during the accounting period (see ESA 1995, § 4.02; SNA 1993, § 7.21).

3.113. *Problem and discussion*

There are two main components of compensation of employees-wages and salaries and employers' social contributions. This section deals with the first of these. The way in which employers make certain payments of wages and salaries to employees raises a number of potential problems for recording on an accrual basis. Again, these are likely to be of greater significance for quarterly estimates than for the annual figures. In general, wages and salaries paid by employers for a given period will relate to economic activity which has taken place in that period. However, there are exceptions to this practice, such as advance or late payments, or bonus or '13th month' payments. This section considers how such payments should be treated in the accounts.

3.114. The quarterly information on wages and salaries for the national accounts is likely to be derived from one of two sources, or indeed some combination of them. The more usual approach is to derive figures based on estimates of employment and average earnings, by industry, which are then aggregated for the economy as a whole. The second possible source is government information, arising out of the administration of the tax system. Whatever estimation approach is used, it is likely that exceptional payments of the kind mentioned above will appear in the figures which are reported for the national accounts, though more likely that they will appear in the government tax information.

3.115. There are a number of factors to be considered in deciding how these payments should be treated in the accounts. In general, increased payments in a particular quarter are likely to represent rewards for economic activity which has been undertaken over a number of earlier quarters. Thus, it might be argued, reflecting the principle of accruals recording, the amounts over and above the 'normal' payment for the quarter should be spread over these earlier quarters. It is important to note that, if this approach were to be adopted, it would also be necessary to adjust other variables in the account, in order to achieve consistency in the estimates. Before deciding on what might be done, it is essential to have a full understanding of recording practices relating to the direct and indirect effects of any exceptional payments of wages and salaries.

3.116. An important part of the accounts which may be affected by such payments would be the income measure of GDP. Here, if an increased level of wages and salaries is recorded in the accounts for a particular quarter, it is essential to ensure that there is an offsetting reduction in the figure of operating surplus. This is only relevant if estimates of operating surplus and of wages and salaries are made independently, and not by residual. Clearly, if no offset existed, the estimate of income GDP would be overstated in one quarter and understated in others. Where operating surplus is derived as a residual, the impact of the increased income will be implicitly taken into account. It will also be necessary to ensure consistency between the value figures and deflators which may be used in the derivation of any constant price estimates.

3.117. A further main area where consistency problems would need to be borne in mind is in relation to the series for household consumption. On the one hand, where employees expect that they will receive increased payments at some time in the future, consumption might be undertaken in advance of actual receipts. As a result, the quarterly pattern of spending might not be much different from what it would have been with a regular flow of income. Alternatively, if an increased level of receipts of income in a particular quarter is not known or anticipated, the likely increase in consumption will occur in the period of payment or in later quarters. The impact of any inconsistency between figures of compensation of employees and household consumption will be reflected in saving and the saving ration

3.118. It is clear that, if any adjustments are made to the estimates of quarterly wages and salaries, related adjustments may be necessary to other key parts of the accounts. It also needs to be remembered that some series may need to be modified even if no adjustments are made to wages and salaries. Although recording practices can be fairly readily determined, it will not be easy to assess other implications, such as the effect on household spending and the type of goods and services consumed. Thus some of the adjustments which might be deemed necessary are likely to be largely subjective.

3.119. Solution

Given all this, it is recommended that, where 'lumpy' payments of wages and salaries are made, no adjustments are made to these quarterly data. This should obtain for all such payments, including those where it is known that they relate to specific activity in a specific period. Although this would seem to be a departure for the accrual basis of the accounts, the recommendation recognises the severe difficulties of making adjustments to not only wages and salaries, but also to other key parts of the accounts. However, some adjustments should be considered for certain variables to ensure consistency with the figures of wages and salaries. In particular, compilers should ensure that the estimate of operating surplus is consistent with the wages and salaries data, so that income GDP is not distorted. In addition the figure of income tax should also be made consistent (say by using some derived tax ratio), as, if relevant, should be the deflator. However, no adjustment should be made to figures of household consumption (or taxes on products), which should appear as reported. As consequence, the figures of saving and the saving ratio (saving to disposable income) will reflect any inconsistency, and this feature should be highlighted in any commentary on the estimates. Finally, it should be noted that, where such payments occur in the same quarters each year, the seasonal adjustment process will tend to smooth out some of the erratic movements.

Taxes on production and imports (D.2)

3.120. Taxes on production and imports are defined and analysed in ESA 1995, § 4.14-4.29, and in SNA 1993, § 7.48-7.70.

Definition

Taxes on production and imports consist of 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. These taxes are payable whether or not profits are made (see ESA 1995, § 4.14).

3.121. *Problem and discussion*

The taxes included under this head are (a) taxes on products, such as VAT and excise duties, and taxes on imports, and (b) other taxes on production, such as recurrent taxes on land, buildings and other structures and payroll taxes.

3.122. Three problems have been identified (i) the need for information to be recorded on an accrual basis, (ii) the consistency of recording in different parts of the accounts, and (iii) the meaningfulness of the figures.

3.123. The first problem is that the information on receipts appearing in the government account, which is the prime source for the estimates appearing in the other accounts, will generally be on a cash basis. One reason for this is the delay which exists between the tax being deducted by the producer and paid over to, and then recorded by, government. This problem may also arise when payments are made in advance of a possible increase in the tax rate. The accrual problem here is a particular example of the general issue discussed in § 3.07-3.09.

3.124. The second problem, which has some relationship with the first, is to ensure payments and receipts are recorded on a consistent basis in different parts of the account. This issue has been discussed in general terms in § 3.10-3.12.

3.125. The third issue is to ensure that the quarterly series are meaningful in an economic sense. One particular series where problems may arise is that for payments of recurrent taxes on land, buildings or other structures. This tax, which may be regarded as an annual tax, may be paid in only one or two quarters of the year, and the resulting quarterly figures, for both the seasonally adjusted and, particularly, the non-seasonally adjusted, series will have little economic significance. This issue has been discussed in general terms in § 3.13-3.15.

3.126. Solution

In respect of all three problems the extent of any distortion to the tax figures will depend very much on the arrangements existing in individual countries for paying these taxes. The estimation approach can be undertaken for information at either current or constant prices, and also for both non-seasonally adjusted and seasonally adjusted data.

3.127. On the first problem, where taxes accrue and are paid on a fairly regular basis during the year, the distorting effect of using cash receipts may be only small. However, for household consumption, the main determinant of taxes on products, the profile of quarterly spending is far from even during the year, although the seasonal pattern will be fairly constant from one year to the next.

3.128. It is recommended that, where taxes on products are recorded in the government accounts on a cash basis, these figures should be adjusted so that they relate better to the consumption activity for the period. The exact nature of how this might be done will depend on the way in which the tax is collected and recorded. One possibility would be to lag receipts by a number of weeks to allow for the delay between accrual and receipt. An alternative approach is to derive the accruals-based estimate of the tax by applying the relevant tax rates to the appropriate detailed components of spending in the quarter (allowing for zero-rated commodities). A third approach, where no ‘explanatory’ variable exists, would involve the use of interpolation or equal allocation of the annual figure over all four quarters. Checks should be made on the plausibility of the overall tax/spending ratios.

3.129. For the second problem, consistency will be achieved by using, for the figures of payments in the accounts of the producers, the (estimated accrual) figures which appear as receipts in the government account.

3.130. On the final issue, it is proposed that, where figures are not meaningful, adjustments are made along the lines suggested in § 3.12. In particular, the estimates for recurrent taxes on land, buildings and other structures can be related to the appropriate pattern of output.

3.131. Finally, as mentioned before, where cash figures are adjusted to an accrual basis, or in some other way, for the main accounts, it will be necessary to include compensating adjustments (the difference between adjusted and cash figures) in the financial accounts to ensure consistency of recording.

Subsidies (D.3)

3.132. Subsidies are defined and analysed in ESA 1995, § 4.30-4.40, and in SNA 1993, § 7.71-7.79.

Definition

Subsidies are current unrequited payments which general government or the Institutions of the European Union make to resident producers, with the objective of influencing their levels of production, their prices or the remuneration of the factors of production (see ESA 1995, § 4.30).

3.133. *Problem and discussion*

Subsidies are equivalent to negative taxes on production in so far as their impact on the operating surplus is in the opposite direction to that on taxes on production. The payment of subsidies by government can give rise to problems similar to those encountered with taxes. The specific problem is that payments will not always reflect the way the subsidies should accrue. This will arise particularly for those subsidies which may be regarded, essentially, as annual in nature, and for which the quarterly payments recorded are not meaningful.

3.134. Solution

As with taxes, the aim should be to ensure that the subsidy is included on an accrual basis. This may be attempted in various ways. Where such payments are made to public corporations or to large private corporations, it may be possible to get some information from their quarterly accounts as to how the subsidies have accrued. If this is not possible, estimates should be obtained by relating the subsidy to the economic activity on which it is due. Failing that, interpolation or uniform allocation to each quarter should be employed. In all cases quarterly figures need to be adjusted to revised annual data. Finally, as with taxes, any move away from the cash-based figures will require an associated adjustment for the financial accounts to maintain consistency.

Property income (D.4)

3.135. Property income is defined and analysed in ESA 1995, § 4.41-4.76, and in SNA 1993, § 7.87-7.133.

Definition

Property income is the income receivable by the owner of a financial asset or a tangible non-produced asset in return for providing funds to, or putting the tangible non-produced asset at the disposal of, another institutional unit (see ESA 1995, § 4.41).

The two components of property income considered under this head are interest and dividends.

Interest

3.136. Interest is defined and analysed in ESA 1995, § 4.42-4.52, and in SNA 1993, § 7.93-7.111.

Definition

Under the terms of the financial instrument agreed between them, interest is the amount that the debtor becomes liable to pay to the creditor over a given period of time, without reducing the amount of principal outstanding (see ESA 1995, § 4.42; SNA 1993, § 7.93).

3.137. *Problem and discussion*

Interest should be recorded in the accounts on an accrual basis, that is as accruing continuously over time to the creditor on the amount of principal outstanding. The interest accruing in each accounting period is the amount receivable by the creditor and payable by the debtor. Such amounts must be recorded whether or not they are actually paid or added to the principal outstanding. The problem which arises here is essentially that of the need for accruals recording. Some payments of interest are made half-yearly or annually, and these need to be put on to the accrual basis. The extent of the problem will clearly depend on the practices for making interest payments.

3.138. *Solution*

It is recommended that, where it is necessary to put payments of interest on to an accrual basis, this is achieved by relating appropriate ‘average’ rates of return to the levels of debt outstanding. Adjustments should be made for both non-seasonally adjusted and seasonally adjusted data. The quarterly estimates can then be aligned with the firmer based annual totals. Again it should be emphasised that, whatever is done, the approach for the given instrument should be consistent as between payments and receipts, and also across the institutional sectors. This can be achieved by using a single source for the estimates of payments and receipts, or by balancing estimates in a matrix of payments and receipts. Adjustments made to cash figures will, again, require related adjustments in the financial accounts.

Dividends

3.139. Dividends are defined and analysed in ESA 1995, § 4.53-4.55, and in SNA 1993, § 7.112-7.114.

Definition

Dividends are a form of property income received by owners of shares to which they become entitled as a result of placing funds at the disposal of corporations (see ESA 1995, § 4.53). Dividends are recorded at the time they are due to be paid, as determined by the corporation (see ESA 1995, § 4.55).

3.140. *Problem and discussion*

The method of recording dividends in the accounts is seen to be different from interest. The reason for this is that the period over which dividends accrue will depend on the decision as to when they are to be paid. The specific problem, therefore, is to ensure consistency of payments and receipts in the sector allocation. These problems will arise for the annual estimates, and the way in which they are resolved should be followed, as far as possible, for the quarterly data.

3.141. *Solution*

As with the interest variable, consistency can be achieved by using a single source for the estimates of payments and receipts, or by balancing estimates in a matrix of payments and receipts.

Current taxes on income, wealth, etc. (D.5)

3.142. Current taxes on income, wealth, etc., are defined and analysed in ESA 1995, § 4.77-4.82, and in SNA 1993, § 8.43-8.54.

Definition

Current taxes on income, wealth etc. cover all compulsory, unrequited payments, in cash or in kind, levied periodically by general government and by the rest of the world on the income and wealth of institutional units, and some periodic taxes which are assessed neither on the income nor on the wealth (see ESA 1995, § 4.77).

3.143. *Problem and discussion*

The taxes included under this head are (a) taxes on income, in particular on wages and salaries, on mixed income and on operating surplus, and (b) other current taxes, such as taxes on capital and wealth.

3.144. As with taxes on income, three problems have been identified (i) the need for information to be recorded on an accruals basis, (ii) the consistency of recording in different parts of the accounts, and (ii) the meaningfulness of the figures. There is also a fourth issue which might be mentioned, namely how to deal with the fact that, for some taxes, the final extent of tax liability is not known until some time after the period of compilation.

The first and second problems are broadly the same as raised in respect of taxes on products (see § 3.115-3.126).

The third issue is to ensure that the quarterly series are meaningful in an economic sense. Two particular series where problems of this kind may arise are taxes on mixed income and on operating surplus. Here, payments may be made in only one or two quarters of the year, and the resulting quarterly figures, for both the seasonally adjusted and, particularly, the non-seasonally adjusted, series will have little economic significance. This problem is broadly the same as raised in respect of taxes on products (see § 3.115-3.126).

The fourth problem affects both annually and quarterly estimates. It relates, particularly, to taxes on operating surplus and, to a lesser extent, to taxes on mixed income. In extreme cases, the final liability may not be known until 10 years after the activity. The issue is how to treat these ‘revisions’ to data in the accounts.

3.145. *Solution*

For all problems, the extent of any distortion to the tax figures will depend very much on the arrangements existing in individual countries for paying these taxes. The estimation approach can be undertaken for information at either current or constant prices, and also for both non-seasonally adjusted and seasonally adjusted data.

3.146. In respect of the first problem, where taxes accrue and are paid on a fairly regular basis during the year, the distorting effect of using cash receipts may be only small. Taxes on wages and salaries are normally collected under a ‘pay-as-you-earn’ system. If the levels of wages and salaries were broadly uniform during the quarters of the year, then this delay may not constitute much of a problem. However, as indicated in § 3.100, wages and salaries can, at times, exhibit erratic quarterly movements.

3.147. For taxes on wages and salaries, it may be possible to put the quarterly figures closer to the accrual basis by lagging the receipts data by a certain number of weeks, reflecting the extent of the lag between payment and recording. If this cannot be done, figures should be derived by applying an estimated ratio of tax to wages and salaries to the latter data for the quarter. This second solution may be more appropriate to dealing with the existence of ‘lumpy’ payments of wages and salaries. In adopting this approach, the impact of tax rebates on the calculation may need to be considered.

3.148. For taxes on mixed income and on operating surplus, or indeed other taxes which exhibited a profile which was not meaningful, adjustments should be made to the basic quarterly figures. This should be done by applying an appropriate tax rate to the corresponding level of economic activity, adjusting the new series to the annual level.

3.149. For the second problem, consistency will be achieved by using, for the figures of payments in the accounts of the producers, the (estimated accruals) figures which appear as receipts in the government account.

3.150. On the third problem, it is proposed that, where figures are not meaningful, adjustments are made along the lines suggested in § 3.115-3.126.

3.151. The fourth issue of late assessments-may be seen, in principle, as no different from any other parts of the accounts where final information does not come to hand until some time after it is required. However, given the possible extent of the delay in finalising assessments, even if they could be allocated to the relevant year, to include them in the estimates in the conventional way would clearly lead to persistent and long-term revisions. It is, therefore, usually the practice that the estimate of tax making up the annual figure is the cash receipts in the particular year. This figure then becomes the basis for determining the quarterly profile, as described above.

3.152. As before, where cash figures are adjusted to an accrual basis, or in some other way, for the main accounts, it will be necessary to include compensating adjustments in the financial accounts to ensure consistency of recording.

Capital transfers

3.153. Capital transfers are defined and analysed in ESA 1995, § 4.145-4.167, and in SNA 1993, § 10.131-10.141.

Definition

A capital transfer in cash consists of the transfer of cash that the first party has raised by disposing of an asset, or assets (other than inventories), or that the second party is expected, or required, to use for the acquisition of an asset, or assets (other than inventories). The second party, the recipient, is often obliged to use the cash to acquire an asset, or assets, as a condition on which the transfer is made (see ESA 1995, § 4.146).

A capital transfer in kind consists of the transfer of ownership of an asset (other than inventories and cash), or the cancellation of a liability by a creditor, without any counterpart being received in return.

3.154. Capital transfers cover capital taxes (D.91, i.e., taxes on capital transfers like inheritance, death duties, gifts *inter vivos*), investment grants (D.92, i.e., capital transfers made by government or by the rest of the world to resident or non-resident institutional units to finance the cost of acquiring fixed assets) and other capital transfers (D.99, i.e. capital transfers that redistribute saving or wealth among the different sectors or sub-sectors of the economy or the rest of the world). They are recorded in the capital account.

3.155. On a quarterly basis too, the rules of recording capital transfers follow the principles stated in ESA 1995 and in SNA 1993:

- a capital transfer in cash is recorded when the payment is due to be made;
- a capital transfer in kind is recorded when the ownership of the asset is transferred or the liability cancelled by the creditor.

The transfer of a non-financial assets is valued by the estimated price at which the asset, whether new or used, could be sold on the market plus any transport, installation or other cost of ownership transfer incurred be the recipient.

Transfers of financial assets, included the cancellation of debts, are valued in the same way as other acquisitions or disposals of financial assets or liabilities.

C) OTHER FLOWS

3.156. As specified in ESA 1995, § 6.01: “Other flows cover consumption of fixed capital (K.1), acquisitions and disposals of non-financial non-produced assets (K.2) and other changes in assets (K.3-K.12). The other changes in assets consist of different kinds of changes in assets, liabilities and net worth which are not the result of transactions being recorded in the capital and financial accounts. They cover other changes in volume (K.3-K10 and K12) and also holding gains and losses (K.11)”.

For the purposes of quarterly accounts only consumption of fixed capital can be regarded as a key variables.

Consumption of fixed capital (K1)

3.157. Consumption of fixed capital is defined and analysed in ESA 1995, § 6.02-6.05, and in SNA 1993, § 6.179-6.203.

Definition

Consumption of fixed capital (K.1) represents the amount of fixed assets used up, during the period under consideration, as a result of normal wear and tear and foreseeable obsolescence, including a provision for losses of fixed assets as a result of accidental damage which can be insured against (see ESA 1995, § 6.02).

3.158. Estimates of consumption of fixed capital are most generally derived from the methodology used to determine figures of capital stock. The approach adopted, almost universally, is the model based Perpetual Inventory Method (PIM) rather than direct measurement, and is usually structured for deriving annual figures. The estimation process, which is undertaken for a range of different assets, incorporates assumptions about the length of life of these assets and their retirement distribution, and how they should be depreciated, together with information on the value and prices of GFCF.

3.159. The quarterly estimates required of capital consumption are much less disaggregated than what is needed annually, although figures are needed in the measurement of government estimates. In principle, it should be possible to adapt the structure and assumptions of the annual model as a basis for deriving quarterly information. However, the data on GFCF and prices required for the estimates may not always be available in the detail needed. Any estimates made in this way would subsequently need to be aligned with the annual figures, which would utilise a fuller and more reliable range on input data. However, reflecting the need for and quality of the estimates, and also the amount of work which would be involved, it is for consideration whether it is essential to adapt the model in this way. The need for the broad estimates of capital consumption quarterly can probably be met by extrapolating the previous annual estimates of capital consumption on the basis of estimates of the quarterly movements in GFCF and prices. The estimation might be made at constant prices, which can then be inflated to current prices. Again the estimates will need to be aligned to the annual information when available. If desired, special procedures might be considered for the government sector, including the possibility of direct measurement.

Section 5 - Population and employment

3.160. Certain comparisons between countries, regions, or between industries or sectors within the same economy, become meaningful only when the aggregates in the quarterly national accounts (for example GDP, the final consumption of households, the value added of an industry, compensation of employees) are considered in relation to the number of inhabitants (to compute per capita GDP, consumption in per capita terms) and labour input variables (to examine productivity and unit labour costs).

3.161. It is therefore necessary to have up-to-date and reliable population and employment figures following accepted definitions of the total population, employment, jobs, total hours worked, full-time equivalence. The aggregates to which the figures for population and labour inputs are related to are quarterly results. Therefore, average population and labour inputs during a certain quarter should be used.

3.162. Population and employment are defined and analysed in Chapter 11 ESA 1995, and in Chapter 17 SNA 1993. The definitions presented are closely linked to the concepts used in the national accounts and are defined on the basis of the concepts of economic territory and centre of economic interest (see ESA 1995, § 11.02; SNA 1993, § 17.22).

Population

3.163. *Definition*

Population is the quarterly average number of persons present in the economic territory of a country (see SNA 1993, § 17.24).

By convention, the economic territory includes embassies, military bases and ships and aircraft abroad. On a given date, the total population of a country consists of all persons, national or foreign, who are permanently settled in the economic territory of the country, even if they are temporarily absent from it (see ESA 1995, § 11.05). Total population is defined for national accounts according to the concepts of residence (see ESA 1995, § 11.06).

3.164. *Problem and discussion*

For a qualifying date (day or week) population and employment statistics estimate on the basis of a census, random sample surveys, and household panels, the amount and structure of the population categorised by age, sex, marital status, nationality, regional distributions, their composition according to education, religious denomination, profession, employment, and their subdivision in household and family forms. For quarterly considerations, an average value of the total population in each quarter is needed.

3.165. *Solution*

The change in the population must be updated and extrapolated. The sources for doing this include the employment administration, the registry offices for vital events, other registration authorities and the family law courts.

Employment

3.166. *Economically active population*

Definition

The economically active population comprises all persons of either sex, and above a certain age, who furnish the supply of labour for the productive activities, during a specified time-reference period. The economically active population, which is a subset of the whole population, is split into employed (employees and self-employed) and unemployed persons (see ESA 1995, § 11.10).

3.167. *Employment*

Definition

Employment has been defined by the International Labour Organisation (ILO). Employment covers all persons, both employees and self-employed, engaged in some production activity that falls within the production boundary (see ESA 1995, § 3.07-3.09). Employees consist of resident persons employed by resident producer units plus resident commuters employed abroad. Self-employed are resident self-employed. Preferably, the number of employees by industry and self-employed by industry have to be presented in quarterly national accounts.

3.168. *Unemployment*

Definition

In accordance with the norms established by the International Labour Organisation following the Thirteenth International Conference of Labour Statisticians, the unemployed comprise all persons above a specified age who during the reference period were ‘without work’, ‘currently available for work’ and ‘seeking work’ (see ESA 1995, § 11.20).

3.169. *Jobs*

Definition

Jobs could be looked at in terms of the residence of the employee or self-employed person, because resident producers alone contribute to GDP. A job is defined as an explicit or implicit contract between a person and a resident institutional unit to perform work in return for compensation for a defined period or until further notice (see SNA 1993, § 17.25; ESA 1995, § 11.22).

3.170. *Total hours worked*

Definition

Total hours worked is the preferred measure of labour inputs, because output per job is regarded as too inaccurate to measure productivity. Total hours worked is the aggregate number of hours actually worked during the year in employee and self-employment jobs (see SNA 1993, § 17.11-12, ESA 1995, § 11.26).

3.171. *Full-time equivalent*

Definition

Full-time equivalent employment is the number of full-time equivalent jobs, defined as total hours worked divided by average annual hours worked in full-time jobs within the economic territory (see ESA 1995, § 11.32). Measuring labour input in terms of full-time equivalent work years is an inferior alternative to expressing labour input in terms of total hours worked (see SNA 1993, § 17.24).

3.172. *Problem and discussion*

In practice, the compiler of quarterly accounts has to determine adequate employment figures. The phenomenon of hidden employment is not fully reflected in administrative statistics and there is often a lack of suitable information, especially in farming, construction, catering and domestic services. The size of the problem can be indicated by the following examples: seasonal work and clandestine work in agriculture; seasonal workers, "odd-jobs" and black work in hotels and restaurant trades; part-time job-holders and temporary workers such as pupils, students, pensioners as supermarket cashiers in retail trades, paper-boys, students as taxi-drivers; persons with two incomes - unemployment benefits plus clandestine job; self-build and contributions from neighbours in the construction sector; 'black' workers in abattoirs and in the construction sector. For firms in declining sectors who need to cut costs or for illegal immigrants unable to join the formal sector, it may be a survival strategy. Identifying such groups of workers in the parallel economy doesn't entail an automatism for an upward revision of GDP.

3.173. *Solution*

No ready-made solution is available for this problem. National compilers must therefore make their own best estimates.

Section 6 - Constant price estimates

CONSTANT PRICES

3.174. Many of the key aspects relating to constant price data in the quarterly accounts are discussed, implicitly or explicitly, in other chapters in the handbook. This part of the handbook brings together these key points, together with some other important features. The issues, which apply equally to annual and quarterly data, are considered under four broad headings (a) the form of constant price series, (b) conceptual and definitional issues, (c) data aspects, and (d) other issues. Where relevant, reference is made to the more detailed discussion elsewhere in the handbook.

3.175. It is worth making a few brief introductory remarks about the need for and derivation of constant price data. To begin with the main purpose of the constant price data is to provide measures of economic activity in which the effect of price movements is removed. Further information on needs for quarterly data generally is given in Chapter 1. In the main, all components of the production and expenditure measures of GDP can be estimated in constant price terms. For the income measure, however, there is no meaningful approach to estimating operating surplus (and possibly mixed income) at constant prices.

3.176. Constant price estimates can be compiled in three broad ways. These are (i) deflation of current price estimates by appropriate price information, (ii) direct quantity measurement, or (iii) extrapolation of ‘base year’ figures by volume indicator series which are deemed to represent the movement in the particular variable. For all approaches, the estimates should be compiled in as much detail as possible. In practice, countries are likely to use a combination of all these approaches, depending, in large part, on the availability and reliability of data. The point should be made that, other things being equal, the deflated value approach is to be preferred to extrapolation. This is because price relatives will generally move within a narrow range, while quantities can move much more widely. The use of deflated values also provides, through the price data, a better basis for making allowance for quality changes (see § 3.199-3.200). There is, however, one caveat to be mentioned. This is that, in a period of high inflation, the constant price change will generally be small compared with changes in value and price. As such, the precision with which the volume data can be measured is expected to be reduced, as the effect of measurement errors and timing differences, for example, become much more important. In these circumstances, as well as observing more caution, there will be some advantage in basing constant price statistics more on quantity data than on deflated values. Once the raw constant price data have been derived, they can be incorporated in the framework of the national accounts in the same way, and consistent with, the current price figures. In particular, the information can be balanced in a supply-use table (see Chapter 11).

3.177. The United Nations Manual M64 on “National Accounts at Constant Prices” provides an extremely useful guide to the various problems of compiling constant price figures. The manual covers, in particular, the main issues discussed in the handbook, and also considers the derivation of constant price figures for certain variables and for particular industries. The broad principles of estimation are also covered in ESA 1995/SNA 1993. In order to determine how the principles of constant price estimation might be implemented in practice, Eurostat has set up a Task Force comprising certain EU Member States to look at all aspects of the problem. Some recommendations made by the Task Force are reported in § 3.180.

The form of constant price series

3.178. Three broad issues will be considered here. The first concerns the **base year** in which the constant price data are to be expressed. The second issue is the choice of **reference year**. The final matter under this head relates to the **form of index number** to be used for the constant price figures.

3.179. The **base year** is the year used to determine the pattern of prices on which the constant prices figures are calculated. Different base years lead to different estimates of constant price levels. The specification of the base year may be considered as taking one of two forms. In the first, usually called chaining, figures for a given year are expressed in the prices of the previous (base) year, and the base year is changed every year. In the second, usually termed a fixed base, data are given in terms of a particular (base) year which is then updated periodically, and regularly, over a period of more than one year (usually five). Hitherto, most countries have adopted the second approach, updating the base year every five years (often using years ending in 0 or 5). However, ESA 1995 and SNA 1993 recommend the former approach, that is updating the base year every year. The main reason for this is that, with changes in relative prices, the figures derived from a fixed base lose much of their meaningfulness as the period of measurement moves away from the base year. Further, with a fixed base, for a given year, proper comparisons are possible only with the base year; for other comparisons, constant price movements will also reflect the effect of movements in relative prices. Chaining provides the proper basis for comparison of one year with the previous year. It should not go unmentioned, however, that chaining is more demanding of resources than the fixed base approach.

3.180. The Task Force, mentioned above, has recommended that Member States should start to use annually changing base years from the introduction of ESA 1995 onwards (namely, in 1999). Derogations are permitted, during which time 1995 should be used for the fixed base approach. The Task Force has also made certain recommendations about the level of detail which should be used for the derivation of constant price data. The broad principle to be adopted is that the calculations should be made in as much detail as possible. It is recognised, however, that the detail available when the first quarterly estimates are required will be less than that which will emerge later from firmer and more detailed annual inquiries. It should be remembered that the constant price estimates for a given quarter in a particular year are based on the relative prices of the whole of the previous year, and not on the prices of the corresponding quarter of a year earlier.

3.181. The issue of the **reference year** relates to the compilation of long-run series. As the corollary of the statement at the end of § 3.179, where constant price data are compiled using a base year which changes annually, it is not possible to compare, directly, figures for other than two adjacent years. It might be noted, in passing, that, where a fixed base is employed, although this problem does not obtain for the years over which this base is used, it does arise for years in different base periods. In order to achieve long-run comparability of constant price data, it is necessary to establish a reference year in which long-run series can be expressed in terms of a common 'value'. For data in the form of currency, this is simply the value of the particular series in the reference year. For data in index number form, it is the year in which the index is expressed as 100. The long-run series are thus determined by taking their reference year value (or 100, if in index) form and cumulating the separately compiled annual chained growth rates. In the context of Eurostat statistics, the reference year will be the year to be used for the submission and presentation of constant price data.

3.182. There is one further matter to be mentioned in relation to the consideration of the reference year. This is the well-known issue of 'additivity'. A key feature of the constant price compilation process is that changes in the reference year should not influence the year-to-year movements in the estimates. In other words, for a given variable, the year-to-year changes are independent of the reference year chosen. For a single detailed, aggregate, this is not a problem. However, a problem does arise in the more likely situation where variables are derived by aggregating a number of component series. In this case, for a particular variable, on re-referencing there will be a difference in the growth rates or levels obtained for (a) the variable itself, and (b) the variable derived as the sum of the re-referenced component series. This phenomenon is usually referred to as the additivity problem. It should be borne in mind that there are advantages and disadvantages of trying to achieve additivity. In essence, this can be achieved by either (i) defining all aggregates as the sum of detailed components, or (ii) spreading the differences over the components. Both procedures would distort the chained growth rates, either for the aggregates or for the components. For Eurostat needs, these differences should not be removed. In other words, the lack of additivity will be evident in the figures. It is important that this problem is explained clearly to users. In addition, compilers should provide guidance to those users who would wish to have a data set in which the constant price figures do add up.

3.183. The third issue concerns the **type of index series** to be used for compiling constant price estimates. The ESA 1995/SNA 1993 recommends the use of Fisher indices. The rationale for these indices, which are derived as the square roots of the products (i.e. the geometric means) of the Laspeyres and Paasche indices, is that they move between the other two indices, and as such are likely to provide a better estimate of reality than one or other of the alternative measures. However, the derivation of both Laspeyres and Paasche indices needed for compiling Fisher indices is a particularly time-consuming task requiring much actual and estimated data. Some experimental work undertaken by the Eurostat Task Force has suggested that, where relative prices are not changing much and inflation is low, the chained Laspeyres index may be regarded as an adequate approximation to the corresponding Fisher index. The Eurostat proposal, therefore, is for the use of chained Laspeyres indices for compiling the constant price figures

3.184. There are two further points which should be made under this head. The first is that the change between Q4 of say year t and Q1 of year t+1 should be computed in the weights of the same base year. If this were not done, there would be a distortion resulting from the use of different base years for the two periods. Ideally, the common base year should be that for year t. In practice, when the Q1 figures for year t+1 are first compiled, in some cases in April, the detailed information needed to provide the full set of weights or relative prices for year t will not be available. Thus, the first estimate of Q1 in year t+1 will need to be derived from the best estimates of the weights for year t. These can be based on the weights for year t-1, taking account of any data available or known economic developments.

3.185. The second point is that, for some series, for example, the index of production or the constant price foreign trade data, the quarterly estimates going into the accounts are derived as the appropriately weighted sum of monthly figures. Where this occurs, it is important to ensure that the requirements for chain linking the quarterly data, discussed above, should also be applied to the monthly figures.

3.186. *Definitional and conceptual issues*

Although the issues included in this sub-section relate, essentially, to current price figures, their importance is such that they should be mentioned here. They also affect the annual estimates, but have a much greater impact on quarterly data.

3.187. The first point is that the estimates should be derived on an **accrual** basis. Where constant price figures are derived by deflation, provided the current price data are on the accrual basis, there is no problem. However, where the constant price figures are based on direct quantity measurement or obtained by extrapolation, it is essential to ensure that the proper accrual basis is observed (see § 3.07-3.09).

3.188. The second issue concerns the **meaningfulness** of the figures, in other words that the quarterly data are sensible in an economic sense. The same points relating to accruals (above) apply here (see § 3.13-3.15).

3.189. There is also a problem as to whether the estimates of constant price **non-market output** (and consumption) should reflect the impact of **productivity** changes. Neither ESA 1995 nor SNA 1993 are clear on this matter. Amongst the Member States, for some countries the output rather than input measures are used, or employment-based figures incorporate productivity adjustments; in most countries estimates are based on inputs, with no adjustments. In principle, it seems correct that the figures should be output-based or include productivity adjustments. In practice, it would help to minimise an obvious discontinuity in the estimates which would otherwise arise when a non-market activity is privatised. It is suggested that, conceptually, constant price estimates for non-market output should include the effect of productivity changes. Thus, where the non-market figures are based on employment data, some adjustment for productivity should be imposed on the basic estimates. All countries should follow this conceptual requirement. To do so will improve the comparability of the statistics.

3.190. *Data issues*

This head brings together the main issues related to the methodology for the compilation of certain components of the quarterly constant price estimates. As mentioned elsewhere in the handbook, where estimates are based on annual information, ideally, a broadly similar approach should also be adopted for the quarterly figures. However, for many components of the accounts, the range of information which can be collected quarterly is much less than is available annually. This aspect is, essentially, relevant to current price or actual quantity data. For price information, used for deflation, series are usually available on a monthly basis.

3.191. The reduction in the availability of quarterly information means that estimates will be derived by using either (i) the broad methodology as for the annual figures, but with more aggregated and less accurate data, or (ii) a different methodology, depending more on the data available. Where appropriate, this issue has been discussed in this chapter for a range of variables making up the accounts. The main areas, as they relate to the constant prices figures, are given below.

3.192. **Value added**

For annual data, the approach which should be adopted for deriving constant price estimates is double deflation. For the quarterly figures, however, the absence, in general, of information on intermediate consumption (and often on output) requires the use of some alternative approach. One possibility is to extrapolate ‘base year’ value added, for detailed industries, by indicator series which are deemed to represent the movement in value added. Such an approach may be adequate in the short-term, but requires that the figures are subsequently aligned with what should be firmer annual data, based on double deflation. This issue has been discussed earlier in this chapter (see § 3.75-3.84).

3.193. **Inventories**

The particular issue for inventories is that, ideally, the calculation should be undertaken on a quarterly basis, with the annual figures derived as the sum of the quarterly estimates. This is because, with goods held in stock, on average, for around 2-3 months, annual calculation would not include the effect of changes in quantities and prices occurring during the year. However, in deciding the way in which annual or quarterly data are used, it is important to consider the quality of the available information. Estimation of inventories affects not only the expenditure estimates, but also those for output and intermediate consumption. There may also be some relevance for income estimates. This issue, including the estimation and treatment of holding gains, has been discussed earlier in this chapter (see § 3.94-3.106).

3.194. **Agriculture**

Although the problems with agriculture, which affect the production, expenditure and income estimates, largely reflect issues related to measurement at current prices, it is worth including a reminder in this section on constant prices. In brief, estimation of constant price data needs to be considered in two separate parts. The first concerns activity, such as the production of milk and eggs, where output is largely produced and sold in the same quarter. The second, more problematical, other area relates to those parts of production which extend over a number of quarters, such as crop production. The issue is dealt with in § 3.35-3.51 in this chapter.

3.195. **Prices**

The main approach to estimation at constant prices is likely to be provided by deflation of current price data. Thus, the nature and quality of the price statistics will have a major bearing on the reliability of the derived constant price estimates. The paragraphs below set out the main issues of the role of prices in the deflation process. Some of these issues have been considered elsewhere in the handbook.

3.196. The first issue to be mentioned is that price series used for deflation should be compiled as chained Paasche indices. These indices are consistent with the use of chained Laspeyres data for the constant price estimates, as discussed in § 3.179 above. Secondly, deflation should be undertaken in as much detail as possible. Where value figures have been collected only for an aggregate, but more detailed prices are available for components, then it is preferable to attempt some disaggregation of the value total and to deflate with the separate price series, rather than deflating at the level of the total. The greater the level of aggregation used in the deflation process, the more important it becomes to use Paasche price indices. Thirdly, deflation should be undertaken consistently both within and between the expenditure and production measures of GDP. For example, within the expenditure estimates, there should be consistency as between imports and GFCF. Similarly, goods which are produced for export should be deflated consistently as between output in the production measure and exports in the expenditure statistics.

3.197. The fourth issue considered is that the constant price information must incorporate the effects of quality changes in goods and services. This allowance is more readily made through price data. The issue of allowance for quality changes is considered in § 3.199-3.200. Fifthly, seemingly identical products, produced and consumed at different times of the year, should be regarded as different products, with different prices series and separate deflation. An example for agriculture (potatoes) is given in § 3.51. The sixth point reflects the fact that the price data collected most generally relate to a given point in time. If information is collected only quarterly, then, depending on where this point of time occurs in the quarter, some weighting of the data may be necessary for deflation of a value relating to the whole quarter. For example, if prices are collected only for the end of the quarter, then the average of the that price and the price for the end of the previous quarter would seem to be the more appropriate figure for quarterly deflation. A seventh issue to be mentioned here relates to the use of price data when inflation is high. Amongst other things, this will tend to exacerbate some of the problems mentioned above. Paragraph 3.03 has made some mention of the effect of high inflation in the context of deriving constant price estimates. Finally, and obviously, as far as possible the price information collected and used for deflation should relate to the same classification of goods and services used in the accounts, and also be on the same basis, that is basic or purchaser's prices.

3.198. *Other issues*

The following paragraphs include a number of other issues related to the compilation of constant price data. While the issues also affect the current price data, given their importance for the constant price figures, it is useful to mention them here.

Allowance for quality change

3.199. The issue of allowing for quality changes in goods and services represents an important feature of the reliability and plausibility of the constant price estimates. An improvement in quality in an otherwise unchanged good or service should be regarded as a volume change in the accounts. In other words, where such an improvement leads to a change in price, this change should be ignored in deflating to obtain the constant price estimate. It should be noted that the quality problem may also be relevant for those current price estimates which are derived by reflating quantity information by appropriate prices. In practice, allowances for quality changes are best made through consideration of the price movements of the particular good or service, rather than on the basis of the quantity measure. Allowances are best made by the price statisticians. However, the national accounts compilers have an important role to play in contributing to and assessing what is being done by the price statisticians, and for any series for which specific price data may not be collected, or where quantity data are used as a basis for the estimates.

3.200. The way in which allowances for quality changes might be made in price statistics is somewhat complex, and is well beyond the scope of this handbook. In brief, two broad approaches might be adopted. The first involves evaluating particular features of the production process and seeing how these and their associated costs change with the introduction of the improved product. In the second, particular characteristics of the product are related to the price through a regression relationship. Changes in the characteristics are then used to estimate changes in the price, free of the estimated quality change. This latter method is known as the ‘hedonic’ approach. Further discussion of the role and importance of allowing for quality change in the compilation of constant price figures for the national accounts may be found in ESA 1995, § 10.15-10.18 and Chapter 16, SNA 1993.

Seasonal adjustment

3.201. One of the key differences between annual and quarterly data is that the latter appear in both ‘raw’ and seasonally adjusted form. Part IV of the handbook discusses the need for seasonally adjusted data, and has indicated ways in which such estimates might be compiled. An important consideration, discussed there, is that the sum of the seasonally adjusted (and unadjusted) quarterly data should be the same as the annual totals.

Provision of data

3.202. It should be noted that, in the derivation and provision of constant price data, the supply-use or input-output tables are compiled at the prices of the previous year, while the long-run data relate to the prices of the reference year. It is important that the different bases of the constant price figures are fully explained to users in order to avoid confusion in the existence of different estimates.

Constant price income GDP

3.203. As mentioned earlier, it is not possible to derive constant price estimates of GDP, based on income data, in the same way as used for the production and expenditure estimates. The reason for this is that operating surplus and mixed income do not have meaningful price and quantity components. For the other main variable - compensation of employees - constant price estimates, largely consistent with the production and expenditure approaches can be derived, for example by using employment and productivity estimates, or by deflation of value data by ‘wage’ rates adjusted for estimated changes in productivity and profitability.
However, in practice, it is suggested that the most sensible way of using income data in the context of the constant price figures is to derive an estimate for total GDP by deflating the income-based value data by a GDP price index. In practice, given the nature of the income estimates and the way in which such estimates are likely to be assembled, the most appropriate deflator would be the implied price index derived from the production-based measure. However, in the light of the reliability of information, consideration should be given to using the weighted average of the implied price series for the production and expenditure estimates.

Section 7 - Summary of main points

3.204. This chapter has discussed certain problems which arise with quarterly estimation for some of the variables in the accounts. Suggestions have been made as to how these problems might be dealt with. It will be useful to bring together, in this summary section, some of the common features which have emerged. Perhaps the main point to be re-iterated is that quarterly estimates should follow, as far as possible, the approach adopted for the annual figures. However, in practice, it is recognised that the information available quarterly is generally more restricted and of lesser accuracy than the annual data.

3.205. The two main principles of the approaches to measurement which have been suggested have been (i) to ensure that estimates are compiled on the accrual basis, and that (ii) they should be made consistent, in terms of time and variable and sector, over the three measures of GDP and also for the analysis by institutional sector. Where cash figures are modified, a corresponding adjustment is needed for the financial accounts to preserve consistency. The need to differentiate between arrangements for non-seasonally adjusted and seasonally adjusted data has also been raised.

3.206. Some of the discussion has concerned how quarterly estimates might be made where administrative arrangements or recording practices do not yield sensible quarterly figures, or where no quarterly data are available at all. Here, the approach proposed is to make the best annual estimate for the current year and to establish the most appropriate quarterly profile. Annual estimates can be based on the historic run of data, together with any other information of relevance. The quarterly profile should also make use of any appropriate information which might be associated with the variable. Adjustment factors, which seek to allow for any historic bias in the quarterly series, may need to be included. In the complete absence of any data, the profile will need to be based on statistical extrapolation and interpolation, where there is some direct association with economic activity, or by simple equal allocation over the quarters, for other variables which are essentially annual in nature. Revisions made subsequently to the annual estimates should be carried through to the quarterly estimates.

3.207. It has been mentioned that some of the regular distortions which occur in the quarterly figure will be reduced as a result of the seasonally adjustment process. It was also observed that inconsistencies will tend to be ironed out during the balancing process. However, this should not be viewed as the main way of dealing with the distortions. It is important that the 'best' estimates that might be derived should enter the balancing exercise. The end-product for the given series and also overall is likely to be of better quality when such adjustments are made directly, rather than letting them be derived as a result of the general balancing process.

3.208. Finally, where adjustments are needed to the quarterly series, consideration should be given to possible changes in collection, recording or estimation practices so that such adjustments can be avoided in the future.

CHAPTER 4

BASIC DATA FOR COMPILING QUARTERLY ACCOUNTS

Quarterly national accounts can only be as good as the data used to compile them. These basic statistics come from many sources, including administrative data from government, censuses, surveys of businesses and surveys of households. Sources vary from country to country and may cover a large set of economic, social, financial and environmental items, which may not be strictly related to quarterly accounts. This chapter recommends that basic statistics should meet some minimum standards of homogeneity of definitions, coherence of the generating process, nomenclatures used and periods covered. This means that a degree of harmonisation is necessary, so the chapter considers relevant existing Community legislation and makes some further suggestions on the matter.

The first part of this chapter is devoted to the theoretical analysis of basic statistics. The second part analyses the main sources used in compiling national accounts starting from the experience accumulated by some countries, especially in quarterly accounts. The third part deals with some suggestions concerning the more suitable basic statistics to be used in the compilation of quarterly accounts, following the criteria of harmonisation and reliability. In this context, the information arising from Community legislation on short-term statistics is considered in order to suggest a more harmonised and useful set of basic statistics for the compilation of quarterly accounts.

Basic data for compiling quarterly accounts

4.01. The compilation of quarterly national accounts and the estimation of the aggregates are made using a lot of statistical information. This information is usually referred to as *basic statistics*.

Clearly, basic statistics vary between the different countries and their different systems of compilation of quarterly accounts since the methodological approaches to the compilation, the statistical methods and, above all, the economic systems to be measured are themselves different.

The necessity of developing an adequate system of basic statistics has therefore always been a concern for national accountants seeking to develop quarterly accounts.

The accounting problems, the methodological choices, the revision process and timeliness of publishing are all elements which are strictly related to the use and the choice of the set of basic statistics for compiling quarterly accounts.

4.02. From a statistical point of view, the reliability of national account aggregates depends on the set of statistics on which they are based and on the way data is used in the compilation process by the statisticians in charge of compiling quarterly accounts. Consequently, the more complete the set of basic statistics and the higher the quality, the more reliable are the resulting quarterly national accounts aggregates.

4.03. For international use and in order to evaluate the properties of a system of national accounts, it is not sufficient to consider only the quality of the national aggregates and their reliability, but it is also necessary to make a comparison between similar aggregates in different countries. Then the same aggregates in different countries should be comparable. Comparability derives from both theoretical and practical considerations. It is possible that, even if the theoretical definition of identical aggregates in two different countries is the same, some differences can arise between the evaluation of the aggregates: for example, aggregates are not comparable due to the different set of basic statistics on which they are based.

In general, the more harmonised the systems of basic statistics in the different countries, the more comparable are the corresponding national accounts aggregates.

4.04. The arguments treated above are not just applicable to quarterly accounts but to all national accounts. On a quarterly basis their relevance is, however, more important. The following reasons explain this importance:

- less available information on a quarterly basis than on an annual basis;
- higher variability of quarterly basic statistics compared with annual basic statistics;
- the reduced sample size used in quarterly surveys;
- the use, on a quarterly basis, of basic statistics which represent indicators and can describe only indirectly the phenomenon which we want to measure;
- the fact that the basic statistics used in compiling annual accounts may not be suitable for compiling quarterly accounts since the aim of quarterly accounts is essentially to capture and describe short-term economic movements.

Theoretical aspects of basic statistics

4.05. Basic statistics used in the compilation of quarterly accounts present several different characteristics. Since they are the synthesis of the basic information associated with an economic phenomenon, their differences are strictly related to the economic object they are intended to measure.

Basic statistics are of many kinds and reflect the nature of the economic phenomenon they measure. So, for example, in compiling GDP according to the production approach, the amount or the quantity of output, often expressed in physical terms, represents the basic information. In retail and wholesale trade, sales, turnover and data on receipts are the most common data sources. Employment and earnings data are often used as indicators for the output of some industries. Final consumption of households may be derived from household surveys, and final consumption of general government may be derived from, for example, wage and salary statistics for the public sector. For specific items, particular sources can be considered. For example, car registration records can well describe the purchase of vehicles.

4.06. Ideally, basic statistics would supply the statistical information on an economic phenomenon related to the entire population to which the phenomenon refers. Often, basic statistics do not directly refer to the entire statistical population since, for some aggregates, collecting the information for the whole population is not possible or too expensive.

From a theoretical point of view, the information can be collected on the entire statistical population on the base of exhaustive surveys (*censuses*) or collected on a sample and then grossed up to the population (*sample surveys*). In practice, quarterly censuses are rare and the basic information is collected via sample surveys. After the collecting phase, these surveys require a grossing up procedure, that means to adapt the results of the surveys, that are based on the sample units, to the global population.

4.07. *Definition*

A survey is a general view or consideration of an economic phenomenon usually conducted by means of a questionnaire submitted to the units in scope.

The frequency of the survey can vary since the survey itself may not be conceived only for quarterly account purposes. So, monthly, quarterly and annual surveys may be the source of information for quarterly accounts. If the frequency does not correspond to the desired one, then the necessary adjustments have to be made in order to prepare the basic information.

4.08. It should be noted that the organisation of the surveys depends on the role of the quarterly accounts in the national system of accounts. In the countries in which the quarterly accounts are the key accounts, survey statistics are often targeted at the needs of quarterly accounts. In this case these statistics can be specified to obtain information on a specific aggregate and can be considered specific surveys. This is particularly true in those countries in which basic statistics are used more directly in compiling quarterly accounts (see Chapter 5). This situation, that can be considered as an optimal one, implies that the quarterly accounts are the key accounts in the national accounts system and that they play a central and vital role in the system of short-term statistics.

4.09. Basic statistics can be designed either to be used directly in quarterly accounts or to collect information about a sector or an economic unit. In this case the quarterly information has to be extracted or derived from the results of surveys that are not expressly done for quarterly purposes.
Another highly relevant source of basic statistics, is administrative records.

4.10. According to these characteristics, the sources for basic statistics can be distinguished in:

a) data coming from surveys for a specific aggregate or sector/economic unit;
b) administrative statistics.

Data coming from surveys may be specifically conceived to record information on a particular national account aggregate, on a quarterly or higher frequency (for example, the quarterly survey on value added). Otherwise they may be compiled to collect information on a specific sector of the economy or on specific statistical units. In this case, the main aims of these surveys are not necessarily the quarterly accounts needs (examples of this type of surveys are: production statistics, price statistics, balance of payments, etc.). Quarterly information is then extracted from these sources.

Administrative sources supply data coming from administrative records. This information is then used in the compilation of quarterly accounts.

4.11. Surveys for a specific aggregate are usually the base for the compilation of annual national accounts.

On a quarterly basis the situation is quite different. The need for timeliness in publishing the figures, on one hand, and the high frequency at which this kind of survey should be carried out, on the other, are an obstacle for its application for quarterly purposes. Nevertheless, in some countries a strong tradition has been developed for using such surveys for quarterly accounts.

However, information coming from surveys for a specific aggregate that is not directly employed in the compilation of quarterly accounts may influence anyway quarterly figures in an indirect way. This situation corresponds to surveys carried out at a lower or higher frequency than quarterly. For example, each time an annual version of the surveys becomes available, a revision of the corresponding quarterly figures starts in order to ensure adherence to the temporal constraints (see Chapter 10). In this way quarterly estimates are progressively influenced by subsequent annual or less frequent surveys. On the other hand, monthly surveys must be aggregated to be used in the quarterly context.

4.12. Surveys on a specific aggregate are usually fairly detailed, and take time to complete, hence their reliability increases with the passage of time: provisional quarterly estimates are based on a restricted set of information which grows when passing through intermediate revisions till the final estimate.

4.13. Surveys carried out on a specific sector have been established to supply short-term information on the different sectors of the economy. They have often been the only statistics available for short-term analysis and forecasts. When countries decided to collect more information at a macro-economic level, less detailed but more coherent in a national accounting sense, the statistics on a specific sector became more and more important. They have rapidly become the main source for compiling quarterly accounts.

4.14. These statistics are limited for quarterly purposes since they were conceived for other aims than the role of basic statistics in quarterly account compilation, even if they fulfil that role now. In consequence, they should be carefully analysed and national accountants should examine their suitability before using them as basic statistics for quarterly accounts.

4.15. The different uses of quarterly or higher frequency sources of data across Member States highlights the difference between the direct and indirect use of basic information in compiling quarterly national accounts (see Chapter 5). In the direct approach the surveys are used directly to obtain estimates of the national accounts aggregates, whilst in the mathematical-statistical (indirect) approach data from surveys are used as indicators which feed into a model to generate national accounts estimates.

4.16. Because of their construction and their theoretical basis, data generated by surveys for a specific aggregate are generally coherent with national accounts concepts whilst data coming from surveys for a specific sector are less quarterly accounts oriented.

4.17. Much statistical information can be derived from the administrative records or registers. This information is usually collected for different purposes, for example on a legal compulsory basis, and it is used to estimate the quarterly figures.

4.18. National laws and regulations define many compulsory declarations and registrations to be made by citizens and enterprises. The information arising from the files related to these compulsory registrations is often potentially suitable to be used for quarterly accounts purposes. This kind of data is particularly useful in those fields for which it is not so easy to have accurate estimates: for example, the final consumption of vehicles is easily derived from the registration record of vehicles, other consumption items can be measured using the VAT or the tax records. Obviously, a lot of statistics for the public sector are generated by administrative statistics.

Quantitative and qualitative statistics

4.19. Basic statistics cannot, in general, be used directly in the compilation of quarterly accounts. As stated in the previous paragraphs, in some cases they do not directly refer to a particular aggregate but they are built in order to obtain information on some economic sector or unit and the quarterly information is derived from these sources. In other cases, as stated above, they refer only to a sample of the target population and they require a grossing-up procedure to estimate the quarterly aggregates. Finally, in certain cases they directly refer to the physical quantitative quarterly aggregate and have to be assigned a monetary value, whereas in others they are expressed in qualitative terms.

4.20. The nature of quarterly information can be separated into two different types:

- *Quantitative information*

  The figures for the aggregate are expressed in value terms or in physical quantities.

- *Qualitative information*

  Quarterly figures are derived from a quality evaluation or description of the phenomenon they refer to (for example, household opinion surveys, business opinion surveys, etc.).

4.21. *Definition*: *Qualitative survey*

A qualitative survey is a survey in which the units involved are asked for their opinion on a specific economic question. The answer is usually chosen from a set of pre-specified choices and is intended to give an idea about the qualitative view of the respondent about the subject.

4.22. Qualitative surveys are usually used to supplement other data sources which are not considered to be sufficiently reliable by themselves for the compilation of national accounts figures. For example they can be useful to adjust the information coming from mathematical techniques of estimation (i.e. trend extrapolation).

How to measure basic statistics

4.23. Particular attention should be given in this chapter to the unit of measure used in compiling basic statistics. National accounts usually measure levels both in current prices (current quantities times current prices) and in volume (current quantities times constant prices of the base year). To be directly used in the national account scheme, basic statistics should be coherent with the corresponding aggregates in terms of unit of measure. For obvious reasons, it is not always possible. Index numbers are often preferred since they favour the comparison between different aggregates or different sectors.

4.24. In compiling quarterly accounts the elementary information is aggregated to obtain the figures corresponding to the single aggregates. The aggregation process usually asks for expressing the elementary information in value terms. So, all the original information must be translated in value terms (in particular volume information and qualitative information). To determine values, prices must be combined with volumes through some statistical elaboration and/or criteria to obtain the associated values.

4.25. Quantitative information may refer to the level of the aggregate or to the growth rates. Data on levels can be directly used in the compilation of quarterly accounts, while data on growth rates may be used as an indicator to obtain the corresponding level or in the estimation of other aggregates. If the basic data are expressed in physical quantities an evaluation process is demanded.

Qualitative information is usually related to opinion expressed on the path of the economy and can be used as indicators in the compiling process.

4.26. Basic statistics are usually available as:

- Levels in monetary units reflecting both current prices and volume (households surveys, balance of payments data, surveys of value-added, etc.);
- Index numbers in prices, volume or values (business indices and accounts, industrial production index, consumer price index, etc.).

4.27. The first group of statistics can be directly used as input for the compilation of quarterly accounts but the subsequent quarterly national accounts figures and basic statistics values will differ because the basic statistics are not subject to accounting constraints, whereas quarterly accounts are. The levels calculated from the basic statistics cannot then be directly introduced into the national accounts.

4.28. Indices cannot be used as a direct input for the compilation of quarterly accounts in that they do not define the level for the variable but they describe the growth of the variable. Consequently they must be used in a preliminary step to estimate the level of the variable by extrapolating the level of the previous period or according to an indirect approach (see Chapter 6). These methods allow the estimation of the levels for the quarters of the current year. These figures must be submitted to a balancing and validation process to produce the temporal and accounting-balanced estimates of the aggregates.

Price indices are used to establish the relationship between value and volume figures.

Quantification of qualitative surveys

4.29. Qualitative surveys use questionnaires in which the answers are given in a qualitative form. For example, the survey on entrepreneurs' short-term expectations about the economy, prices, or production is usually based on personal opinions concerning the short-term path of the economy. The question submitted to the entrepreneurs is something like "Do you think that in this quarter the economy (or a specific activity or economic object) is going to be better, worse or the same as the last quarter?". The result is typically a set of answers like "better", "the same", "worse". There are several techniques to convert these kinds of answers for interpretation in quantitative forms:

- *Balancing techniques*: the results of the survey are synthesised according to the balance of the answers given by the entrepreneurs. For example, if the results are: 75 "better", 50 "the same" and 60 "worse", then the quantitative value is the balance between the three alternatives in this instance (75+50)-(50+60) = 15 "better".
- *Probabilistic techniques:* a probabilistic distribution is associated with the percentages of the possible answers to the question; then the quantitative values are determined according to some characteristic of this distribution (median, mean, …) and according to a quantitative indicator (for example, the index of industrial production), if a suitable one is available.

Extrapolation and projection methods

4.30. In some cases the quarterly figures are not collected using surveys but are derived using extrapolation and projection methods: these techniques are used when there is lack of information at the desired frequency or when it is not possible to make a survey on the specific item. In this case extrapolation and projection can offer estimates of the unknown figures starting from the past history or related information.

Theoretical requirements

4.31. Basic statistics should present the following characteristics:

a) consistency of definitions;
b) time of recording;
c) compatibility of the nomenclatures.

Until now, national accountants had to choose their basic statistics carefully, firstly verifying the possibility of their use from a theoretical and practical point of view, then finding proxy variables to estimate missing information. Eurostat recommends an evolution towards a more central role in the national accounts system for quarterly accounts (they should become the key accounts) with surveys and the collection of basic statistics adapted to quarterly requirements.

4.32. *Consistency of definitions*

Economic concepts that share the same name (for example, production, final consumption, etc.) often have different meanings in different statistical contexts. Since in national accounts all the activities are clearly defined, in both their treatment and recording, the definitions used for the basic statistics should be coherent with national accounts concepts in order to avoid distortions.

4.33. *Time of recording*

In ESA 1995 and SNA 1993, particular attention is paid to the generating process which underlies each transaction. The accrual basis is the approach recommended by ESA 1995 and SNA 1993 rather than the cash basis. A lot of the available statistics, in particular those derived from the public administration accounts and from the accounts of the big enterprises, are recorded on a cash basis and this may cause some problems. A cash basis can disrupt the allocation of transactions to the quarters even if the annual figure is correct. Anomalies may arise where the total annual value, recorded on an accrual basis, is distributed across the quarters according to a cash basis criterion. Moreover, the reference period for national accounts and the period in which the cash flow arises can be different due to the generating process. This leads to an incorrect distribution among the quarters even if the annual total is correct. Quarterly and annual accounts would be not coherent and more problems may arise, like discrepancies between quarterly figures for the current year and corresponding annual value.

At present, many statistics for a specific sector are based on cash flows (for example fiscal statistics, public accounts, and external trade statistics).

These aspects must be carefully evaluated before choosing basic statistics to be used (see Chapter 3).

The optimal solution is that basic statistics should be harmonised with national accounts concepts. If this is too difficult, an alternative solution may consist of using suitable indicators able to take the place of those statistics that cannot be converted.

4.34. As stated in ESA 1995, § 1.57, and in SNA 1993, § 2.63-2.66, transactions should be recorded according to the period in which they took place and not on the date in which the corresponding cash flow took place. Salaries should then be recorded in the period in which the corresponding work has been done and not when the flow of money takes place. In the same way, imports and exports should be recorded when the products are exchanged and not when the corresponding cash flow takes place.

The problem of the discrepancies related to the recording period increases with a higher frequency of recording. This problem has relatively small significance in annual accounts, and an increasing relevance in higher frequency accounts, i.e. quarterly and monthly accounts (see Chapter 17).

4.35. *Compatibility of nomenclatures*

It is possible that some basic data in different countries are not entirely harmonised in terms of nomenclatures. Starting from 1996, statistical data are harmonised in the context of NACE rev. 1. Differences may still persist for data coming from different sources (i.e. administrative statistics). Several reasons explain these differences, the most common being the possibility that the items covered by basic statistics are recorded according to different national nomenclatures and the fact that in each country basic statistics are generally compiled using a more detailed level of breakdown than the breakdown of standard nomenclatures. The differences at this level may have no impact on the more aggregated level of published national account figures. If the differences between standard and national nomenclatures is relevant, the estimation of the aggregates may be very much influenced. A higher level of harmonisation, towards standard nomenclatures, following the example of the NACE rev. 1, should avoid these problems.

Current and constant prices

4.36. Quarterly accounts are compiled both in current and in constant prices. As we have seen (Chapter 3) by inflation and deflation the passage between constant and current prices and vice-versa can be easily reconstructed.

At present, in compiling quarterly accounts, there is no settled procedure for computing current and constant prices figures. Sometimes basic statistics refer to constant prices and current price figures are built according to an inflation process. Sometimes the opposite process is applied.

In the following discussion we consider the basic statistics mainly used in compiling quarterly accounts, without distinguishing between sources for current and constant price statistics.

The use of basic statistics in the compilation of quarterly accounts

4.37. In principle, the same basic statistics could be used for the compilation of quarterly accounts as for annual accounts. The main problem lies in the fact that these statistics are not always available on a quarterly basis or that they are less accurate when measured quarterly. This implies a different choice of basic statistics for quarterly accounts that must be able to satisfy the demands of fast availability and reliability.

4.38. Among the sources and the methods used in compiling quarterly accounts, it is apparent that certain basic statistics relate to volume-type indicators, and thus in general form the basis of constant price series, while others are value-type indicators and thus in general form the basis of current price series.

Some general rules in choosing basic statistics can be derived from the current practices adopted in the countries which compile quarterly accounts.

4.39. The following paragraphs consider the sources mainly used by OECD Member States to compile their quarterly accounts. They consider the three approaches for the compilation of GDP (see Chapter 2) and the sources used to derive the estimates of the aggregates included in these three approaches.

The three approaches are not entirely independent of one another: firstly, the same basic data sources are sometimes used to estimate strictly related components of the value added, income and expenditure flows; secondly, it is not always possible to estimate directly all components of a particular GDP approach due to gaps in source statistics. In this case these components are often derived as residuals (commonly changes in inventories in the expenditure approach).

4.40. The compilation of quarterly accounts according to the three different approaches is based on numerous different basic statistics coming from different sources.

The main sources of information used are the traditional ones: short-term surveys, indicators, government accounts, extrapolations, commodity flows, indices, etc.

4.41. We note that also qualitative surveys represent a good source of information but their use is not always very well developed (because of difficulties of interpretation, sample representativeness, problem of quantitative transformations of the results), however they are useful for improving the timeliness of publication and to supply additional information or to fill gaps in information.

GDP: the production approach

4.42. GDP by kind of activity is often estimated quarterly by extrapolating value added with indicators related to output (in the form of indices of industrial production or of the physical quantity measures). Another common source is the value measure of sales/turnover/receipt information that can be obtained from VAT sources. There are also other sources such as employment/earnings data and trend extrapolation.

The estimates, derived from the indicators described above, can be subject to a balancing process within an input/output framework (as in Denmark, France, Netherlands, Norway and Sweden), in the context of the three approaches to the estimation of GDP.

This may require a relationship between output, intermediate consumption and value added. These relationships are usually updated once a year, and occasionally quarterly when the balancing process explicitly requires it.

Table 4.1: Production Approach - Sources

NACE A17- aggregates	Aggregates	Sources
Agriculture, hunting and forestry	• Value added	Difference between output and intermediate input
	• Output – Wheat and barley – Grains and crops – Livestock slaughtering	– Marketing boards – Harvesting data – Quantity of meat produced and prices obtained from abattoirs – Numbers of animals slaughtered
	– Wholemilk and eggs – Wool production	– Data on deliveries – Quantity data • Physical quantity indicators • Other Indicators • Quantitative data multiplied by average producers' prices
	– Animal production – Crop production – Fruits and vegetables – Horticultural products – Forestry	– Sales – Allocation of annual estimates – Quantities and values delivered on auctions – Trade Association about yearly turnover (allocation to the quarters) – State forestry sales – Indicators – Labour force in forestry – Quantity of timber felled – Same movement as the agriculture aggregates – Trend estimation • Official Economic Ministry estimates
	• Intermediate consumption	• Administrative data • Statistics on quantities • Suitable indicators: – Costs of marketing, fodder, fuels,... – Fodder and consumption of fertilisers – Judgmental estimation
Fishing		• Indicators • Value and size of catches • Sales revenue and quantities • Same movement as the agriculture aggregates • Amount of fish slaughtered on fish farms • Fishermen's landings • Trend extrapolation
Mining and quarrying	– Petroleum	• Interpolation/extrapolation according to quarterly movements • Sub-indices of industrial production • Quantity indicators: – Metres drilled

NACE A17- aggregates	Aggregates	Sources
Manufacturing		• Index of industrial production • Interpolation/extrapolation of annual values according to quarterly movements • Sample surveys • Census surveys • Production information • Trend extrapolation
Electricity, gas and water supply		• Physical quantities • Interpolation/extrapolation of annual values according to quarterly movements • Sales • Sub-indices of industrial production • Consumption of inputs
Construction		• Turnover of general trade contractors in general building construction and engineering • Employment figures • Volume index • Interpolation and extrapolation of annual data • Investments
	– Residential constructions – Non-residential constructions	• Indicators: – Estimate of work put in place by type of dwelling – Estimate of work put in place by type of structure – Building and engineering construction surveys
	– Public sector constructions	– Estimates of work done – Employment indicators – Budget data
Wholesale and retail trade, repair of motorvehicles, motorcycles and personal and households goods		• Sales • Gross sales • Surveys of private enterprises • Sales by public market authorities • Interpolation/extrapolation of annual values according to quarterly turnover indicators • Output volume indicators • Activity indicators • Turnover statistics (e.g. from VAT statistics) • Volume trade index • Sum of trade margins

NACE A17- aggregates	Aggregates	Sources
Hotels and restaurants		• Output volume indicators • Balance of payments data • Statistics on nights spent by non-resident • Estimation according to total domestic consumption • VAT statistics on turnover • Sales in restaurants • Nights spent in hotels
Transport, storage and communications	• Transport – Air transport, rail freight, pipeline system, water transport, ferry operations,... – Transit operation – Road haulage – Taxicab services • Communications	• Indicators: – Passengers – Weight/volume-kilometres – Revenues – Real output of industries relying on road haulage – Number of workers – Turnover according to VAT statistics • Indicators: – Audience viewing hours – Sample surveys of radio advertising sales – Number of subscribers to cable services – Data receipts for letters, parcels and telephone calls – Gross revenue of the postal service
Financial intermediation		• Indicators: – Revenue – Stock market volume traded – Issues of stocks and bonds – Mutual fund sales – Extrapolation using hours worked – Volume indices (e.g. number of cheque account transactions) – Employment
Real estate, renting and business activities	– Ownership of dwellings – Accommodation services	– Estimates of end period housing stock – Number of rooms and occupancy rates – Final consumption expenditure of households on dwelling rent – Turnover from VAT statistics
Public administration and defence; compulsory social security		– Number of employees – Extrapolation using hours worked – Wages and salaries

NACE A17- aggregates	Aggregates	Sources
Education		– Number of employees – Extrapolation using hours worked – Wages and salaries – Pupil weeks taught
Health and social work		– Number of employees – Wages and salaries – Extrapolation using hours worked – Government output
Other community, social and personal service activities		– Labour inputs – Extrapolation using hours worked
Private households with employed persons		• Labour force survey
Extra-territorial organisa-tions and bodies		

GDP: the expenditure approach

4.43. The components of the expenditure approach to the compilation of GDP are estimated by using different sources according to the available data and the choices made by countries. Distinguished here are the different sources used in compiling the GDP according to expenditure approach, for each of the components.

Final consumption expenditure of households

4.44. The main sources used in compiling GDP from the expenditure approach and in particular the final expenditure of households are sales or turnover statistics. Sales statistics are those primarily related to the sales of goods through retail outlets. This information is usually structured by “type of outlet” and must be converted to outlays on commodities through the use of a transformation matrix. In order to do this with the necessary detail, regular censuses of retail businesses must be carried out.

Another relevant source for final consumption expenditure of households are households surveys: household respondents report their expenditures over a specified period of time.

A good practice to estimate final consumption expenditure of households is to combine and cross-check the different sources. In particular, if households surveys are used, it is necessary to verify the significance of the sample (especially in small countries), timing and precision.

Revenue statistics are usually related to the receipts of services providers and the revenue of transportation and utility companies. The split between revenue from households and revenue from enterprises is usually not measured by this kind of statistics. Proxy information, annual ratios, etc. must then be used to estimate the portion going to households.

In some countries for certain specific products (i.e. food and beverages, alcohol, tobacco and, sometimes, fuel and power) the commodity flow method is employed to derive the use of particular goods and services from their known supply.

If the expenditures can be considered stable over the short-term, then trend extrapolation can be used (for example, rents). This method is also useful for minor expenditures for which no other method is readily available (for example personal care expenditure). In any case, the most important use of this technique is to prepare preliminary estimates when other indicators are not yet available.

Other specific methods are used to cover certain items.

Table 4.2: Household Consumption Expenditure - Sources

COICOP[1] one digit	COICOP[1] two digits	Sources
Food, beverages and tobacco	• Food • Beverages • Tobacco	• Sales or revenue statistics • Commodity flow method • Household surveys • Tax records tobacco
Clothing and footwear	• Clothing • Footwear	• Sales or revenue statistics
Housing, water, electricity, gas and other fuels	• Gross rents • Regular maintenance and repair of dwelling • Other services related to the dwelling • Electricity, gas and other fuels	• Sales or revenue statistics • Commodity flow method • Household surveys • Trend extrapolation • Housing stock (rents) • Quantity purchased (motor fuel) • Weather data, volumes of gas, electricity etc. generated • VAT returns (house repairing)
Furnishing, household equipment and routine maintenance of the house	• Furniture, furnishings and decorations, carpets and other floor coverings and repairs • Household textiles • Heating and cooking appliances; refrigerators, washing machines similar major household appliances, including fittings and repair • Glassware, tableware and household utensils • Tools and equipment for the house and garden • Goods and services for routine household maintenance	• Sales or revenue statistics • Employment/earnings in the activity concerned

COICOP[1] one digit	COICOP[1] two digits	Sources
Health	• Medical and pharmaceutical products and therapeutic appliances and equipment • Non-hospital medical and para-medical services • Hospital services • Sickness and accident insurance services	• Employment/earnings in the activity concerned • Trend extrapolation • Social security benefits, fees charged • Beds occupied (hospitals)
Transport	• Purchase of vehicles • Operation of personal transport equipment • Transport services	• Sales or revenue statistics • Household surveys • Passengers, passengers/km • Freight km • Traffic indicators • Stock of vehicles (personal transport)
Leisure, entertainment and culture	• Equipment and accessories, including repairs • Recreational and cultural services • Newspapers, books and stationery	• Trend extrapolation • Stock of receivers (radio and TV repairs)
Education	• Educational services • Educational materials • Ancillary educational services	• (private education) Employment/earnings in the activity concerned
Hotels, cafes and restaurants	• Catering • Accommodation services	• Sales or revenue statistics • Overnight~~s~~ stays
Miscellaneous goods and services	• Personal care • Personal effects n.e.c. [2] • Communications • Social services • Financial services n.e.c. • Other services n.e.c.	• Sales or revenue statistics • Employment/earnings in the activity concerned • Trend extrapolation • Population growth (personal services) • Funeral services (death rate) • Stock exchange transactions (brokerage charges) • Radio and TV licences (telecommunications) • Output of the services providers (finance, banking and insurance services)

[1] Classification Of Individual COnsumption by Purpose

[2] n.e.c. = not elsewhere classified

Final consumption expenditure of general government

4.45. Final consumption expenditure of general government, of course, consists primarily of the value of non-market goods and services produced by government itself (see ESA 1995, § 3.79). These are valued by convention as the sum of intermediate consumption, compensation of employees, consumption of fixed capital and other taxes on production, less other subsidies on production (see ESA 1995, § 3.53).

4.46. Expenditure statistics are the main source in most countries for estimates of government expenditure, other than wages and salaries.

Comprehensive data, in the sense that they cover all the agencies concerned, are sometimes available only for central government. Sometimes sample surveys are used.

Wages and salaries are usually recorded on a regular and timely basis. They are often used as an indicator for total compensation of employees and sometimes for government final consumption because of their high proportion of the total.

Trend extrapolation is used in some countries, as well as other specific methods.

Table 4.3: General Government Consumption Expenditure - Sources

COFOG*	Sources
General public services	• Expenditure statistics (comprehensive) • Expenditure statistics (sample surveys) • Wage and salaries statistics • Trend extrapolation
Defence affairs and services	• Wage and salary statistics • Trend extrapolation
Public order and safety affairs	• Trend extrapolation (wages and salaries)
Education affair and services	• Wage and salary statistics • Trend extrapolation (wages and salaries)
Health affairs and services	• Wage and salary statistics • Trend extrapolation (wages and salaries)
Social security and welfare affairs and services	• Expenditure statistics • Trend extrapolation (wages and salaries)
Housing and community amenity affairs and services	• Monthly survey of construction projects (value of construction put in place)
Recreational, cultural and religious affairs and services	• Expenditure statistics • Wage and salary statistics • Trend extrapolation
Fuel and energy affairs and services	• Expenditure statistics • Wage and salary statistics • Trend extrapolation
Agriculture, forestry, fishing and hunting affairs and services	• Expenditure statistics • Wage and salary statistics • Trend extrapolation
Mining and mineral resource affairs and services, other than fuels; manufacturing affairs and services; construction affairs and services	• Expenditure statistics • Wage and salary statistics • Trend extrapolation
Transportation and communication affairs and services	• Expenditure statistics • Wage and salary statistics • Trend extrapolation
Other economic affairs and services	• Expenditure statistics • Trend extrapolation
Expenditures not classified by major group	• Expenditure statistics • Trend extrapolation

* Classification Of Functions Of Government

Final consumption expenditure of Non-Profit Institutions Serving Households (NPISHs)

4.47. This item is not separately identified for many countries but it is included in the final consumption expenditure of households. When estimates are made they are often based on employment or earnings statistics. Sometimes trend extrapolation is used because of the small size of this sector.

Gross fixed capital formation

4.48. The estimates of gross fixed capital formation are derived by asking capital goods producers what they have produced and asking capital goods purchasers what they have purchased. Estimates are also derived by calculating the supply of capital goods in the domestic economy and by a variety of other methods (surveys, notifications of major projects, commodity flow method, registration records, etc.).

For specific items of gross fixed capital formation most of the countries use commodity flow methods or other methods like registration records, indicators related to the volume of work done, like labour inputs, materials supplied, etc.

Table 4.4: Fixed Capital Formation - Sources

Fixed Capital Formation – Pi 6*	Sources
Products of agriculture, fisheries and aquaculture	• Capital outlays by purchasers of capital goods • Trend extrapolation (land improvement and forestry)
Equipment: metal product and machinery	• Value/volume of work done by capital goods producers • Capital outlays by purchasers of capital goods (corporate sector) • Commodity flow/supply statistics • Average purchased by farms/unincorporated businesses with estimated number of farms/unincorporated businesses (machinery and equipment)
Equipment: transport equipment	• Value/volume of work done by capital goods producers • Capital outlays by purchasers of capital goods (ships) • Commodity flow/supply statistics (ships, etc.) • Estimated commercial share of dealers' sales, registration records (road transport equipment)
Construction: housing	• Value/volume of work done by capital goods producers (dwellings) • Capital outlays by purchasers of capital goods (improvements to dwellings, public construction) • Number of units sold (brokers' commissions on sale of new and existing dwellings) • Index of construction output • Trend extrapolation (major repairs and alterations to dwellings, secondary dwelling) • Productive hours worked and number of employees in construction • Trend extrapolation, government investment grant (construction for agriculture)

Fixed Capital Formation – Pi 6*	Sources
Construction: other construction	• Value/volume of work done by capital goods producers • Value/volume of work done by capital goods producers (corporate sector) • Capital outlays by purchasers of capital goods • Labour inputs in physical terms and labour cost • Investment intentions • Oil and gas drilling • Trend extrapolation (construction by non-communications utilities) • In line with value added
Other products	• Value/volume of work done by capital goods producers • Commodity flow/supply statistics (appliances and home furnishing) • Metres drilled (oil and gas well drilling) • Trend extrapolation (leather goods and footwear industries)

* See ESA 1995, Annex IV

Changes in inventories

4.49. Even if, very often, changes in inventories are unfortunately determinated as a balancing item in the account, thus statistical discrepancies, a good practice is to estimate them directly. In this case changes in inventories are collected by using business surveys conducted monthly or quarterly. Other information coming from holders of stock is primarily used for stock of food and strategic materials held by government agencies. Methods like extrapolation and estimation with activity indicators are used in some cases.

Table 4.5: Changes in Inventories - Sources

Aggregates – A6*	Sources
Agriculture, hunting, forestry and fishing	• Business surveys (wool and fruit stocks) • Information from holders of stocks (farm stocks) • Commodity flow (agricultural stocks, forestry stocks) • Trend extrapolation of annual data derived from commodity flows
Industry, including energy	• Business surveys (mining stocks, manufacturing stocks, energy stocks) • Information from holders of stocks (stocks at bulk petroleum stations, electric utilities and at car and truck dealerships, fuel stocks held by producers) • Figures assumed to move in line with unincorporated manufacturing and trade stocks (unincorporated stocks)
Construction	• Business surveys (new housing stocks) • Trend extrapolation • Construction materials
Wholesale and retail trade, trans-ports, hotels	• Business surveys (wholesale and retail trade stocks, trade stocks in general, transport and communications stocks) • Trend extrapolation (transportation)
Financial, real estate	• Trend extrapolation (finance) • Financial records
Other services	• Trend extrapolation • Employment or revenue data
Public sector	• Information from holders of stocks • Information from holders of stocks (public enterprises stocks)

* See ESA 1995, Annex IV

Imports and exports of good and services

4.50. Imports and exports of goods are readily available in all countries. Quarterly data are generally available for exports and imports of services from balance of payments estimates and are used directly in the national accounts, though the balance of payments classification of services is often not very detailed.

GDP: the income approach

4.51. Among the three approaches to the compilation of GDP, the estimation of figures on the income side has a short and less consolidated experience. In fact, in many countries the figures of the income approach are not estimated on a quarterly basis, or their compilation is quite recent.

Several sources are used to estimate the different components of the income approach to the estimation of GDP.

Compensation of employees

4.52. In almost all countries, quarterly and monthly employment and earnings surveys are used to estimate wages and salaries of non-government employees. The surveys usually provide detail on numbers employed and average earnings by industrial activity.

Taxes represent another relevant indirect source even if some problem can arise when using this kind of basic statistics (delay in recording, problems of updating).

The main sources for wages and salaries for the government sector are the government accounts.

In some activities such as agriculture, services of domestic staff, forestry and fishing, the compensation of employees is estimated by using trend extrapolation due to the difficulty in obtaining regular employment data.

Other methods, like indirect indicators, are used for some specific categories.

Table 4.6: Compensation of employees - Sources

Components	Sources
Wages and salaries of government	• Government accounts • Indices of employment and salaries
Wages and salaries of local government employees	• Employment/earning surveys
Military pay and allowances	• Government accounts
Wages and salaries in large public enterprises	• Number of employees along with wage and salary index

Components	Sources
Wages and salaries in welfare institutions	• Gross output
Wages and salaries of non-government employees	• Employment/earning surveys • Supplementary labour income • Product of employment and average earnings
Wages and salaries in agriculture, fishing, hunting and trapping	• Trend extrapolation • Value of fish landings (fishing) • Surveys in agriculture finance, estimated employment and hourly wage rate in service (agriculture)
Wages and salaries in financial institutions	• Employment and banking industry pay scale
Wages and salaries of domestic servants	• Trend extrapolation
Employers' contributions to social security	• Government accounts • Trend extrapolation • Wages and salaries
Employers' contributions to non-government social security	• Accounts of scheme administrators
Payments in kind	• Ratio of wages and salaries
Free or subsidised accommodation as wages in kind	• Difference between ordinary rents and rents actually paid

Consumption of fixed capital

4.53. The consumption of fixed capital is usually estimated by using extrapolations of annual estimates.

Operating surplus

4.54. The operating surplus is estimated from information available from surveys of corporate profits, records of government for the operating surplus of government enterprises, statistics on output, sales or revenue which are used as indicators for mixed income of unincorporated enterprises, taxes, trend extrapolation and other methods like the use of indicators or company reports to householders.

Table 4.7: Operating Surplus

Components	Sources
Profits of government enterprises	• Records of government or other official agencies • Temporal disaggregation using annual data
Profits of companies in regulated industries (gas, electricity, transportation)	• Records of government of other official agencies
Profits of local government enterprises	• Trend extrapolation

Components	Sources
Profits of enterprises:	• Estimated value added less compensation of employees and taxes less subsidies on production • Estimated GDP less compensation of employees, consumption of fixed capital and taxes less subsidies on production) • Net value added less gross compensation of employees and taxes less subsidies on production
• Profits of corporate enterprises	• Surveys of company profits
• Profits of unincorporated enterprises	• Gross output, sales or revenue statistics
• Income of unincorporated enterprises in agriculture, fishing	• Gross output, sales or revenue statistics
• Income of unincorporated enterprises in forestry	• Number of working proprietors
• Farm income	• Trend extrapolation • Gross farm output less intermediate consumption
• Income of unincorporated enterprises	• Sample surveys
• Income of unincorporated enterprises in construction	• Residential investment outlays, work put in place
• Profits of corporate enterprises in service activities, real estate, financial industries	• Trend extrapolation
• Profits of corporate enterprises in communication and insurance and non-depository institutions	• Company reports to shareholders
• Profits of corporate enterprises in certain transportation	• Trend extrapolation
• Income of unincorporated enterprises in retail and wholesale trade	• Gross output, sales or revenue statistics
Interest receipts and miscellaneous, investment income of government	• Records of government or other official agencies
Interest received by households	• Total interest payments
Rents:	• Trend extrapolation
• Rents of dwellings received by households	• Housing stock, average rent paid, floor space, gross rent less operating costs

Taxes less subsidies on production

4.55. All countries have monthly or quarterly records available for taxes less subsidies on production. Several countries estimate this component from cash receipts and payments of subsidies, or by applying rates to the relevant tax bases.

Ideal data requirements for quarterly accounts

4.56. This section discusses how data sets whose aim is to constitute an ideal or minimum set of data can be used to derive quarterly data. It focuses on two data sets which can be used for the provision of meaningful and sensible series for GDP.

4.57. The precise specification of a desirable data set will depend on the economic structure in the different countries and the importance of the various components in the accounts (for example, where agriculture represents 1-2% of GDP in one country, the statistics can be based on less information for this industry than for a country where the proportion is, say, 10%).

The sets of data suggested here will not deal with the above considerations, explicitly, nor with the accuracy of the information collected. For the accuracy, suffice it to say that an appropriate degree of reliability of the information collected is an essential pre-requisite for producing good statistics.

4.58. Against this background, given below is an “ideal” main set of quarterly data which might be deemed desirable for compiling quarterly GDP figures, based on the expenditure, production and income approaches, at current and constant prices, as appropriate. The point should be made that the derivation of the national accounts estimates will also need to make use of other information from government and non-government sources. As mentioned above, an appropriate degree of accuracy is assumed. In addition, consideration will need to be given to any industry or institutional sector breakdown which might be required.

Suggested “ideal” data set for compiling quarterly estimates

- *Household budget surveys*

  Expenditure on goods and services. A key point is the need for the sample to be balanced quarterly.

- *Business surveys*

  These should collect information, as appropriate, on:

  - Sales/turnover;
  - Purchases*;
  - Gross fixed capital formation;
  - Inventories;
  - Foreign trade in services*;
  - Wages and salaries;
  - Operating surplus*;
  - Employment.

  Specific business surveys would, most generally, embrace collection of information required for the monthly index of production and the monthly (or quarterly) index of retail sales. Some product/commodity breakdown would be useful for deflation, particularly for the production and retail sales indices.

• *Government spending and receipts*

This information should be on the accrual basis.

• *Foreign trade in goods*

This information would normally be provided by the monthly/quarterly external trade statistics. Concerning services information comes from the balance of payments.

• *Prices*

These should cover:

- Consumer prices;
- Producer prices (including agriculture);
- Service prices*;
- Export and import prices.

• *Tax authorities and government administrative sources*

Information on the following variables might be available from government administrative sources, for use in the compilation of the income measure of GDP:

- wages and salaries;
- operating surplus;
- mixed income.

4.59. As mentioned above, this should be regarded as an ideal, main data set, with other information also required in the estimation process. It includes certain items (marked *) which are likely to be included in the establishment and development of a statistical system but which involve measurement problems (services prices), register problems (foreign trade in services), and the issues of costs and the general burden on businesses. The value of any income data from Revenue department sources would need to be considered particularly carefully, given definitional differences and other problems of measurement.

Excluding those items marked with an asterisk, it is tentatively suggested that the above data set may be regarded as a minimum requirement to provide meaningful quarterly GDP statistics.

Ideal data requirements for quarterly accounts

- *Household budget surveys*
- *Business surveys:*
  - sales/turnover;
  - purchases;
  - GFCF;
  - inventories;
  - foreign trade in services;
  - wages and salaries;
  - operating surplus;
  - employment.
- *Government spending and receipts*
- *Foreign trade in goods*
- *Prices*
  - consumer prices;
  - producer prices (including agriculture);
  - service prices;
  - export and import prices.
- *Tax authorities and government administrative sources*
  - wages and salaries;
  - operating surplus.

Community legislation in the field of short-term statistics

4.60. The ideal data requirements for quarterly accounts represent the first step towards the harmonisation of basic statistics to be used in the compilation of quarterly accounts. As remarked in the previous paragraphs, the sources that can be used to collect quarterly information are quite disparate and so too are the approaches and methods.

Community legislation in the field of statistics aims to suggest and recommend both principles and rules to obtain harmonised basic statistics so to allow an easier compilation and comparison of national accounts.

In the following paragraphs the Community legislation concerning short-term statistics and national accounts is introduced to illustrate some general principles to be applied and to illustrate the direction in which harmonised statistics are moving. Clearly, the principles that underlie Community legislation are general principles suitable to be used in any country to compile basic national accounts statistics.

4.61. The objective of Community legislation is to establish a common framework for the production of Community statistics.

Harmonisation of concepts, norms, and standards is a prerequisite to the comparability of statistics. The evolution of the European Statistical System involves more statistical harmonisation to supply reliable statistics fully comparable at all levels.

A more sector-oriented approach is needed to take account of the characteristics of the global business cycle. This basic information has to be adequately integrated in an accounting framework to obtain a harmonised system of accounts.

The harmonised statistics should answer, first of all, to the need for detailed information on the business cycle. They should represent the basic information by which the economic operators could analyse the business cycle; they should be comparable and then collected and calculated with the same methods in all Member States. Finally, basic statistics should be integrated in the general framework of their sector statistics and in the national accounts framework.

4.62. The following paragraphs examine the Community legislation in more detail. The following areas are considered:

- the system of industrial and services short-term indicators;
- consumption statistics and consumer prices;
- employment statistics;
- trade statistics: trading of goods between Member States (Intrastat) and with third countries;
- balance of payments statistics.

Council Regulation on Community Statistics

The main reference concerning community statistics is Council Regulation (EC) n° 322/97 of 17 February 1997 on Community statistics ("the Statistical Law") whose purpose is to establish a legislative framework for the systematic and programmed production of Community statistics with a view to the formulation, application, monitoring and assessment of the policies of the Community.
Community statistics means quantitative, aggregated and representative information taken from the collection and systematic processing of data, produced by the national authorities and the Community authority in the framework of implementation of the Community statistical programme.

Basic statistics: principles for quality

(art. 2, Regulation n°52/2)

- *Impartiality*

Objective and independent manner of producing statistics free from any pressure from political or other interest group, particularly as regards the selection of techniques, definitions and methodologies best suited to the attainment of the objectives as set out. It implies the avail ability of statistics, with a minimum delay, to all users.

- Reliability

Statistics have to reflect as faithfully as possible the reality which they are designed to repre sent. It implies that scientific criteria are used for the selection of sources, methods and procedures.

- Relevance

The production of statistics is a function of clearly defined requirements determined by the Community objectives. These requirements determine the fields, timeliness and scale of statis tics.

- Cost-effectiveness

The optimum use of all available resources and the minimisation of the burden of the respondents. The amount of work and the costs that the production of statistics requires should be in proportion to the importance of the results/benefits sought.

- Statistical confidentiality

The protection of data related to identifiable statistical units which are obtained directly for statistical purposes or indirectly from administrative or other sources against any breach of the right to confidentiality.

- Transparency

The right of respondents to have information on the legal basis, the purposes for which the data are required and the protective measures adopted. The authorities responsible for collecting statis tics shall take every step to supply such information.

The system of industrial and services short-term indicators

Reference Community legislation

4.63. In the field of the industrial short-term indicators, the main reference for the Community legislation the Regulation on short-term industrial statistics and the corresponding manual “Methodology of industrial short-term indicators – Rules and recommendations”.

Aims and characteristics of the system of industrial short-term indicators

4.64. The target of a system of industrial short-term indicators is to measure, analyse and forecast, in as much detail as possible, all patterns of industrial activity.

To pursue this aim a set of short-term indicators is necessary:

- a measure of (quantitative) activity: industrial production;
- an anticipation of activity: orders;
- the main factor of short-term fluctuations: investments;
- the extrapolation of investment trends: through an indicator of turnover and compensation of employees;
- indicators of adjustments in different markets: output price index, stocks, utilisation of industrial capacity, employment and unemployment;
- links to the rest of the world: foreign demand (exports) and competition from abroad (imports).

The production index

4.65. The production index represents the core of the business cycle indicators. A production index tracks the change in volume of value added in a given segment of industry and can be derived in the following ways:

- recording the change through time of quantities of representative products;
- recording the change through time of the value of representative products deflated with appropriated indexes;
- measuring the turnover of the given segment of industry, corrected for changes in inventories and sales of products of other industries, deflated with appropriate indexes;
- measuring the change of appropriate inputs like electricity consumption, labour input, etc.

The production volume index shows the development of value added at factor cost. The formula actually used is the standard Laspeyres volume index.

The turnover index

4.66. The turnover index, in value, shows the actual sales in the business cycle, that is the demand side of the production process. It represents an important element of profitability and should be split into domestic, intra-EU and extra-EU markets.

Indices of orders

4.67. Qualitative business surveys are the main tools to look into the near future. The “new orders received” quantitative indicator is, at the same time, a very good tool for short-term analysis purposes. It can be measured in two ways:

- *new orders received* , which show the latest trend in future demand;
- *stock of orders* , which shows the cumulated demand on a given branch for the near future.

Output prices indices

4.68. These indices give the information on the prices of output when it leaves the factory.

Indices of labour input

4.69. Indices of labour input, like employment and hours worked, are valuable tools for assessing the aspect of labour input in the business cycle and for calculating the short-term productivity path.

4.70. *Other indices*

- *Capacity utilisation*: gives a view on the utilisation of the capital stock of an enterprise in the production of goods and services. It is a part of qualitative business surveys.

- *Stocks:* summarises the information about stocks, broken down into raw materials, semi-finished goods and finished goods.

- *Investment*: it brings together the information related to the investments and it is a very important short-term indicator.

- *Input prices*: these indices are needed to deflate material costs in order to obtain value added at constant prices if a double deflation method is used.

- *Labour costs*: an index of wages and salaries covering aspects related to employment (age, gender, skills, marital status, etc.).

- *Foreign trade*: information on imports and exports (in volume and value) on an industry breakdown. It should be split into intra-EU and extra-EU markets.

- *Enterprise success and failure*: measures the deaths and the births of enterprises and is very helpful in assessing up-swings and down-swings of the economy.

4.71. In order to describe the short-term path of the economy, the above-mentioned indices should satisfy certain requirements:

- accuracy and representativeness;
- timeliness;
- a high level of detail;
- a wide range of different indicators;
- comparability of statistics between countries;
- clarity.

For quarterly national accounts the most important requirements are timeliness, harmonisation and integration.

Timeliness answers to the demand of faster availability of the short-term indicators to be useful to political and economic decision makers.

Harmonisation in the practices is aimed at achieving a common base on which to analyse the economic behaviour in different countries.

Integration underlies the role that each sectoral system of statistics has in the national accounts system and the interrelations between the elements that compose the system itself.

Consumption statistics

4.72. The main sources for consumption data are different for household consumption and government consumption.

Household consumption is usually determined according to a family budget survey. A questionnaire is presented to a sample of families about their consumption during a particular period.

Government consumption is usually derived from administrative data.

Employment

Reference Community legislation

4.73. The main Community statistical legislation in the field of employment is the Council Regulation concerning labour force surveys.

This is an example of sample surveys expressly driven for a specific aggregate: i.e. employment. It is expressly conceived and conducted in order to collect information about a specific subject: the labour force.

The quarterly labour force survey is part of the general labour force survey conducted, at present, by most of the EU Member States. This survey provides for annual and quarterly data.

The survey is based on the analysis of representative samples of the labour force, it is carried out by a questionnaire, it refers to some fixed reference-weeks during the year and normally occurs the week after the reference-week.

4.74. The survey is based on a sample of households that are resident on the national economic territory when the survey is carried out. The information comes from the answers that the subjects of the survey give or, if it is equivalent, from administrative sources.

The main information collected by the survey concerns: the demographic context (age, sex, birth date, marital status, nationality, etc.), the activity status (employment or unemployment during the reference week, reasons for the unemployment, job-search activities, etc.), characteristics of the actual job, working time, second activity, search for a job, education and professional qualifications, previous professional experience, one-year-before situation, principal employment status, wages and salaries.

From a quarterly national accounts perspective the more relevant information is the data on wages and salaries, working time and activity status.

Import and export data

Reference Community legislation

4.75. The Community legislation in the field of trade statistics comprises:

a) Trade statistics related to the trading of goods between the Member States, whose main reference document is the Council Regulation (EEC) n° 3330/91 of 7th November 1991 on the statistics related to the trading of goods between the Member States and its successive amendments and implementations;

b) Trade statistics related to the trading of goods with third countries, whose main reference document is the Council Regulation (EC) n° 1172/95 of 22nd May 1995 on the statistics related to the trading of goods between the European Union and its Member States and non-member countries and its successive implementation and amendments.

Statistics relating to the trading of goods with third countries

4.76. Statistics on the trading of goods by the Union and its Member States with non-member countries are compiled on the basis of customs procedures. They refer to all goods that, after entering or before leaving the statistical territory of the Union, are subject to customs-approved treatment or use.

4.77. For each type of goods the statistical information must indicate the customs-approved treatment or use, or the statistical procedure; the country of origin or, in some cases, the country of consignment; the quantity of goods; the statistical value of the goods; the mode of transport at the frontier; the internal mode of transport; the nationality of the means of transport crossing the frontier; and the container.

Member States have to forward on a monthly basis statistics on their trade with non-member countries.

Statistics relating to the trading of goods between Member States

4.78. Community statistics relating to the trading of goods between Member States have been developed to cover the accounting and statistical needs derived from the abolition of the physical barriers between the European Union countries. A satisfactory level of information on the trading of goods between Member States should thus be ensured.

The collection of the data necessary to compile statistics relating to the trading of goods is directly made from the consignors and consignees using methods and techniques which ensure that the statistics are exhaustive, reliable and up to date.

4.79. The statistics relating to the trade of goods include all the goods that move from one Member State to another. The coverage then includes transit statistics, which are compiled on goods transported across Member States without being stored or used, and statistics of goods stored as well as the goods which are not included in the two previous categories.

The statistical collection system, concerning these trade transactions, is called *Intrastat.* The system covers both movements of goods leaving the Member State ("dispatches") and movements of goods entering the Member State ("arrivals").

For each type of goods the statistical information must provide, in the Member State of arrival/dispatch, the Member State of consignment/destination, the quantity and value of goods, the nature of the transaction, the delivery terms and the presumed mode of transport.

Balance of payments

Reference legislation

4.80. The main reference in the balance of payments field is the "Balance of Payment Manual", fifth edition, compiled by the International Monetary Fund, 1993 ("5BPM"). The balance of payments data are collected in the European Union and are published by Eurostat in accordance with the procedures set out in the 5BPM. The 5BPM is totally consistent with ESA 1995/SNA 1993 concepts and requirements.

The balance of payments statistics

4.81. The balance of payments is an accounting system and so it is not really a set of basic statistics in the sense of the previous paragraphs. Anyway the reliability and the availability of data on some aggregates allow the use of balance of payments figures in compiling national accounts. So, the data for imports and exports from the balance of payments can be used directly in the national accounts context. The main sources are then those to which the balance of payments refers to and the rules for the collection of the data are those established for the balance of payments.

The balance of payments records all economic transactions undertaken between the residents and non-residents of a country during a given period.

Definition: transaction (balance of payments)

A transaction is defined both in the 5BPM and in ESA 1995, § 1.33 and in SNA 1993, § 3.12 as being an economic flow that reflects the creation, transformation, exchange, transfer, or extinction of economic value and involves change in ownership of goods and/or financial assets, the provision of services, or the provision of labour and capital.

Definition: resident (balance of payments)

The concepts of resident in the 5BPM, ESA 1995 and in SNA 1993 are the same: "A unit is said to be a resident unit of a country when it has a centre of economic interest on the economic territory of that country that is, when it engages for an extended period (one year or more) in economic activities on this territory" (see ESA 1995, § 1.30; SNA 1993, § 2.22-2.23).

The balance of payments accounts are based on the double double-entry accounting system.

4.82. In the 5BPM, the balance of payments is divided in two sub-balances: the current account and the capital and financial account.

The current account is subdivided into four basic components: goods, services, income and current transfers.

The capital and financial account shows the financing (generally by way of capital transfers or transactions in financial instruments) of real resource flows. It has two major components: the capital and the financial account. The current account is the main source for quarterly purposes.

Current Account

4.83. *Goods*

Goods usually represents the biggest category of the current account. They cover general merchandise, non-monetary gold, goods for processing, repairs of goods and goods procured in ports by carriers.

The evaluation of these items has to be made f.o.b. (free on board) for both imports and exports.

It has to be noted that the balance of payments does not have a product breakdown. For this reason, for quarterly purposes, the use of foreign trade statistics represents a valid instrument to have a product breakdown.

Services

4.84. The breakdown of services foreseen by the 5BPM contains a higher level of detail than in the past. The main services identified are transportation, travel, other services (like communication services, construction services, freight insurance), financial intermediary and auxiliary services, royalties and licence fees and government services.

Income

4.85. This sub-balance contains two main items: compensation of employees and investment income. The former records wages, salaries and other benefits, in cash or in kind, earned by individuals for work performed for foreign economic units (border workers, seasonal workers, employees of international organisations, etc.).

Investment income covers income which a resident entity derives from the ownership of external financial assets (credit) and income non-residents derive from their financial assets invested in the compiling economy (debit). The components are classified as direct investment, portfolio investment and other investment income.

4.86. *Current transfers*

Transfers are international transactions in which goods, services or financial items are transferred between the residents of one economy and the residents of foreign economies without something of economic value being received in return. They are broken down between - general government and other sectors.

The general government transfers arise when the resident government is the receiver or sender. They cover transactions between resident governments and international organisations (e.g. contributions to the budget of international organisations), governments of foreign countries and private non-residents (cash transfers and gifts to/from other governments).

The other sectors' current transfers are related to the transfers between resident individuals and non-governmental institutions.

PART III

CHAPTER 5

THE USE OF INFORMATION IN THE COMPILATION OF QUARTERLY ACCOUNTS

This chapter leads on from the discussion of data sources in Chapter 4 to the use of these sources in compiling quarterly national accounts. The recommended approach is a pragmatic one, based on a flow-chart system with a series of steps, and a decision process based on the information avail able, the quality of that information, and the general philosophy adopted by the compiling Institute. It is recommended that data sources be improved continuously, either by making changes to existing sources or by finding new sources. Practices of four large Member States are presented, giving an indication of the wide variation in sources and techniques used to compile quarterly accounts.

The use of information in the compilation of quarterly accounts

5.01. Chapter 4 has discussed the data sources that are available for estimating quarterly accounts series, and the techniques which may be used to gather the data with minimum resource burden to Government and the respondents. This chapter considers the next step in compiling the accounts, that of using the available data sources for producing the best possible estimates, given the quality of the data and seeking to improve existing data sources or finding new sources.

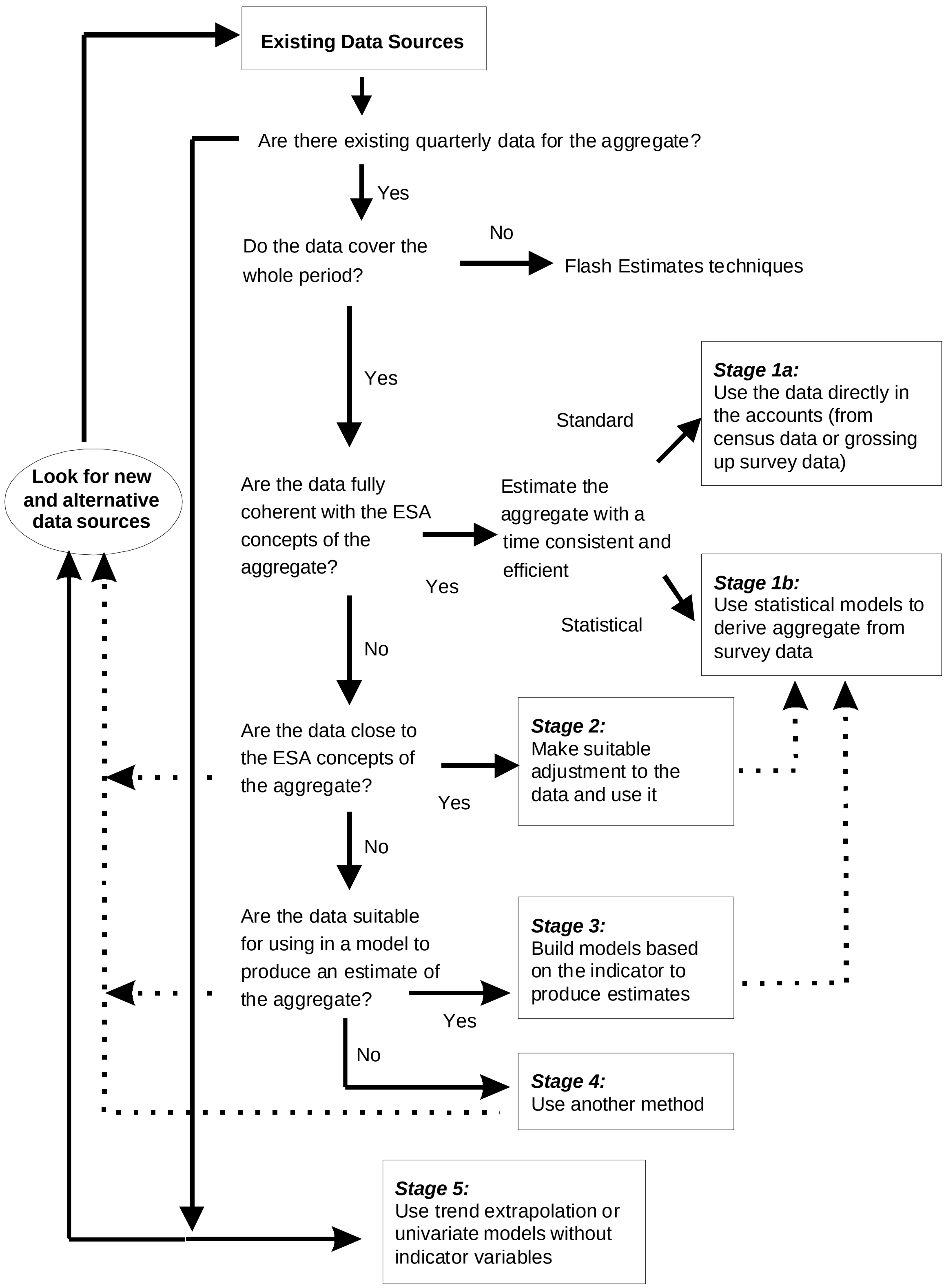
5.02. The methods of compilation of quarterly accounts may differ from those used in the annual exercise. This because the information available quarterly is much less than annually. Moreover the quarterly information, at least in some cases, is less reliable. The differences of compilation methods between quarterly and annual accounts have been clearly discussed in ESA 1995, § 12.04: “The statistical methods used for compiling quarterly accounts may differ quite considerably from those used for the annual accounts. They can be classified in two major categories: direct procedures and indirect procedures. Direct procedures are based on the availability at quarterly intervals, with appropriate simplifications, of the similar sources as used to compile the annual accounts. On the other hand, indirect procedures are based on time disaggregation of the annual accounts data in accordance with mathematical or statistical methods using reference indicators which permit the extrapolation for the current year. The choice between the different indirect procedures must above all take into account the minimisation of the forecast error for the current year, in order that the provisional annual estimates correspond as closely as possible to the final figures. The choice between these approaches depends, among other things, on the information available at quarterly level”.

This classification is made in a purely descriptive sense since in reality the procedure used in compiling quarterly accounts are a mixture in which the emphasis is put on one side or on the other according to the information available and the philosophical preferences of the compilers.

5.03. The recommended approach is to decide for each accounts’ aggregate the best way to use the existing basic data; this may be described as a “pragmatic” approach. The approach can be articulated as a flow chart (see Figure 5.1).

5.04. This system is intended as the depiction of the thought process that the statistician can follow to find the most appropriate method for estimating national accounts aggregates. The order of the stages is intentionally designed to give emphasis to the first two stages. All statisti-

Figure 5.1: The use of information in Vthe estimation of a single aggregate



cians are agreed that one should make as much use as possible of good quality data sources which are directly related to the aggregate to be measured, although, as described later in this chapter, these data sources may be insufficient given practical difficulties in collecting data and the resource burdens involved.

Description of the system

5.05. The process starts from a given set of quarterly and annual data sources which are available in the Member States. These will have been established over a period of time and will be of variable quality. Some will be specifically for national accounts purposes, but most will be used by other areas of the Statistical Institute. The discussion of data sources in the previous chapter gives some more details of what is available.

5.06. The dimension of time is an important factor in the system described. For each successive release of the national accounts there will be an increasing range of available data which can be used for estimating the required series. Given that the available data sources vary according to the time scale of release, it is necessary to go through the system described for each release, to ensure that the maximum amount of source data is being used in the most efficient way. Clearly there will also be revisions made to existing data sources, but this issue is described more fully in Part VI on the process of revision.

5.07. For each national accounts series or aggregate, one proceeds to the first question in the system are there existing quarterly data for the aggregate? This question refers to quarterly data sources which may be available. The range of data which would allow this criteria to be met is very wide, from perfect data which exactly matches the requirements, to less reliable data (even qualitative data) which may be vaguely correlated to the required accounts series. If the answer to one of the above questions is ‘no’ then one moves to “Stage 5” with the associated techniques of trend extrapolation and univariate methods, both of which are described in Chapter 6. This is to be considered the least satisfactory of methods, given that no complete data source is available to form the estimate and the statistician should look to find a new source or improve the timeliness of an existing source (see § 5.15 - 5.18).

5.08. Given that some data is available, the next question asks if the data are available for the whole period. It is likely for early releases of national accounts data that source data for the full quarterly period will not yet be available (for example one has two months of data, but not the third month). The methods to deal with this situation are discussed in Chapter 16 on quarterly flash estimates. There may of course be possibilities to improve the timeliness of the existing data source or to find a more timely source, so as to avoid the use of excessively incomplete information, even for early releases.

5.09. Stages 1 to 4 assume that one has some data available which is conceptually related to the required accounts series. They can be summarised as follows:

Stage 1: Using the derived data directly in the accounts with no change in measurement or coverage definitions but possibly some classification changes for disaggregations. Clearly data derived from a census source can be used directly in the accounts, but for data from a survey source there is a further choice to be made between using standard statistical grossing techniques (based on sampling theory, given that the usual methodological standards are met) and more complex statistical models described in Chapter 6.

Stage 2: Using techniques to correct defects in the source data, such as conversion from cash to accruals or adjustments for coverage. These techniques need not be mathematical or use a model, but must assume that the base data is close to the definition required by the ESA 1995/SNA 1993 so that the adjustments are of relatively small magnitude and have firm theoretical foundation.

Stage 3: Using mathematical, statistical or econometric techniques to improve the source data (for example correcting for measurement bias) or use an indicator variable in a model to estimate for the required accounts series. The techniques are described more fully in Chapter 6.

Stage 4: Applying a non-mathematical, often qualitative, approach to estimate the path of the accounts series using knowledge of the series and of the principal influences upon its level and growth.

5.10. If there is some complete data available for the aggregate, the statistician has the choice of using Stages “1 to 4”. The movements between the stages will be determined by several factors described below:

i) ***Closeness of the data to ESA definitions*** - This is the most important factor in deciding between Stages 1 and 2/3 of the system. If the coverage and definition of the data source matches those required by the ESA for the accounts series, then Stage 1 is the most appropriate method to use (i.e. using the data directly in the accounts). However most data sources differ from ESA definitions, whether in coverage (for example a section of the population is not measured by a survey, or is present in data when they should not be) or in measurement concepts (the most common difficulty is converting cash-basis data onto an accrual basis). In Stage 2 appropriate adjustments are made to the data using non-mathematical techniques (see Chapter 3 for a discussion of the most common problems faced for quarterly accounts and how to resolve them).

ii) ***Quality of the data*** - Moving on from the above point, there is clearly a decision to be made on the quality of the data, which then determines whether the source data are used in the accounts directly (whether with some correction for coverage/measurement or not) as in Stages 1/2 or whether mathematical techniques are used to ‘improve’ the data as in Stage 3. This is partly a question of philosophy (discussed below) but also one of data quality standards what is an ‘acceptable level’ of error for using the source data directly in the accounts? The Statistical Institute should be very clear about this point and fix a strategy for dealing with data of insufficient quality the source can be improved or a new source found, and mathematical corrections used where this is not possible.

iii) ***Philosophy of accounts compilation*** - Each Member State has its own general philosophy about the compilation of quarterly national accounts, and tend to adopt different criteria for moving between the stages of the scheme. Some will use the techniques of Stage 3 (discussed in Chapter 6) more readily than others, given that they have a tradition in using mathematical and statistical techniques to improve data quality of existing sources, and this may mean that they look less readily for new sources of data (see discussion below).

iv) ***Closeness of an indicator variable to the required accounts series*** - Once a decision has been taken to use the techniques that form part of Stage 3 in the outlined scheme, it is necessary to construct an appropriate model to estimate for the required series. In some cases the model established is unsuitable for estimating series because it is unstable over time or because the source data is not sufficiently quantitative for an adequate mathematical approach (for example qualitative surveys of businesses may produce heavily categorised data that give an indication of the direction of movement without sufficient quantification to be useful). Another difficulty often faced by countries with only a short history of compiling national accounts is that the time series available may not be sufficiently long to estimate the model correctly. Stage 4 is the only alternative left open to the statistician until new alternative data sources become available.

5.11. Whichever methodology is adopted to estimate for the given aggregate, the estimates generated will feed into the processes of balancing, ensuring time consistency, and revision which are described in later chapters. It is possible that the method of estimation will determine the method of balancing for example some statistical models and mathematical techniques used in estimation can include sufficient constraints to meet the criteria of time consistency and balancing.

The properties of quarterly estimates

5.12. The aim of a national accountant is to produce good quality estimates of national aggregates. It is clear that the quality of quarterly accounts depends both on the quality of data sources and of the data themselves. Time series that describe the path of the aggregates during a certain period should present some characteristics that ensure a good quality from both the statistical and the accounting point of view. Data quality is strictly related to the process of compilation of quarterly accounts and, consequently, to the available information.

5.13. It may be useful to clarify what is the expected output of the estimation process. In other words we have to define which are the desirable characteristics of the quarterly series we are estimating. This is not a set of optimal properties since there are no methodological justifications behind the desirable characteristics, but it is a set of suitable properties which must be reasonably respected by quarterly account estimates. This set of properties completes the characteristics associated to basic statistics in the previous chapter.

5.14. Quarterly accounts series should have the following properties:

- *Neutrality of the estimates*

  Even if we recognise that subjective judgement plays an important role in the process of estimation of quarterly accounts, no specific economic theory should influence the compilation of accounts. The compilation process must essentially have a statistical (see Chapter 6) and accounting nature.

- *Data must represent reality*

  Economic reality is quite complex and typically stochastic. If the data are too smoothed this may mask the short-term behaviour of the series. This property explains why it is necessary to continuously find new information for short-term (i.e., quarterly) series. Smoothed series are often the result of estimation with inadequate information: trend extrapolation and time disaggregation (Stage 5 of the system) without indicators often produce smoothed and not so realistic series, in the sense stated before.

- *Optimal use of the available information*

  Quarterly estimates must incorporate in an optimal way all the information contained in the relevant basic statistics. In consequence, the short-term profile of quarterly estimates should be closely related to the profile of basic statistics.

- *Invariance of the turning points*

  Quarterly estimates must have approximately the same turning points as the corresponding basic statistics series. This is a consequence of previous properties.

- *Preservation of the growth rate*

  Growth rates of quarterly estimates and basic statistics must be as close as possible.

- *Consistency between short-term and long-term movements*

  Quarterly basic statistics used in compiling quarterly accounts are essentially short-term statistics. Quarterly accounts are a part of the system of national accounts in which annual accounts describe the long-term behaviour of the economy. Quarterly accounts should be closely related to annual ones so that short-term and long-term behaviour are consistent.

- *Comparability of the structure*

  The leading and lagging structure must be comparable between quarterly and annual accounts.

- *Significance of the autocorrelation*

  Quarterly estimates must present a relevant autocorrelation function that should be characterised by some peaks corresponding to the most relevant frequency. This function must be sufficiently regular so that a robust autoregressive structure is obtained.

Improving existing data sources and finding new ones

5.15. The process described above assumes that there is a given set of data sources available in the country. But of course there is a “feedback loop” over time which allows countries to improve their existing data sources and find new alternative ones, thereby allowing more use of Stages 1 and 2 in the process. The choice of whether or not to improve data sources revolves around a judgement of balance between the costs of improvement (both to the Statistical Institute and the respondents) against the benefits to the quality of the estimates of the series in the accounts.

5.16. With a fixed budget, the statistical office must make choices in allocating resources between different data collections. There will also be the response burdens imposed on respondents to be considered; with many governments trying to reduce the burdens of bureaucracy on business, this becomes a key consideration. However the choices are complicated by the difficulty of measuring loss of accuracy arising from the use of indirect methods, and by the task of actually measuring the burden on respondents. It may be possible to undertake a pilot study to compare the results from different data methods, and this would also provide an opportunity to examine the burden placed on respondents. Alternatively there may be experience in other countries that can be drawn upon this is an area where Eurostat can act as a point of information exchange.

5.17. The consideration of synergy with other statistical areas is another point to consider. Some basic statistics are of interest in their own right (for example employment, industrial output, trade balance) and therefore the cost of using them for national accounts is only the marginal cost of adapting the classifications and making the necessary methodological adjustments, if any. It is therefore recommended that the overlap of the national accounts with other areas of statistics is taken into account in the decisions of resource allocation.

5.18. The process laid out in this chapter may mean abandoning existing data collections in favour of new collections, for example moving resources from manufacturing output statistics to service statistics, although the start-up costs (for the statistics office and business) for existing data collections have already been invested so it may be that the running costs are low enough to tip the cost/benefit argument in their favour compared with new collections. There is of course the opportunity to reduce the costs of existing collections by making more use of survey methods and other strategies which will be discussed in the next part.

Reducing the burden of collecting quarterly data

5.19. Collecting quarterly data directly is a costly exercise in terms of time and money for both government and the respondents. In some areas of the accounts, such as balance of payments and manufacturing output, the processes of collecting and processing regular data are established the costs are accepted because they are justified by the benefits of the data. But a move to the process of looking for better quality data described above will inevitably lead to the need to introduce new quarterly collections. However, with the use of statistical methods, the better use of existing data, and a pragmatic approach taking advantage of the particular business and administrative context of the country, the extra burden can be minimised.

a) Sampling Techniques

With the establishment of a common standard for statistical registers of businesses (Council Regulation 2186/93 dated 22 July 1993), a suitable sampling frame for stratified sampling of businesses has become available in all EU Member States. In addition, some Member States have registers of households and individuals (notably the Scandinavian states, and Germany through the 'microcensus') which also provide a sampling frame for the personal sector. The Eurostat handbooks dealing with short-term indicators and household budget surveys both recommend stratified sampling for increasing precision with a given sample size, though they set guidelines for sample fractions and sizes in order to ensure representativeness. The Eurostat methodology manual "Handbook on design and implementation of Business Surveys" (Eurostat, 1997) contains many principles of sampling which can be extended beyond business statistics. There are also many textbooks and journal articles which cover sampling theory and methods.

b) Increasing Response Rate

A high response rate is important for ensuring the representativeness of the sample and for using small samples more efficiently. There are various ways in which the response rate could be increased.

i) Legal sanctions

Most countries have statistical laws which allow statutory surveys of businesses, though there may be stipulations about the periodicity for which data are collected. Whilst legal sanctions, often in the form of cash fines for non-response, are effective for dealing with obstructive businesses, they do not provide an incentive to provide good data and can sour relations for future data collections by reducing voluntary co-operation. The statistical office may therefore introduce a non-statutory code of conduct for itself, which gives some incentives to businesses to return data. The code could include a dispensation to smaller businesses, perhaps by guaranteeing that they will not be included in several future samples after their response. It could also set out targets for the time taken by the statistical office to respond to queries from businesses and targets for the delay before the statistical office follows up inconsistencies in the statistical returns.

ii) Questionnaire design

Good questionnaire design, following business or personal accounting methods where these can be converted into national accounts concepts and classifications, with a limited number of key questions, can substantially increase response rate. The piloting of new questionnaires with a limited number of businesses provides a robust test for their design. Including a polite letter with the questionnaire, which explains the reason why the data are needed and provides a contact for any queries, is an effective way of getting co-operation from a business which has not been surveyed before or for a long period of time.

iii) Follow-up techniques

A selective strategy for chasing non-response can target larger units and thereby increase coverage whilst keeping down the costs of follow-up. For more information see the Eurostat manual on “Methodology of short-term indicators”.

iv) Imputation techniques for item non-response

There are many techniques, from the statistically simple to the complex, for imputing values where there is non-response. For item non-response (where a unit fails to answer one question amongst many), multivariate techniques can impute the most likely response by examining answers to other questions.

v) Feedback of free data

It is possible that the promise of free data on their industry for those businesses completing surveys may lead to more co-operation with the statistical office. Such feedback shows how and where the data is used and gives a reward for co-operation. The benefits would need to be weighed against the loss of sales of official publications of results and possible complaints from businesses who were not selected for the survey and therefore had to pay for data.

c) The ‘Master Sample’ method

Increasingly adopted by Member States, the ‘Master Sample’ method co-ordinates surveys using a common sampling frame to ensure that the maximum efficiency and multivariate information is available from a given sample size. A good description of the method is given in the publication “Household Budget Surveys in the EU”.

d) Using administrative data

The extent of administrative data available and the laws governing its use vary from country to country. Despite its drawbacks in terms of methodology (often the classifications and definitions are different from ESA 1995 recommendations), the regular update of many administrative systems makes them a good source for quarterly data if techniques can be applied to estimate ESA 1995 series. For example cash outlays by government can be converted to an accrual basis by using another activity measure (such as employment) or smoothing techniques. Statisticians should be pro-active in searching for administrative sources it is rare to find an area of policy where Government does not have administrative records of some form and can provide advice to administrators about collection methods. Encouragement, technical assistance, and perhaps in some cases cash assistance, can develop an administrative data source into a suitable form to feed into the national accounts.

e) <u>Electronic data management</u>

With the advent of improved electronic communication and portable computers, it is now possible to use electronic methods to collect quarterly data that was not previously available or was too costly to collect. Administrative data are increasingly stored electronically which allows a full analysis of available data, rather than the sample methods that have been used with paper records in the past. Businesses can return data electronically, possibly even by interface with their management accounting systems, with less difficulty than the paper returns and the government avoids costly data entry. There has been substantial research by Eurostat and others into the protocols for electronic data transfer: the software for sending electronic mail across the Internet is cheap and straightforward, although there are problems with security, whilst protocols for sending metadata (such as ‘EDIFACT’) show that more complex data sets can be exchanged successfully. However the paper questionnaire option must probably be retained for smaller businesses where computerisation is non-existent or basic.

f) <u>Co-operation with other institutions</u>

In certain circumstances the national statistical office benefits by co-operating with other institutions in the collection and analysis of data. Within the government sector, the regional offices and local administrations have the expertise and contacts to collect a wide range of local data, whether by survey or by access to administrative systems. Trade Associations and other organisations representing businesses often have a very large and active membership, from whom data can be collected with high response rate and good qualitative knowledge about the sector. The same is true in respect of labour data from Trade Unions in Member States where the workforce is highly unionised. Private firms also collect and publish business data, although some of this may rely on recycled government data. The Eurostat recommendation in these ‘symbiotic’ relationships is that the standard of data collection should be the same as for the areas in which the government collects data by itself, that is ideally with full coverage and no bias.

Examples of Member States

5.20. The following examples show the different approaches to compiling quarterly national accounts in the largest EU Member States. It is clear that these Member States and others already use a pragmatic approach to the estimation of their quarterly accounts, using the most appropriate method for their existing data sources, but they have different views on the criteria for choosing the appropriate method. The United Kingdom and Germany tend to rely more on the techniques described in Stages 1 and 2; the United-Kingdom relies on the quarterly accounts as the main building blocks for the annual accounts, whereas Germany produces annual accounts separately and integrates the quarterly data with the annual estimates. France and Italy rely more on the techniques described in Stage 3, using mathematical and statistical methods to estimate accounts series.

United Kingdom

5.21. In the United Kingdom the quarterly national accounts are the primary form of national accounts the annual accounts are built up as the sum of quarterly accounts, therefore the quarterly accounts are complete, including financial accounts. This philosophy naturally leads to a system where the techniques in Stages 1 and 2 are considered to be the best way of measuring quarterly data. The same staff co-ordinate the production of the quarterly and annual accounts, but each area of the accounts is managed by statisticians whose job is to provide good quality quarterly data. A preliminary, incomplete, estimate of the quarterly accounts, based on output measures, is published 3 weeks after the end of the quarter. A fuller set of accounts are published 7 weeks after the end of the quarter, followed by a complete set of accounts 12 weeks after the end of the quarter.

5.22. However the United Kingdom also uses methods in Stages 3 and 4 where the data cannot be directly measured or they are of demonstrably poor quality. There is also a reliance on structural assumptions about the economy (most notably about the share of value added in output) although these are scrutinised for their robustness. During each quarter there are a number of meetings between statisticians providing the data and the co-ordinators of the accounts inconsistencies are eliminated through discussion about quality of data and supporting evidence and there is substantial subjective input to this process. Finally the expenditure and income measures of GDP are brought into line with the output measure, thereby producing a single estimate of GDP, although this is only on a seasonally adjusted basis.

5.23. At the end of the year the quarterly data are summed to provide the first estimate of the accounts for the year as a whole. Revisions to quarters can take place during following quarters when basic statistics are updated, and there is an annual review of the data for publication statisticians are expected to provide individual accounts series in which the quarterly data are consistent with the annual data. Finally the annual figures are finalised when a full input/output table becomes available, and the quarterly data are brought into line. More information on the UK system is available from “The UK approach to quarterly national accounts” presented by David Caplan and Sharon Lambert at the Paris quarterly accounts workshop in December 1994, from the working paper “Quarterly national accounts in the UK: Sources” by Ian Cope, and from the “Sources and Methods” publication of the UK Office for National Statistics.

Germany

5.24. In the German system, the quarterly national accounts are also produced by the same staff as the annual national accounts, although the sources may differ depending on the information available quarterly. This means that the staff use their own judgement in determining which method is best for estimating quarterly data. Quarterly national accounts are published in aggregate 7 weeks after the end of the quarter and then in a more detailed breakdown 9 weeks after the end of the quarter. The quarterly accounts are not as comprehensive as annual accounts, even though there are data on output, expenditure and income aspects, but they provide a second estimate of the current year when the fourth quarter is published (though only the non-seasonally adjusted data are constrained to add up to the annual total).

5.25. Data suitable for using Stages 1 and 2 methods are available for the primary sectors of agriculture, forestry, and fishing. Estimates for value added in manufacturing industries are obtained predominantly by collection of output data, then an extrapolation of the structural relationships from the previous year. Good data for the public sector are available from the finance statistics of General Government, and balance of payments data are used for trade in goods and services. However there are only indicator data available for some series, and these are estimated using an interpolation method even here there is the opportunity for manual adjustment using the experience of the statistician compiling the series.

5.26. When annual data become available, the quarterly data are adjusted to meet the annual totals, even if the adjustments will be small for data which have been collected directly on a quarterly basis. More information on the German system is available from the “Quarterly national accounts of the Federal Statistics office of Germany” presented by H. Lützel at the workshop on quarterly accounts, held in Paris in December 1994.

France

5.27. In France, annual national accounts represent the main accounts. Three kinds of releases of annual accounts are produced: a first estimate, a “semi-revised” and a “final” valuation, whose quality increases according to the delay with respect to the end of the accounting period. The main purpose of annual accounts is to give an exhaustive and detailed description of the field covered. Quarterly national accounts are coherent with the data of the annual accounts. By contrast, their compilation is mainly guided by a time imperative since they attempt to track the short-term fluctuations with indicators that, for reasons of availability, may give inferior coverage of the field.

5.28. The French quarterly national accounts are constructed on the basis of sub-annual or short-term indicators. The basic method consists in establishing a statistical link between a sub-annual series and an accounting variable (see Chapter 6). Each account series is linked to a quarterly series (indicator) available in the same time frame as the preparation of the account series themselves. The movement of the indicator is similar to that of the account series. As a rule, owing to differences in definition and coverage, the quarterly indicator used does not give the same value as the account series. This is the typical situation of Stage 1b, if there is enough available information, or Stages 2, 3 and 4.

5.29. Taking the account indicator as the starting point, the quarterly accounts are calculated in several stages. Among them, interpolation and adjustment (according to the french terminology, *étalonnage et calage*) are the most important (Figure 5.2):

- *Interpolation*

Interpolation is an econometric regression used to convert indicator figures into a quarterly account series. Estimated annual data, the relation is assumed to remain valid for quarterly data (see Chapter 6).

- *Adjustment (time consistency)*

Adjustment is the stage through which a fit between the annual accounts and the quarterly accounts is obtained on past values, by distributing the annual discrepancy among all the quarters as evenly as possible (see Chapter 10).

5.30. The outlined method is used to compile quarterly accounts for past years. For the current year, the equation (statistical model) formulated for preparing the quarterly accounts is used to obtain the current-quarter account and a procedure to avoid a “door-step” profile is run to ensure a continuous sequence in the series (see Chapter 13).

Figure 5.2: The procedure for transforming an indicator into a quarterly aggregate (France)

Indicator

↓

Seasonal adjustment

↓

Seasonally adjusted indicator

↓

Interpolation

↓

Adjustment

↓

Quarterly account aggregate

5.31. This standardised procedure, with few minor variants, is used to prepare all the French quarterly national accounts.

The indicator series are updated as the relevant data become available. When the coverage reaches an adequate level, the accounts are estimated, compiled and published. Subsequently, the accounts are modified in the light of the new information and of any changes in the short-term statistics and annual accounts.

A first issue, concerning the transactions in goods and services at constant prices, is published about 70 days after the end of the quarter (“Initial Results”). 115 days after the end of the quarter follows a “Detailed Results”, which shows the complete tables, in current and constant prices, for transactions in goods and services, together with some accounts for corporate and quasi-corporate enterprises and households.

More information on the French system is available from the “Methodology of French quarterly accounts”, Guillaume Dureau, INSEE.

Italy

5.32. The Italian approach to the compilation of the quarterly national accounts has the same basic ideas as the French one. Since the quarterly available information is not totally complete, with respect to the annual basic statistics, or since the direct use of the available information could give a misleading image of the economy, the compilation of the Italian quarterly accounts is mainly based on the use of sub-annual indicators. As in the French case, the Italian quarterly account aggregates are estimated according to a statistical relation based on the movements of a suitable indicator (Stages 1b, 2, 3 and 4, according to the amount and quality of the available information).

5.33. The quarterly series produced are GDP by kind of activity and final expenditure on GDP. The first step of the compilation process consists in recording the information associated to the indicators. The main indicators used are those presented in Chapter 4. If the indicators are recorded on a monthly basis, they are aggregated on a quarterly basis. To obtain the seasonal adjusted series for the quarterly aggregates, the seasonal adjustment procedure is applied to the quarterly indicator and then the resulting series is used to estimate the desired series in a statistical context according to an optimal technique (see Chapter 6).

The first release of the quarterly figures is published 80 days after the end of the quarter and is submitted to revisions (see Chapter 14) during the same and the two following years.

5.34. The main differences with the French approach consist in the different statistical technique used in estimating the quarterly aggregate values and in the different basic statistics used (basic statistics vary according to the national statistical system). Among the indicators used in the compilation of quarterly accounts, the National Statistical Institute uses also dummy variables that well describe short-trend and particular phenomena.

More information on the Italian system is available from the “I conti trimestrali”, ISTAT.

CHAPTER 6

CONTRIBUTION OF MATHEMATICAL AND STATISTICAL METHODS

Mathematical and statistical methods use mathematical and statistical techniques to estimate the quarterly path of an aggregate for which only annual data are available. Moreover there are some techniques that allow the estimation of quarterly data during the year, before annual data are available.

The chapter describes the mathematical and statistical approach to the compilation of quarterly accounts according to the scheme illustrated in Chapter 5. Availability and reliability of the basic information and the philosophy of compilation represent the main elements that characterise the more intensive or less intensive use of mathematical and statistical methods. Short-term indicators are often used in this approach to construct the path of quarterly data, both in a univariate or multivariate (accounting) approach.

Extrapolation techniques and temporal disaggregation methods are described in the chapter putting in evidence their characteristics and how to use them. Dynamic models are introduced and recommended for use in a fast-moving economy where structural relationships change in the short-term under a given long-term equilibrium.

The annex provides a mathematical description of the most common methods, with a consideration of each method's strengths and weaknesses.

Contribution of mathematical and statistical methods

Introduction

6.01. In this chapter we deal with mathematical and statistical methods for compiling quarterly national accounts series. The first part of the chapter is devoted to the introduction of the mathematical and statistical approach to the compilation of quarterly accounts, while the second part deals with extrapolation methods and temporal disaggregation methods. The emphasis is put on the ideas that underlie this kind of approach. Several methods are presented, for the estimation of both a single aggregate and several aggregates related by accounting constraints.

The chapter has to be read having in mind the pragmatic scheme of Chapter 5 that represents the ideal guide to the logic that underlies the mathematical and statistical approach to the compilation of quarterly accounts. This chapter is supplemented by a technical annex in which the most widely known, used and useful mathematical and statistical methods are presented in a more formal way.

6.02. The pragmatic multi-stage scheme presented in Chapter 5 illustrates the steps to be followed in compiling quarterly accounts. Two basic ideas underlie the scheme and, consequently, the compilation process: (i) the availability of the basic information and (ii) the more intensive or less intensive use of mathematical and statistical models. Both ideas are, in a certain sense, strictly related: the use of mathematical and statistical methods often increases where the lack of available information is evident.

6.03. Mathematical and statistical methods for compiling quarterly accounts are an integral part of the estimation approach. Their use is more intensive or less intensive according to the main philosophy that characterises the system of quarterly accounts. For this reason it makes no sense to speak about a quarterly system based only on mathematical and statistical methods rather than one based only on the same methods used for annual accounts. Most of the countries have a national quarterly accounts system that includes elements of both approaches. Propensity towards one or the other extreme often depends on the philosophy of compilation and the available information.

It has to be stressed that a minimum amount of actual data is necessary to provide meaningful quarterly figures. Without this minimum amount, a reliable quarterly path cannot be established. It is possible, in any case, to supply estimates of the desired aggregates.

They correspond to estimates obtained with trend-extrapolation, or extrapolation based on models without related indicator (see Stage 5 of the scheme presented in Chapter 5) and other more subjective techniques.

Conversely, the use of mathematical and statistical methods do not necessarily imply a lack of basic information since these models can be used also to improve the quality of the estimates. So, even if the basic statistics supply all the necessary information, it may be useful to put this information in a statistical model to obtain estimates that could improve, under specific conditions and in a statistical sense, the quality of the quarterly figures.

6.04. National accounts language usually distinguishes between the *direct* and *indirect* approach when referring to the two approaches described above. As stated in ESA 1995, § 12.04 "The statistical methods used for compiling quarterly accounts may differ quite considerably from those used for the annual accounts. They can be classified in two major categories: direct procedure and indirect procedure. Direct procedures are based on the availability at quarterly intervals, with appropriate simplifications, of the similar sources as used to compile the annual accounts. On the other hand, indirect procedures are based on time disaggregation of the annual accounts data in accordance with mathematical and statistical methods using reference indicators that permit the extrapolation for the current year".

Methods related to the so-called *direct* approach rely on an overall set of surveys and use the same method in the compilation of quarterly and annual accounts (see Stage 1a of the scheme in Chapter 5).

Methods related to the so-called *indirect* approach use short-term indicators such as industrial output indices, turnover statistics, retail sales, labour inputs, etc., within the framework of a statistical model to estimate quarterly accounts.

The distinction between *direct* and *indirect* approaches can be misleading, so, in the rest of the handbook, it is only used where it helps to make exposition clearer or where it is in accordance with traditional accounts language. A more precise distinction is between the approach which is similar to that used for annual accounts and the mathematical and statistical approach which utilises statistical and mathematical models in compiling the aggregates of quarterly accounts.

6.05. As stated in Chapter 1, quarterly accounts allow economists to study business cycles, to statistically measure lags in the effects of economic shocks and to make dynamic analyses with the help of statistical and econometric tools. They permit statistical tests for theoretical hypotheses and econometric estimation of economically meaningful equations as well as providing an input to forecasting exercises.

In respect of the current year, quarterly national accounts compilers are concerned with providing the most robust estimation of the short-term changes of the main economic variables according to the available information. These data allow short-term analysts to detect turning points and help economic agents to reconsider their strategies according to their preferences and their expectations.

Quarterly figures are relevant for statistical and economic analysts because the estimated quarterly series contains the entire history of the aggregate of interest.

6.06. In the statistical institutes in charge of the quarterly national accounts compilation, the use of mathematical and statistical methods assumes a relevance that varies according to the philosophy of compilation and to the available information. So in different countries the estimate of the aggregates of quarterly accounts is carried out according to different methods in which the use of the statistical models is different.

6.07. The mathematical and statistical approach can be interpreted as a compilation method based on surveys that uses regression models to correct the sample estimates. Estimation of the aggregate figures is derived from the survey data with the appropriate system of weights computed from a population register. In this case the mathematical and statistical approach is quite similar, in its principles, to the so-called *direct* method of compilation. In standard conditions, the mathematical and statistical approach, as described above, improves the quality of the estimate since the quarterly information is generally incomplete or affected by measurement errors larger than those of annual surveys.

6.08. The final purpose of mathematical and statistical methods is to give a quarterly breakdown of the figures in the annual accounts. Moreover, some methods allow quarterly estimates to be obtained during the course of the year when the annual aggregates may not as yet be known. An important feature is adherence to the annual constraints for each series and, when more than one series has to be estimated, to given quarterly contemporaneous constraints.

These methods are often referred to as temporal disaggregation models, in the statistical literature. Temporal disaggregation expresses the idea that the procedure carried out corresponds to a disaggregation of the low frequency annual data into high frequency quarterly data.

6.09. A first, simplified, taxonomy of mathematical and statistical methods of estimation distinguishes between:

a. methods that do not involve the use of related indicators;
b. methods that make use of related series;
c. extrapolation methods.

6.10. <u>Methods that do not involve the use of related indicators</u> obtain quarterly estimates by a weighted division according to some purely mathematical criterion, providing a sufficiently smoothed quarterly path coherent with the temporal aggregation constraints or by using time series models. They are the only methods that can be used when there are serious gaps in the basic information, where the only data available are those pertaining to the annual series.

6.11. <u>Methods that make use of related series</u> estimate the quarterly path on the basis of external quarterly information for logically and/or economically related variables. The hypotheses on which these methods are based may be sometimes too restrictive. In fact, the available partial and indirect information is not always suitable for the task. Nevertheless, it is clear that when external quarterly data linked to the relevant variable of interest are available, they should be used.

6.12. According to this framework, quarterly national accounts are generally constructed on the basis of sub-annual or short-term indicators. Each account series is linked to one or more related quarterly series, available at the time of compilation of the account series themselves. Owing to differences in definition and coverage, the account indicators do not give the same value as the series to be estimated (as they would in the direct approach), but their movement can be used to recover the quarterly dynamics of the unknown aggregate.

6.13. Besides the estimation of a single series, national accountants are often faced with the estimation of a set of quarterly series linked by some accounting relationship. Statistical methods can also be used in such cases, to give a solution consistent with both temporal and contemporaneous aggregation constraints.

6.14. Extrapolation methods use the information coming from the indicator series to obtain an estimation of the desired aggregates. The basic idea is that the indicator series and the aggregate have the same time profile and then they have the same growth rate. So the profile of the aggregate for the unknown figures is constructed according to the profile of the known profile of the indicator series.

6.15. In the compilation process, when there is no quarterly information available, the estimates can be derived only from the extrapolation of quarterly data or interpolation of the annual extrapolated data. The methods that do not involve the use of related indicators are, in this case, the solution to the estimation problem.

If the available information is not sufficiently reliable and/or not complete, it is then neces sary to use classical extrapolation methods (based on the previous available quarterly series) or methods that use related series.

Even if the amount of available information is fully coherent with the aggregates to be estimated, the use of extrapolation methods may present some advantages. In fact, the data of year *t* are, after the end of the year, adjusted to respect the balancing accounting rules. In this way they will differ from the inputs of the compiling procedure. In estimating the quarters of year *t+1*, it is useful to extrapolate the level of the previous quarters in order to avoid the risk of jumps in the series between the fourth quarter of year *t* and the first quarter of year *t+1*. The time consistency will be ensured by an adjustment procedure at the end of the year.

Alternatively, the same information can be inserted in a statistical model for temporal disaggregation in which the extrapolation and the interpolation are simultaneously calculated and fulfil the temporal annual constraints.

No theoretical reasons favour one method or the other. The choice is often related to subjective considerations and operational criteria. This handbook does not intend to suggest a particular position with respect to the different approaches. Its aim is to make clear that how far to use the mathematical and statistical models in compilation procedures depends on several factors. Important above all are quality, reliability and availability of the information.

Moreover, the decision itself has to be founded on a valid and duly documented statistical basis.

6.16. The use of mathematical and statistical methods in the estimation of the aggregates of quarterly accounts, has to respect, in any case, some principles in order to avoid the possibility that the compilation of a national system of accounts becomes a pure econometric-modelling exercise. This philosophy is in fact totally extraneous to the accounting philosophy.

The characteristics which render the use of mathematical and statistical methods appropriate can be summarised as follow:

a. the set of basic information should include statistical variables that are considered as good proxies of the aggregates that have to be estimated;

b. all variables that have a high explanatory power with respect to a specific national accounts aggregate but which do not satisfy (a) have to be eliminated from the set of basic information (for example the interests rate for the estimation of GDP);

c. the statistical models need not incorporate any relationships between the aggregates of quarterly accounts that imply economic hypotheses as for example, the relation between consumption and disposable income;

d. the set of basic information should only include variables associated with the economy of the country for which the quarterly accounts are compiled. This means that the information set is closed;

e. any relationship between quarterly aggregates of different countries, except those regarding international trade, should not be included in the formulation of mathematical and statistical models.

The list of characteristics for the compilation of quarterly accounts by means of mathematical and statistical models is the result of considerations related to the construction and the use of these models and of the quarterly accounts series. Economic hypotheses are often verified on the basis of the data derived from quarterly accounts series. Simulations of economic policies are also tested on the basis of national accounts data to study different scenarios and different paths of the economy. If an economic hypothesis is used in the estimation process it can heavily influence the data and then the evaluation of the economic theory or the economic policy. So the compilation of quarterly accounts figures has to respect neutrality with respect to the economic hypotheses.

National accounts data, both annual and quarterly, are often used to verify alternative economic hypotheses and to simulate the evolution of the economy in different scenarios. To ensure their validity for these purposes, national accounts data therefore have to be compiled in a neutral way without any particular economic theory in mind.

Recommendation

6.17. Concerning the more intensive or less intensive use of mathematical and statistical methods, it is not the intention here to suggest the use of a particular method or technique. The characteristics identified in § 6.16 should rather be considered as a set of good practice guidelines for the compilers of quarterly accounts. This chapter is intended to acquaint compilers with the techniques that can be used, leaving the choice between them to the compilers themselves. Advantages and disadvantages of these techniques are illustrated in the rest of the chapter which, it is reiterated, should be read having in mind the scheme of Chapter 5 and also the principles stated above.

The simple extrapolation method

6.18. Following the scheme presented in Chapter 5, in the process of estimation of quarterly accounts, an indicator x_t can be used either directly in the system of compilation or as input in a mathematical or statistical procedure. How it is used depends on such elements as the capability of the indicator to represent exactly the aggregate that it is estimating and the reliability of the indicator. In addition subjective preferences can play an important role in the choice of the method to be used.

6.19. In this section it is implicitly assumed that the indicator must be used in a statistical framework. If this is the case, several methods can be used. These methods vary considerably and their use often depends on the characteristics of the indicator.

6.20. The method we are presenting in this section can be considered as the easier from a mathematical point of view. The main hypothesis is that the indicator (x_t) and the quarterly aggregate (y_t) have the same time profile so that they increase at the same rate:

$$\Delta y_t = \Delta x_t$$

where

$$\Delta y_t = \frac{y_t - y_{t-1}}{y_{t-1}}$$

This hypothesis is quite strong because it implies that in all the economic phases the behaviour of the two variables is the same and that there are no lags or leads. In order to respect this hypothesis the indicator and the quarterly aggregate have to measure exactly the same economic phenomenon.

6.21. If the conditions discussed in the previous paragraph are respected, the simple extrapolation formula can be used:

$$y_{t+1} = y_t \left(1 + \Delta x_{t+1}\right) \qquad \text{(F.1)}$$

When the new value x_{t+1} becomes available, some past values may change (for example, due to a regular process of revision or as a consequence of the seasonal adjustment procedures). In this case, the past values of the aggregate must be re-computed according to the new pattern described by the new past values of the indicator.

If m past values of the indicator have been revised so that x_{t-m} is the last unchanged value, all the past values of the aggregate, starting from y_{t-m} upwards, must be re-computed.

The estimation of y_{t+1} is then obtained by a sequential procedure:

$$y_{t-m+1} = y_{t-m}\left(1+\Delta x_{t-m+1}\right)$$
$$\dots$$
$$y_{t+1} = y_t\left(1+\Delta x_{t+1}\right)$$

It is observed that y_{t+1} is an exponential combination of the present and past values of the growth rates of the indicator x_t. At the same time, y_{t+1} is a linear combination of the present and past values of the indicator x_t.

6.22. The extrapolation formula presented above is very useful when the data are not characterised by seasonal variations (e.g. they have been seasonally adjusted).

The extrapolation formula in the seasonal case is:

$$y_{t+1} = y_{t-3}\left(1+\Delta_4 x_{t+1}\right)$$

where

$$\Delta_4 x_t = \frac{x_t - x_{t-4}}{x_{t-4}}$$

In this case it is implicitly hypothesised that the indicator and the aggregate have the same growth rate at the seasonal lag (4):

$$\Delta_4 y_t = \Delta_4 x_t$$

This relation implies that for each quarter of the year the forecast formula is independent from the formulas of the three other quarters.

The effect of using this extrapolation formula is to transfer exactly the same seasonal pattern from one year to the following, implicitly assuming that the seasonal component is constant.

6.23. The most important problem in the application of the simple extrapolation is represented by the choice of the initial conditions. A recursive back-calculation of expression (F.1) leads to obtain y_{t+1} as

$$y_{t+1} = y_0 \prod_{i=1}^{t+1}\left(1+\Delta x_i\right)$$

The level of y_{t+1} depends on the initial condition y_0. By contrast the growth rate of y_t is totally independent of the initial condition. This implies that simple extrapolation is a good method for the estimation of the growth rate but not necessarily a good method for the estimation of the levels. If a plausible value of y_0 has been chosen, the values y_1, y_2, y_3, y_4 can be considered as reasonable until the availability of the annual estimates (or improved quarterly estimates obtained using other methods). It is then necessary to run an adjustment procedure as described in Chapter 10 to make the levels for the quarters consistent with the figures for the year.

Following the above adjustment, the first quarter of the second year can be estimated starting from a consistent level. In principle, the estimation of y_5 should be considered as also being of the correct level. Since the information set used for quarterly accounts is generally different from the set used for annual accounts, even if the estimates for the year *t* start from a fully consistent set of estimates of the last quarter of year *t-1*, they are not necessarly correct in level and, when a new annual value becomes available, an adjustment procedure is needed.

It has to be noted that temporal and accounting coherence of starting values ensure a higher reliability of the estimates during the year.

6.24. As discussed above, the extrapolation model (F.1) is very simple and does not always describe the economic behaviour satisfactorily. It is quite conceivable that the hypothesis $\Delta y_t = \Delta x_t$ may not be valid even if, in certain situations, it is possible to accept it as an approximation. This hypothesis can then be said to hold in long-run equilibrium but necessarily so valid in the short run.

Various factor can perturb the position of equilibrium $\Delta y_t = \Delta x_t$ and include:

a) the different time of reaction during the business cycle;
b) the different appreciation of some future events;
c) sample problems.

6.25. Starting from this consideration, it is possible to formulate a new version of the simple extrapolation formula, which takes into account some corrections to the basic relation (F.1). Many different correction mechanisms can be considered.

In this paragraph, we present the easiest and most used mechanism:

$$y_{t+1} = y_t\left(1 + \Delta x_{t+1}\right) + w_t$$
(F.2)

where w_t is a random variable representing the correction term.

The elements that can be included in w_t, are:

1) evidences coming from external variables generally used to validate the estimates;
2) experience of making from past errors made in similar situations or learning from revisions (see Chapter 15);
3) compilers' own appraisals of the economic situation.

6.26. All the factors listed above play a role in the commonly used procedures of compilation of quarterly accounts. The first two factors must be interpreted as judgmental ones even if they have some statistical foundations. The third one is purely subjective and carries the risk that quarterly accounts could reflect some personal opinion/judgement rather than the real economic situation. It is nonetheless important to recognise that personal intervention, if limited and correctly used with the benefit of experience can improve the quality of quarterly estimates.

6.27. The use of extrapolation methods is subject to some limits. Particularly relevant is the hypothesis of a pure deterministic relation between indicator and aggregate that rules out management of the anomalous or erratic evolution of the indicator. This is a problem which still persists with the subjective correction model at (F.2) because the correction does not derive from a stochastic process.

6.28. *Generalisations*

The problem stated in the previous paragraph can be overcome by considering a stochastic formulation of (F.1):

$$y_{t+1} = y_t\left(1 + \Delta x_{t+1}\right) + \varepsilon_{t+1}$$

Where ε_{t+1} represents the stochastic error term in the classical statistical definition[1].

Alternatively, we can consider a model in which the growth of the aggregate is partially explained by the growth of the indicator, let's say *a*, according to the same idea as in (F.1), and partially by the endogenous dynamic of the aggregate itself, let's say *(1-a)%*. This model is very useful when the indicator does not reflect the path of the aggregate well.

Temporal disaggregation methods

6.29. Temporal disaggregation methods were originally devised to give a breakdown of low frequency figures into high frequency figures (for example, annual figures into quarterly figures). They reconstruct the high frequency path of the series giving the possibility of extrapolation. There are different temporal disaggregation methods that require different amounts of basic information. We can distinguish temporal disaggregation methods according to the following groups:

- smoothing methods;
- two-steps adjustment methods;
- time series methods;
- optimal methods;
- dynamic model methods;
- multivariate methods.

6.30. When there is a lack of information, *smoothing methods* ensures the possibility of obtaining both interpolation estimates for the quarterly breakdown and extrapolations for now-casting during the year. They are usually based on mathematical techniques and do not allow, in general, direct extrapolation.

6.31. The *two steps adjustment methods* divide the process of estimation in two parts. The first step consists of a preliminary estimate of the aggregate that does not fulfil the annual

1 $e_t \sim N(0; s^2)$

constraints. The second step consists in distributing the discrepancy according to appropriate criteria between annual data and preliminary estimates.

6.32. *Time series methods* can be used both in situations with lack of information where, allowing the extrapolation, they represent a more sophisticated statistical smoothing method, and as adjustment-optimal methods.

6.33. *Optimal methods* merge the steps of preliminary estimation and adjustment in one statistically optimal procedure using all the available information in the context of a statistical regression model which involves annual information and quarterly related information.

6.34. The *dynamic model* extends the optimal approach by incorporating dynamic elements that permit consideration at the same time of the short-term influences derived from related series and of the effects of the recent past history of the aggregate to be estimated.

6.35. Finally *multivariate models* take into account the multivariate dimension of national accounts introducing contemporaneous accounting constraint in the estimation step in order to obtain estimates of national accounts aggregates which are coherent both temporally and in the accounting sense.

Smoothing methods

6.36. Methods of disaggregation in which no quarterly related indicators are involved will be referred to as *smoothing methods*. They typically assume that the unknown quarterly trend can be conveniently described by a function of time, either given *a priori* or to be chosen within a larger class, such that the necessary condition of satisfying aggregation constraints and the desirable condition of smoothness are both met.

Characteristic of almost all smoothing methods is the derivation of the quarterly breakdown starting only from annual data and the use of a suitable time function that generates the interpolation. No related quarterly information on the path of the phenomenon is used. Generally these techniques estimate the quarterly figures by considering a “window” of annual values an a subset of the time series. Starting from these data, the techniques minimise the discrepancy between known annual values and quarterly estimated data.

In order to give a formal idea of these kind of techniques, the Boot, Feibes and Lisman (BFL) method is illustrated in more detail in the annex.

6.37. Purely mathematical methods can also be used to produce a quarterly “distribution” for the annual discrepancies between an annualised preliminary series and the annual data to be disaggregated.

Two-steps adjustment

6.38. Two-steps adjustment methods start from the availability of related quarterly information. This information corresponds to available quarterly series strictly related to the aggregate to be measured. The related series supplies the compiler with information about the quarterly dynamic of the aggregate, even if this information may be partial or indirect.

6.39. The first step in indirectly estimating quarterly accounts series is usually the conversion of quarterly indicators into quarterly series which are not consistent with the annual counterpart. We shall refer to this step as *preliminary estimation*. The preliminary estimates are then processed in order to fit the known annual series, using procedures that we shall refer to as *adjustment*.

6.40. If preliminary estimation and adjustment are operationally separated phases, in the sense that the adjustment works independently from the procedure used to obtain preliminary estimates, this is a genuine two-steps adjustment method.

6.41. Preliminary estimation can be performed either in a *direct* way, for example deriving quarterly estimates by a sample survey, or in a mathematical-statistical way, for example by using a linear regression relationship between the annual accounts series and the annualised related indicators.

6.42. However it is obtained, the preliminary quarterly estimates do not generally satisfy the temporal aggregation constraints. The annual discrepancy between the annual aggregate and the aggregated preliminary quarterly estimates must therefore be distributed according to an adjustment procedure. The procedure operates by fitting the annual constraints and by altering the quarterly path given by the preliminary estimates to the least extent possible.

Consideration is given here to two adjustment procedures:

a. the adjustment procedure by Bassie (1958);
b. the adjustment procedure by Denton (1971).

6.43. *Adjustment according to Bassie*

The preliminary estimates (except those for the first year) are adjusted in two steps: the quarterly figure is corrected in proportion to the discrepancy registered (i) in the same and (ii) in the next year. The adjustment factors have been obtained by using a sort of ‘corrections--generating function’ (further technical details can be found in the annex to this chapter).

6.44. *Adjustment according to Denton*

The final estimates are obtained by minimizing a quadratic loss function that involves the preliminary estimates and that is subject to the aggregation constraint. Different versions of the loss function (expressed as a weight matrix) generate different solutions from among which the compiler can choose the most plausible one. The set of solution ranges from the simple adjustment rule to “divide by four” the discrepancy between the annual value and the sum of the preliminary estimates, up to the more often used and justifiable first difference and second difference loss functions (see the annex to this chapter for more details).

Clearly, the practice to divide the discrepancy by four is not advisable since it can create an unjustified discontinuity between the estimate for the fourth quarter of one year and the first quarter of the following year.

Time series methods

6.45. Time series methods are techniques recently developed in the context of temporal disaggregation. Their aim is to take into account the time series approach (in particular the ARIMA model approach) in interpolating and extrapolating high frequency figures. This kind of approach allows inclusion in the temporal disaggregation approach of dynamic elements derived from the temporal path of the aggregate. At the same time quarterly information derived from quarterly related series can be included in the estimation process in order to guide the infra-annual path.

Time series methods are particularly useful in situation with lack of quarterly information since they can be used to produce “now-casts” during the year even if no related indicators are available. This property directly derives from the time series nature of the estimation process.

It was stated at the beginning of the chapter that a minimum amount of actual quarterly data is necessary to provide meaningful quarterly figures. All the same, time series methods offer a good approach to the estimation problem when there is little or no available actual information.

6.46. The techniques of Wei and Stram and Al-Osh are formally described in the annex to this chapter putting in evidence their characteristics, the underlying ideas and the advantages of their use.

Optimal methods

6.47. The classical univariate temporal disaggregation problem is how, when given the annual observations for an account aggregate and the quarterly values for a related series, to estimate the unknown quarterly values of the aggregate. Chow and Lin worked out a least-squares optimal solution on the basis that a linear regression model involving the quarterly aggregate series and the related quarterly series will hold.

6.48. A very important quality of this estimation approach is the ability to evaluate the precision of the estimates by means of the estimation error covariance matrix. The estimation errors covariance matrix can be used to:

a. compute confidence intervals for the estimates according to suitable distribution hypotheses;
b. assess reliability indicators for the estimates;
c. perform econometric estimates taking into account the 'noisy' nature of the data.

6.49. The optimal estimation approach offers a natural and coherent solution to the extrapolation problem. Given the new values of the related series the optimal forecasts (or now-casts) for the aggregate values are directly obtained from the quarterly regression model.

6.50. The general technique proposed by Chow and Lin has been intensively used in National Statistical Institutes, especially in France and in Italy. Different versions of this technique have been developed according to the different hypotheses related to the structure of the error in the regression model. The stochastic error models usually considered when estimating quarterly accounts series are the following:

a. AR(1) model (Bournay and Laroque, 1979);
b. Random walk model (Fernàndez, 1981);
c. Random walk-Markov model (Litterman, 1983, Di Fonzo, 1987).

Dynamic models

6.51. As was seen in the description of optimal methods, no dynamic components are considered in the regression model. The temporal disaggregation and interpolation processes are then based only on the dynamic coming from the quarterly related series. Some improvements, statistically speaking, can be obtained by introducing dynamic elements in the model, elements that come from the past time series history of the aggregate.

The reasons for a dynamic specification of a model

6.52. One of the causes of revisions of quarterly national accounts (considered further in Part VI of this handbook) is when an annual estimate of an account item in a recent past year is modified in the usual process of annual accounts compilation by the introduction of new information. In this case, revisions of quarterly figures occur due to the re-estimation of the econometric relationships underlying the quarterly calculation.

6.53. When the economy shows clearly cyclical movements, it is frequently observed that revisions of first estimates by quarterly national account compilers are correlated with the phase of the business cycle. Upward revisions tend to take place during a phase of accelerating growth, downward revisions during a flagging one. This phenomenon may have various causes. For instance, when the monthly or quarterly indicators used to extrapolate annual quantities are computed from a constant sample drawn from a register, they do not capture the consequences of changes in the number of enterprises caused by the economic situation. This can lead to under-estimation of the growth rate during accelerating phase of the business cycle and conversely to over-estimation in a flagging phase. There are inevitably lags in the registration of new firms and the deregistration of failed firms. In the case of a positive shock, the variable is still positively influenced at the later date. In the cas e of a negative shock, which may take the form of an interruption to the trend growth rate, this shock persists and influences negatively the variable under study. This kind of revision can then be related to the fact that the statistical models used to extrapolate current estimates have no dynamic specification and then do not take into account within-period relationships between indicators and accounts.

6.54. In practice, a more satisfactory description of macroeconomic time series can be obtained by using a variation-based model with a small number of parameters rather than by a level model.

Good indicators usually have the same properties as the account items which they are used to extrapolate. The former can capture the statistical properties of the latter in two ways. First, the indicators can proxy short-term changes of the account item but their long-term paths are not comparable. In this case, compilers would prefer a model that links variations of both variables. Secondly, the indicators can correctly describe short-term and long-term changes of the related account item. Compilers would then choose a model that links the levels of both variables.

6.55. Each case described in the previous paragraph corresponds to a particular linear approximation of the pair of times series under study, the approximation being in the sense that it minimises the variance of the one-period forecast error. Nevertheless, it is possible to specify a model with a small number of parameters that encompasses both cases without the aim of testing for their relevance. In a very automated and systematic approach, frequent use of the same test procedure can lead to meaningless analyses of time series model structures, whereas here the main interest is in their ability to produce correct short-run forecasts.

Problems related to a static specification of the relation between an indicator and the account item

6.56. Current year estimation of account items involves, on the one hand, a mechanical extrapolation of a modified latest annual residual in order to avoid a step-change at the beginning of each year. On the other hand, it also involves the linear combination of the coefficient estimates applied to the currently observed values of the indicators.

6.57. In an economy with stable growth, static specifications can be used without major problems.

However, in a cyclical economy the lack of dynamic specification in the relation between indicators and account items can be problematic: a non-negligible part of the business cycle is present in the residuals of the model. The mechanical extrapolation of a modified latest annual residual is partly responsible for the quarterly accounts’ inability to detect turning points in the series for the variable in question.

Aims of using a dynamic specification

6.58. The cases described in the previous paragraphs illustrate the basic time series models we can use to capture the relationship between two or more variables. On the one hand, when there exists a long-run relationship between the level of the variables, the model involves levels but also lags of varying lengths, to take into account the possible correlation of the error terms. If the indicators used to extrapolate and time-disaggregate the account item are conceptually and quantitatively close, we can expect the existence of a long-run relationship. On the other hand, if a long-run relationship does not exist, the changes of the indicators and the account item, and eventually their lagged values, are only included in the dynamic model to correct for the possible autocorrelation of the error term. This situation may occur when the indicators are short-term indicators that are compiled to quickly detect changes in the economic situation.

6.59. When the true relationship between the account item and the indicator is such that only variations (and possibly their lagged values) are involved, a static specification of the relationship in level terms and the use of standard estimation methods lead to non consistent estimates and to a variance of the one-step ahead forecast error which increases with the size of the sample.

6.60. With a correct specification, the mechanical extrapolation of the modified latest annual residual continues to influence the equation's ability to capture turning points in the current year. Adding lagged variables to the specification reduces the size of residuals and their contribution to the changes in the account item.

6.61. On the other hand, in such a framework, the residuals obtained are not autocorrelated in the sense that their signs are less related to the effects of changes in the economic situation on the dependent variable, and are more related to the current changes of the particular variable under study in comparison with its average movement. Aggregating more homogeneous modified latest annual residuals may on average increase the aggregate times series' ability to properly describe turning points, at least for the main macroeconomic variables, by reducing their contributions to the changes of these variables.

6.62. Various models can be used. For example, state-space models seem to be good candidates. In this framework, the use of Kalman filter is helpful and allows the statistician to compute the estimates recursively. Nevertheless, if greater importance ought to be given to simple, easily interpreted, models simple estimation methods, which can be easily used by a range of people with different training, should then strongly be preferred. This is a reason for avoiding the use of this powerful framework of state-space models, given that their methods of parameter estimation involve time consuming algorithms.

6.63. As illustrated above, the estimation of autoregressive linear models, under the constraint that the sum of the four quarters of a given year is equal to the available annual account estimate, may be relatively complicated. Moving from a quarterly dynamic relationship to an annual dynamic relationship leads to non-linear parameters and identifiability problems.

6.64. For the current year, measurement errors in the estimates of the first quarters of the year are propagated by the dynamic specification to the following quarters, which harms the first annual growth rate estimates.

Multivariate methods

6.65. A problem often faced by government agencies that collect and publish quarterly time series is that of obtaining quarterly data that simultaneously comply with the relevant annual figures and satisfy accounting constraints. From a formal point of view, one is interested in estimating a number of individual variables starting from variables that are aggregated over units and time. This problem can also be treated in an indirect estimation framework involving a system of variables rather than a single one.

6.66. A similar problem arises when the quarterly estimates of the components of an account are available but they are not coherent in the account framework, namely that the sum of these does not satisfy the contemporaneous constraints.

6.67. In these cases, a balancing procedure is necessary to handle the discrepancies that can arise between the components of the accounts. Techniques for accomplishing a balancing procedure are available from within the frameworks of both the indirect approach and the adjustment-balancing process. This subject is treated more extensively by Chapter 11 in Part V of this Handbook.

CHAPTER 6 - Annex

A FORMAL PRESENTATION OF MATHEMATICAL AND STATISTICAL MODELS

eurostat

A formal presentation of mathematical and statistical models

Introduction

6.A.01. In this annex to Chapter 6, mathematical and statistical methods are formally presented. The hypotheses associated with each method and with each technique are stated and the advantages of the use of one or the other technique are discussed.

The annex follows the same structure of Chapter 6 starting from smoothing methods and continuing with two-steps adjustment methods, time series methods, optimal methods, dynamic models and multivariate models.

Emphasis is put on the extrapolation aspect of the estimation process due to its importance in compiling quarterly accounts.

This annex is far from being a complete overview of temporal disaggregation techniques since its aim is to present the most frequently-used mathematical and statistical methods, in the context of quarterly accounts, from a rigorous statistical point of view.

In this annex we describe the best known and relevant disaggregation techniques which are also available in ECOTRIM, the temporal disaggregation program developed by Eurostat.

Basic principles

6.A.02. Depending on the nature of the series, the processes for temporal disaggregation of annual data will be described as:

Distribution: when the annual data are either sums or averages of quarterly data (e.g. GDP, consumption, and, in general, all flow variables, price indexes, employment, unemployment, and, in general, all average stock variables).

Interpolation: when the annual value equals by definition that of the fourth quarter (e.g. population at the end of the year, money stock, and, in general, all stock variables). This category also includes the case of stock variables annually observed at the beginning of the year, though this is less frequently encountered in practice.

Extrapolation: when estimates of quarterly data are made where the relevant annual data are not yet available.

The third type of process is conceptually different from the first two, because the extrapolated estimates do not have to fit any annual data. Nevertheless, all three types of process can be included within a common framework.

6.A.03. Let us denote $y_{j,4(t-1)+i}$ the unknown value of the aggregate y_j, $j=1,\dots,$ M, in quarter i of year t, and let $y_{ja,t}$, $t=1,\dots,n$, be the corresponding known annual value. Omitting index j for the sake of simplicity, the linkage between y and y_a in the distribution case is:

$$y_{a,t} = \sum_{i=1}^{4} y_{4(t-1)+i}, \quad t=1,\dots,n.$$

or

$$y_{a,t} = \frac{1}{4}\sum_{i=1}^{4} y_{4(t-1)+i}, \quad t=1,\dots,n.$$

In the interpolation case we have:

$$y_{a,t} = y_{4t}, \quad t=1,\dots,n.$$

or

$$y_{a,t} = y_{4t-3}, \quad t=1,\ \dots,\ n.$$

6.A.04. The linkage between quarterly and annual series can be reformulated in matrix form as

$$\mathbf{Y_a} = \mathbf{B_y}$$

where $\mathbf{y}$ is the $(\mathrm{N}\times 1)$ vector of the unknown quarterly data and y_a is the vector containing the $(n\times 1)$ annual series to be disaggregated. N is generally equal to $4n$; however, when dealing with extrapolation problems it will be convenient to assume $N=4n+q$, with $q>0$.

$\mathbf{B}$ is an $(n\times \mathrm{N})$ aggregation matrix whose form depends on the type of temporal aggregation we consider. More precisely, it is

$$\mathbf{B} = \begin{bmatrix} \mathbf{c'} & 0 & \cdots & 0 \\ 0 & \mathbf{c'} & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \mathbf{c'} \end{bmatrix};$$

where

$\mathbf{c} = (1 \quad 1 \quad \cdots \quad 1)'$ for flow variables distribution problems;

$\mathbf{c} = \frac{1}{4}(1 \quad 1 \quad \cdots \quad 1)'$ for index variables distribution problems;

$\mathbf{c} = (1 \quad 0 \quad \cdots \quad 0)'$ for stock variable interpolation problems;

$\mathbf{c} = (0 \quad 0 \quad \cdots \quad 1)'$ for stock variables interpolation problems.

As far as $q \ (\geq 1)$ extrapolations are concerned, either for a distribution or an interpolation problem, $q \ (n \times 1)$ null vectors must be adjoined to the corresponding aggregation matrix.

6.A.05. In an accounting framework it is often assumed that a contemporaneously aggregated quarterly series is available, $z_{4(t-1)+i}$, such that, denoting $\mathbf{z}$ the corresponding $(\mathrm{N} \times 1)$ vector, it is $\sum_{j=1}^{M} \mathbf{y}_j = \mathbf{z}$.

Smoothing methods

6.A.06. The methods of disaggregation in which no quarterly related indicators are involved are referred to as smoothing methods. These methods typically assume that the unknown quarterly trend can be conveniently described by a function of time, either given *a priori* or to be chosen within a larger class, such that the necessary condition of aggregation constraints and the desirable condition of smoothness are satisfied.

6.A.07. A widely used purely mathematical method has been provided by Boot, Feibes and Lisman (1967), hereafter BFL. According to this approach, the estimated quarterly series consistent with a given annual series is the solution of a constrained quadratic minimisation problem.

6.A.08. Two versions of the BFL method are currently in use:

a. First Difference (FD);
b. Second Difference (SD).

The BFL-FD estimates are the solution in $\mathbf{y}$ of the following linear system:

$$\begin{bmatrix} \mathbf{S} & -\mathbf{B} \\ \mathbf{B} & 0 \end{bmatrix} \begin{bmatrix} \mathbf{y} \\ \lambda \end{bmatrix} = \begin{bmatrix} 0 \\ \mathbf{y}_a \end{bmatrix},$$

Where λ is a vector $(n \times 1)$ of Lagrange multipliers, $\mathbf{B}$ is the aggregation matrix defined above and $\mathbf{S}$ is the matrix given $(n \times \mathrm{N})$ by where , d=1, $\mathbf{S} = 2\left(\Delta^1{}_n\right)' \Delta^1{}_n$ is a $\Delta^d{}_n$ matrix *of differentiation* whose general form is:

$$\Delta^d{}_n = \begin{bmatrix} \delta_1 & \delta_2 & \cdots & \delta_d & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & 0 \\ 0 & \delta_1 & \delta_2 & \cdots & \delta_d & \cdots & \cdots & \cdots & \cdots & \cdots & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \vdots & \vdots & \vdots \\ 0 & \cdots & \cdots & \cdots & \cdots & \cdots & 0 & \delta_1 & \delta_2 & \cdots & \delta_d \end{bmatrix}$$

where δ_i are the coefficients of L in the polynomial $(L-1)^d$, where L is the lag operator.

The BFL-SD estimates are in turn given by the solution in $\mathbf{y}$ of the following linear system:

$$\begin{bmatrix} \mathbf{T} & -\mathbf{B}' \\ \mathbf{B} & \mathbf{0} \end{bmatrix} \begin{bmatrix} \mathbf{y} \\ \lambda \end{bmatrix} = \begin{bmatrix} \mathbf{0} \\ \mathbf{y}_a \end{bmatrix},$$

where $\mathbf{T} = 2\left(\Delta^2{}_n\right)' \Delta^2{}_n$.

Further technical details and a simplified way to perform calculations can be found in the original BFL paper.

Note that all the quarterly estimates need to be recalculated when new annual data become available. As will be seen, this characteristic is common to all methods considered in this annex.

Two-steps adjustment methods

6.A.09. As stated in Chapter 6, the two-steps adjustment methods divide the estimation process in two operationally separated phases: preliminary estimation and adjustment to fulfil annual constraints.

6.A.10. However it is obtained, in general the $(\mathrm{N} \times 1)$ vector **p** of preliminary quarterly estimates does not satisfy the temporal aggregation constraints, so that:

$$\sum_{i=1}^{4} p_{4(t-1)+i} \neq y_{a,t}, \quad t = 1,\ldots, n,$$

or, in matrix form,

$$\mathbf{Bp} \neq \mathbf{y}_a.$$

Given that

$$\mathbf{u}_p = \mathbf{y}_a - \mathbf{Bp}$$

is the $(n \times 1)$ vector of annual discrepancies between the annual aggregate and the aggregated preliminary estimates, adjustment procedures operate to ‘distribute’ $\mathbf{u}_p$ in order to fit the annual constraints and altering the quarterly path given by **p** to the least extent possible.

6.A.11. Two adjustment procedures are considered here:

a. the adjustment procedure by Bassie (1958);
b. the adjustment procedure by Denton (1971).

6.A.12. *Adjustment according to Bassie*

The preliminary estimates (except those for the first year) are adjusted in two steps: the quarterly figure is corrected in proportion to the discrepancy registered (i) in the same year and (ii) in the next year. The adjustment factors have been obtained by using a sort of 'corrections--generating function' (further technical details can be found in Bassie, 1958), such that:

a. in year *t-1* the correction must be zero;
b. in year *t* the correction must be equal to $\mathbf{u}_{p,t}$;
c. to avoid discontinuities, the correction at the beginning of the year *t-1* must be zero;
d. at the end of year *t* the function must be flat.

The adjusted final estimates, $\hat{y}^{B}_{4(t-1)+i}$, are then given by:

$$\hat{y}^{B}_{4(t-1)+i} = p_{4(t-1)+i} + w_i \quad u_{p,t+1} \quad \text{I=1,2,3,4} \quad \text{t=1,...,n-1}$$

where the weights $w_{i,j}, i = 1, 2, 3, 4,\ j = 1, 2$, are given in the following table:

i	j=1	j=2
1	-0.024536	0.143433
2	-0.036060	0.225708
3	-0.002026	0.294799
4	0.062622	0.336060

6.A.13. *Adjustment according to Denton*

The final quarterly estimates are calculated by minimising with respect to **y** the quadratic loss function

$$(\mathbf{y} - \mathbf{p})'\mathbf{M}(\mathbf{y} - \mathbf{p})$$

constrained by

$$\mathbf{By} = \mathbf{y_a}$$

where **M** is a $(\mathrm{N} \times \mathrm{N})$ symmetric, non-singular matrix. The solution to this problem is given by:

$$\hat{\mathbf{y}}^{D} = \mathbf{p} + \mathbf{M}^{-1}\mathbf{B}\left(\mathbf{BM}^{-1}\mathbf{B'}\right)^{-1}\mathbf{u}_p .$$

6.A.14. It is immediately possible to verify that, if $\mathbf{M} = \mathbf{I}_N$, the matrix that 'distributes' the discrepancies reduces to $\mathbf{M}^{-1}\mathbf{B'}\left(\mathbf{BM}^{-1}\mathbf{B'}\right)^{-1} = \frac{1}{4}\mathbf{B}$. Thus, in such a case, the adjustment simply consists in dividing the annual discrepancy by four. This practice is not advisable, in that it can create an unjustified discontinuity between the estimate for the fourth quarter and that of the first quarter of the following year.

6.A.15. More attractive alternatives are given by quadratic loss functions of either first or second order differences between the series to be estimated and the preliminary one. For the first order differences (FD) case, matrix **M** is given by $\mathbf{M} = \mathbf{D'D}$, where **D** is the $(\mathrm{N} \times \mathrm{N})$ matrix,

$$\mathbf{D}=\begin{bmatrix} 1 & 0 & 0 & 0 & \cdots & 0 & 0 \\ -1 & 1 & 0 & 0 & \cdots & 0 & 0 \\ 0 & -1 & 1 & 0 & \cdots & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots & \vdots \\ 0 & 0 & 0 & 0 & \cdots & -1 & 1 \end{bmatrix}$$

such that:

$$\mathbf{D}(\mathbf{y}-\mathbf{p})=\begin{bmatrix} y_1-p_1 \\ (y_2-y_1)-(p_2-p_1) \\ \vdots \\ (y_N-y_{N-1})-(p_N-p_{N-1}) \end{bmatrix}.$$

As far as second order differences are concerned, matrix $\mathbf{M}$ is given by $\mathbf{M}=\mathbf{D'D'DD}$.

Time series methods

6.A.16. As was explained in Chapter 6, time series methods aim to incorporate into the temporal disaggregation model all information on dynamics contained in the historical time series. These methods are essentially based on models of the ARIMA type. They estimate the high-frequency series by using the information supplied both by the aggregated ARIMA model associated with the low-frequency available series and by the theoretical relationships that link aggregated and disaggregated ARIMA models.

6.A.17. As a result of the ARIMA model based approach, some further information can be obtained using time series methods. In particular all the techniques considered provide for confidence intervals and some of them supply an estimate of the disaggregate ARIMA model as well as the opportunity to predict future values. It should be noted that, with reference to the first two procedures which will be analysed here, the only information available corresponds to the aggregated series and to its ARIMA model. The problem is therefore one for which information is very much lacking.

Nevertheless, in practice these methods require more computational resources and a more active role on the part of the researcher/compiler.

Wei and Stram's procedure

6.A.18. Since the ARIMA model and its autocovariance structure are closely related, Stram and Wei (1986b) and Wei and Stram (1990) considered the possibility of estimating the autocovariance structure for the unknown series from the available autocovariances of the aggregated model.

The relationship between the disaggregated and the aggregated structure of covariance is the basis of the approach.

We refer to the stationary series $w_{jt} = (1-\mathrm{B})^d y_{jt}$ and $u_{at} = (1-\mathrm{B})^d y_{at}$ obtained by differentiating the basic and the aggregated series respectively. A result by Barcellan and Di Fonzo (1993) states the relationship between the covariances of w_{jt} and y_{at} permitting use of a generalised least squares procedure able to supply estimates which fulfil the aggregation constraint:

$$\mathbf{y}_j = \begin{bmatrix} \Delta_n^d \\ 0 \;\; \mathbf{I}_d \;\; \otimes \;\; \mathbf{c}' \end{bmatrix}^{-1} \begin{bmatrix} \mathbf{V}_w \left(\mathbf{C}^d\right)' \mathbf{V}_u^{-1} \Delta_n^d \\ 0 \;\; \mathbf{I}_d \end{bmatrix} \mathbf{y}_a,$$

where $\mathbf{V}_u$ and $\mathbf{V}_w$ are the variance-covariance matrix derived from the relation between the autocovariances of the stationary aggregated and disaggregated model, $\mathbf{C}_d$ is a matrix which include the information derived from the aggregation type and the differentiation, and $\otimes$ is the Kronecker product.

6.A.19. In practice the matrices $\mathbf{V}_u$ and $\mathbf{V}_w$ are usually unknown and have to be estimated using the available data. While $\mathbf{V}_u$ can be easily calculated by using the aggregated model parameter estimates, the estimation of $\mathbf{V}_w$ is not straightforward. Wei and Stram (1990) founded their disaggregation procedure on the relationship between the autocovariances of the aggregated and the disaggregated model. This is not generally a one to one relationship but, under suitable assumptions, it permits estimation of the disaggregated ARIMA model and then the associated autocovariance matrix (see Wei and Stram, 1990). As will be seen for the optimal approach the extrapolation problem can be solved by using the augmented aggregation matrix $[\mathbf{0} \vdots \mathbf{B}]$ instead of $\mathbf{B}$.

Al-Osh's procedure

6.A.20. Al-Osh (1989) considered a dynamic linear model approach for disaggregating time series. He used an appropriate *state space* representation of the ARIMA model which describes the unknown series and which takes care of the temporal aggregation constraint. The estimated state vectors and the corresponding covariance matrices are obtained by using the Kalman filter with reference to the *state space* representation.

Optimal methods

6.A.21. Chow and Lin (1971) worked out the optimal (in least squares sense) solution to the following univariate temporal disaggregation problem: given the $(n \times 1)$ vector $\mathbf{y}_a$ of annual observations for an accounts aggregate and given the $(n \times \kappa)$ matrix $\mathbf{X}$ of quarterly observations on k related series, we wish to estimate the unknown quarterly values contained in the $(\mathrm{N} \times 1)$ vector $\mathbf{y}$. We suppose that the following linear regression model holds:

$$\mathbf{y} = \mathbf{X}\beta + \mathbf{u},$$

Where β is a vector $(\kappa \times 1)$ of unknown parameters and $\mathbf{u}$ is a vector of $(\mathrm{N} \times 1)$ random disturbances such that:

$$\mathrm{E}\left(\mathbf{u} | \mathbf{X}\right) = 0 \quad \mathrm{E}\left(\mathbf{uu}' | \mathbf{X}\right) = \mathbf{V}.$$

6.A.22. The best linear unbiased estimator of **y** consistent with the temporal aggregation constraints $\mathbf{By} = \mathbf{y}_a$ is given by:

$$\hat{\mathbf{y}} = \mathbf{X}\hat{\beta} + \mathbf{VB}'\mathbf{V}_a^{-1}\hat{\mathbf{u}}_a,$$

where $\hat{\mathbf{u}}_a = \mathbf{y}_a - \mathbf{X}_a\hat{\beta}$ and

$$\hat{\beta} = \left(\mathbf{X}_a'\mathbf{V}_a^{-1}\mathbf{X}_a\right)^{-1}\mathbf{X}_a'\mathbf{V}_a^{-1}\mathbf{y}_a.$$

6.A.23. It is observed that:

a. $\hat{\beta}$ is the generalised least squares estimate of β in the annual observed model:

$$\mathbf{By} = \mathbf{BX}\beta + \mathbf{Bu},$$

i.e. $\mathbf{y}_a = \mathbf{X}_a\beta + \mathbf{u}_a$, where the $(n \times 1)$ vector of annually aggregated random disturbances $u_a = \mathrm{B}u$ is such that:

$$\mathrm{E}\left(\mathbf{u}_a \middle| \mathbf{X}_a\right) = 0 \qquad \mathrm{E}\left(\mathbf{u}_a\mathbf{u}_a \middle| \mathbf{X}_a\right) = \mathbf{V}_a = \mathbf{BVB'}.$$

b. The aggregation constraints are satisfied:

$$\mathbf{B}\hat{\mathbf{y}} = \mathbf{BX}\hat{\beta} + \mathbf{BVB'}\mathbf{V}_a^{-1}\hat{\mathbf{u}}_a = \boldsymbol{y}_a.$$

c. The quarterly estimates can be viewed as the sum of two components: a systematic one, given by $\mathbf{X}\hat{\beta}$, and an adjustment term, given by $\mathbf{L}\hat{\mathbf{u}}_a$, where **L** is the $(\mathrm{N} \times n)$ smoothing matrix:

$$\mathbf{L} = \mathbf{VB'}\mathbf{V}_\mathbf{a}^{-1}.$$

6.A.24. A very important feature of this estimation approach is the capability to get an evaluation of the precision of the estimates by means of the estimation errors covariance matrix (Bournay and Laroque, 1979):

$$\mathrm{E}\left[(\hat{\boldsymbol{y}} - \boldsymbol{y})(\hat{\boldsymbol{y}} - \boldsymbol{y})'\right] = (\mathrm{I_N} - \boldsymbol{L}\mathrm{B})\boldsymbol{V} + (\boldsymbol{X} - \boldsymbol{XL}_\mathbf{a})\left(\boldsymbol{X}_\mathbf{a}\boldsymbol{V}_\mathbf{a}^{-1}\boldsymbol{X}_\mathbf{a}^{1}\right)(\boldsymbol{X} - \boldsymbol{LX}_\mathbf{a})'$$

This matrix depends on two components: the former is only related to **B** and **V**, the latter is a systematic one and rises with $(\boldsymbol{X} - \boldsymbol{LX}_\mathbf{a})$.

6.A.25. The estimation errors covariance matrix can be used to:

a. compute confidence intervals for $\hat{\boldsymbol{y}}$ under the hypothesis $\mathbf{u} \sim N(0, \mathbf{V})$;

b. assess reliability indicators for the estimates like $\frac{\hat{\sigma}_{\hat{y}}}{\hat{y}}100$ (Van der Ploeg, 1985, p.9);

c. make econometric estimations taking into account the ‘noisy’ nature of the data.

6.A.26. The optimal estimation approach offers a natural and coherent solution to the extrapolation problem. Given the $(\kappa \times 1)$ vectors of related series x_{4n+i}, $i = 1, \ldots, q$, the optimal forecasts for y_{4n+i}, $i = 1, \ldots, q$, are:

$$\hat{y}_{4n+i} = X_{4n+i}\hat{\beta} + w_{4n+i}V_a^{-1}\hat{u}_a \quad i = 1, \ldots, q,$$

where $w_{4n+i} = \mathrm{E}(u_{4n+i}u)$ is a $(\mathrm{N}\times 1)$ covariance vector.

6.A.27. From a computational point of view, the extrapolated estimates can be obtained according to the general disaggregation formula $\hat{\boldsymbol{y}} = \boldsymbol{X}\hat{\beta} + \boldsymbol{V}\mathrm{B}'\boldsymbol{V}_{\boldsymbol{a}}^{-1}\hat{\boldsymbol{u}}_{\boldsymbol{a}}$, provided the last q columns of the aggregation matrix **B** are null vectors.

6.A.28. In most practical problems matrix **V** is unknown and must, therefore, be estimated according to suitable assumptions on **u**. The stochastic models usually considered when estimating quarterly accounts series are the following:

a. AR(1) model (Bournay and Laroque, 1979)

$$u_l = \rho u_{l-1} + \varepsilon_l, |\rho| < 1.$$

b. Random walk model (Fernàndez, 1981):

$$u_l = u_{l-1} + \varepsilon_l, u_0 = 0.$$

c. Random walk-Markov model (Litterman, 1983, Di Fonzo, 1987):

$$u_l = u_{l-1} + e_l \quad e_l = \mu e_{l-1} + \varepsilon_l, \quad |\mu| < 1, \quad u_0 = e_0 = 0.$$

Dynamic models

6.A.29. Optimal methods as described in the previous section do not include dynamic elements in their formulation. The quarterly path is then derived only from the information coming from the related series. In practice, a better description of macroeconomic time series can be obtained by using a first-differences model with a small number of parameters rather than by a level model. This result has been studied by many time-series econometricians since the beginning of the eighties, and it corresponds to a special non-stationary class of processes called “integrated processes”.

6.A.30. Good indicators usually have the same properties as the account items which they are used to extrapolate. They can capture their statistical properties in two ways. First, they can correctly describe short-term changes of the account item but their long-term paths are not comparable. In this case, compilers would prefer a model that links first-differences of both variables. Secondly, they can correctly describe short-term and long-term changes of the related account item. Compilers would then choose a model that links the levels of both variables.

6.A.31. Each of two cases described in § 6.A.30 corresponds to a particular linear approximation of the pair of times series under study, approximation being used in the sense that it minimises the variance of the one-period forecast error. Nevertheless, it is possible to specify a model with a small number of parameters that encompasses both cases without the aim of testing for their relevance. In a very automated and systematic approach, frequent use of the same test procedure can lead to meaningless analyses of time series model structures, whereas the main interest here is in the ability to produce good short-run forecasts.

6.A.32. Classical asymptotic inference can be used when variables under study do not have the property of persistency. The integrated processes mentioned in § 6.A.29 are, however, characterised by this property which invalidates the use of classical test procedures for the regression coefficients. Model selection must then be based on other criteria such as treatment of white noise residuals and stability of estimations.

6.A.33. Various models can be selected according to the aforementioned criteria. For example, state-space models seem to be good candidates since they can take in a simple case the following form: a state equation for the non-observed quarterly variable:

$$y_{j,t} = \alpha y_{j,t-1} + x_t \beta + \varepsilon_t$$

where $y_{j,t}$ is the value of the account item to be estimated at time t. It is assumed that estimation at time t can be satisfactorily calculated by means of a dynamic relationship involving its lagged value and a set of variables denoted by x_t (which may contain first differences of variables of interest). The error term ε_t is assumed to be independent and normally distributed. In practice, the actual observation is the annual figure y_a.

6.A.34. The statistician has to estimate the regression parameters and the best prediction of $y_{j,t}$ conditional on the observation of the annual quantities $y_{a,1}, y_{a2}, \ldots y_{a,T}$ and the quarterly time series. The initial value of the time series is assumed to be drawn from the unconditional probability distribution of the dependent process. In this framework, the use of Kalman filter is helpful and allows the statistician to compute recursively the likelihood of the observed sample. Numerical procedures then have to be used to compute the maximum likelihood estimators. Nevertheless, if greater importance ought to be assigned to simple, easily interpreted, models then simple estimation methods, which can be easily used by a range of people with different training, are strongly to be preferred. This is a reason for avoiding the use of this powerful framework of state-space models, given that their methods of parameter estimation involve using calculated and time consuming algorithms to compute and maximise the likelihood function.

6.A.35. The estimation of autoregressive linear models under the constraint that the sum of the four quarters of a given year is equal to the available annual account estimate may be relatively complicated, as illustrated above. Moving from a quarterly dynamic relationship to an annual dynamic relationship leads to non-linear parameters and identifiability problems. On the other hand, in this annual relationship, a correlation exists between lagged endogenous variables and error terms, which necessitates the use of instrumental variable methods when we want to use the M-estimate.

6.A.36. For the current year, measurement errors in the estimates of the first quarters of the year are propagated by the dynamic specification to the following quarters, which harms the first annual growth rate estimates.

The case of a linear and seasonal dynamic model

6.A.37. The use of dynamic linear models that link quarterly variables of the same quarter for consecutive years allows compilers to avoid the situation identified in § 6.A.30. The simplest specification is the following one:

$$y_{j,t} = \alpha y_{j,t-4} + x_t \beta + \varepsilon_t$$

where $y_{j,t}$ is the quarterly value of the account item to be estimated. In this case estimation is easy since regression can be fitted without loss of the information in the annual equation obtained by time aggregation over the year

$$y_a = \alpha y_{a-1} + x_a \beta + \varepsilon_a$$

With $y_{a,t} = y_{j,4(a-1)+1} + y_{j,4(a-1)+2} + y_{j,4(a-1)+3} + y_{j,4a}$,

$$x_{a,t} = x_{4(a-1)+1} + x_{4(a-1)+2} + x_{4(a-1)+3} + x_{4a}$$

$$\varepsilon_{a,t} = \varepsilon_{4(a-1)+1} + \varepsilon_{4(a-1)+2} + \varepsilon_{4(a-1)+3} + \varepsilon_{4a}.$$

Similarly, their use during the current year does not imply propagation of measurement error to the observations which follow. Nevertheless, care must be taken to select an autoregressive dynamic equation with roots such that the forecast-generating process is not explosive.

6.A.38. Using such models implies consideration of time series with seasonality. Calibration of non-seasonally adjusted indicators allows compilers to compile non-seasonally adjusted accounts. In some cases, indicators are not able to properly describe the seasonality of the related macroeconomic variable. This may be observed when the sampling design does not capture seasonal migration of the population. For instance, when on holidays, the members of households do not go to their usual shops to buy goods and their consumption may not be properly described by the observation of sales in a constant sample of stores over the year. The seasonality of the indicator may be misleading. The introduction of a different coefficient for a particular quarter (or even for each quarter) in the equation specification allows econometricians to partly take into account this phenomenon, but this may lead to the introduction of a large number of parameters in one equation.

6.A.39. A simple autoregressive specification for the level of the variable allows compilers to encompass the situations described in § 6.A.30 with a small number of parameters.

Nevertheless, as stated in § 6.A.33, inference in this kind of model may be non-standard as soon as the levels of the variables are used. Convergence rates differ according to the nature of the variables. Selection of variables requires the use of numerous test procedures, in particular to test for the persistence properties of time series under study. Intensive use of these procedures can be time consuming and theoretically irrelevant. Model selection may rather rely on criteria related to the use of these equations. An important property is parameter estimate stability in recursive exercises as new observations become available. This is under the hypothesis that no exogenous information, for instance a structural modification of the national economy, can be at variance with the stability assumption of the relationship between indicators and account items.

6.A.40. Estimation of quarterly time series by such a disaggregating procedure, based on dynamic autoregressive model, has a drawback. As the model parameter can be efficiently estimated with the annual data, a large number of quarterly times series can satisfy this annual autoregressive specification under the constraint that the sum of the four quarters of a given year is equal to the annual estimate. For instance, an autoregressive equation of order one leaves three degrees of freedom. The time series for each quarter is defined by the value of the corresponding quarter during the first year and the dynamic relationship. Any choice of these four starting values is suitable as long as it satisfies the annual sum of the first year. Compilers have to introduce a supplementary criterion to reduce estimation dimension and to obtain a unique solution. These criteria can have various forms: variance minimisation, minimisation of contribution of initial conditions to variance, correspondence with the seasonal growth rates of the combination of contemporary indicators, etc. The criteria have to be well chosen to ensure that the introduction of a new annual observation does not lead to a global revision of the quarterly time series.

6.A.41. The foregoing points will now be illustrated by taking as an example the measure of the output of non-ferrous ores, metals and semi-finished products using French data.

The natural indicator x_t is the industrial output index of the product under study (whose annual value is denoted x_a) from which is to be estimated the quarterly value of the output $y_{j,t}$ in the national accounts system. A static relationship between annual quantities with a deterministic trend ($a = 1, 2, \ldots, A$ $r = 1, 2, \ldots A$, corresponding to the number of observations in the sample) has first been specified over a sample from 1970 to 1992 and provides the following results: $y_a = 10.24x_a + 730.3_a + \varepsilon_a$ with a Root Mean Square Error (RMSE) equal to 2901 and a Durbin-Watson statistic equal to 0.7. This value of the Durbin-Watson statistic does not allow the statistician to reject the hypothesis of zero autocorrelation of the residuals.

6.A.42. A simple autoregressive model with the form $y_{j,t} = 0.89y_{j,t-4} + 13.68x_t - 12.29x_{t-4} + \hat{\varepsilon}_t$ has also been fitted to the same data. The RMSE falls to 2114 and the Durbin-Watson statistics corrected for lagged endogenous variables rises to 2.1. In this second specification, the error-term variance is reduced and the null hypothesis of no autocorrelation of the residual is accepted at the usual level of confidence. The use of this model is more satisfying in a current year since the size of the error-termis reduced and the one-step ahead forecast is obtained correctly by the usual linear forecast formula. The quarterly time series can be computed following selection of a set of four starting values that satisfy the constraint that their sum is equal to the annual value of the first year in the sample. These values can be derived from a statistical optimisation program, e.g. minimisation of the contribution of these four values to the empirical over the sample variance of the quarterly time series or a sub-sample of it.

Multivariate methods (forwarding)

6.A.43. Multivariate methods will be treated, from a formal point of view, in the annex of Chapter 11.

CHAPTER 7

SOME NUMERICAL EXAMPLES

This chapter presents some examples of compilation of quarterly accounts and it recommends the best practices to be followed according to the pragmatic approach suggested in Chapter 5. The aggregates are estimated according to the available information and the most suitable method among those illustrated in Chapter 6. The different approaches are explained, examined and some suggestions are proposed. The basis of the examples is generally the estimation of a single aggregate prior to its adjustment in the balancing process. Whichever method is used, there will be a need to go through the steps described in later chapters for ensuring time consistency with the annual data set, balancing and validating the accounts, and establishing a scheme for revisions.

Some numerical examples

7.01. The process of compilation described in Chapter 5 as well as the mathematical and statistical methods presented in Chapter 6 must be integrated by a set of numerical examples which can lead the compiler through a better understanding of the different procedures. The aim of this chapter is:

- to lead the compiler through the choice of the more appropriate approach on the base of the available set of information;
- to explain the utilisation of the different methods;
- to illustrate how the result can be evaluated.

The analysis and the comparison of the result obtained under different conditions and by using different methods will play an essential role in the process of quality improvement of quarterly national accounts.

The examples presented in this chapter have been mainly obtained by using the Ecotrim program. Ecotrim is a software for univariate and multivariate temporal disaggregation developed by Eurostat (for more details, see the annex to this chapter).

7.02. The philosophy of compilation has been described in Chapter 5 and, in particular, in Fig. 5.1. As previously stated, the choices to be made in the scheme of compilation depend on the available information and on the philosophy that underlies the quarterly national accounts system.

7.03. In this chapter, several practical situations are presented following an ideal path that considers the different cases that a quarterly national compiler can find during his activity. It should be noted that the compilation process, which has been described in this handbook, involves many aspects starting from the choice of basic statistics till the revision process of past data. Some of these aspects have been treated in Chapters 2, 4, 5, 6 some others will be discussed in the following chapters. Nevertheless, the compilers should have in mind that the construction process of quarterly accounts covers all these different items and involves all the different interrelated problems.

Estimation of an aggregate: different approaches according to the available information and the philosophy of compilation

7.04. In order to define exactly the limits of the examples presented in this chapter, it is useful to keep always in mind that:

- only the univariate estimation problem is treated in this chapter;
- the multivariate analysis is presented in Chapter 11;
- any other aspect like accounting definition, treatment of seasonality, revisions, etc., is expressly ignored in this chapter.

7.05. The ideal process of compiling a quarterly aggregate, given the available information, is described in the following paragraphs. This description follows the different steps of the scheme of Fig. 5.1 and analyses the corresponding different situations.

Our approach evolves from the situation of total lack of information till that one in which direct information is available. The aim of this path is to give suggestions on how to treat the different situations that a national accountant may face with.

At the end of this chapter it will be clear to the reader that, apart from any personal apprecia-tion, there is a strong relation between the choice of a specific group of statistical methods and the amount and quality of the available information. This correspondence demonstrates that the different statistical procedures described in the previous chapter have been designed to answer to well specified situations.

Existence of data sources for the target quarterly accounts aggregate

7.06. The first step in the compilation process is to verify if data sources for the target variable do exist. Obviously, if data sources do not exist at all, the quarterly national accountant should look for new and alternative data sources.

If there are no quarterly data sources available but only annual data sources, then, following the scheme of Chapter 5, trend extrapolation or univariate temporal disaggregation models without indicators may be used (Stage 5 of Fig. 5.1). Obviously, the accountant will decide to use quarterly sources, when available, instead of using this approach.

Stage 5: trend extrapolation or use of univariate models without indicator variables

7.07. In case of lack of quarterly information related to the aggregate, the only available possibility to obtain an estimate of the quarterly figures consists in using trend extrapolation or univariate models that do not use related series.

7.08. In several cases, national accounts compilers face this situation. Two different cases can be distinguished:

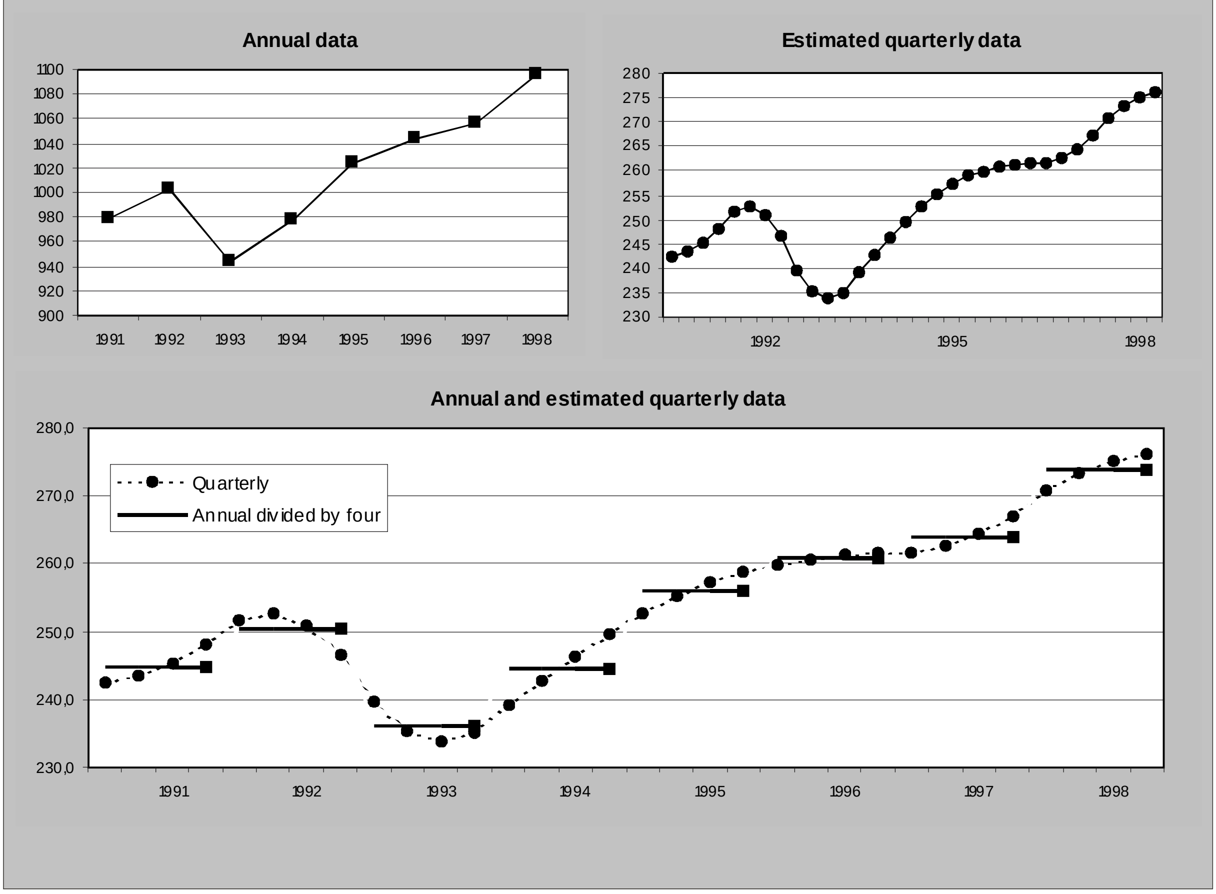
a. only the annual values of the series are available;

b. quarterly values concerning the aggregate are available but only until the last available year.

Univariate models

7.09. In the former case, the quarterly figures can be derived from the annual values by using smoothing methods or time series methods. As stated in § 6.36, **smoothing methods** assume that the unknown quarterly trend can be conveniently described by a mathematical function of time (for example, sinusoidal functions, continuous functions that fufil specific requirements, etc.). No quarterly information is available, so the quarterly path is given *a*

Figure 7.1: Annual and quarterly estimated data (Boot, Feibes and Lisman)



priori or chosen within a larger class, such that the necessary condition of satisfying aggregation constraints and the desirable condition of smoothness are both met.

It should be noted that smoothing methods do not allow extrapolation of quarterly figures since they are designed only to give a quarterly breakdown of available annual figures.

If a national accounts compiler has at his disposal an annual series and he wants to estimate the corresponding quarterly figures, with no quarterly information at all, he can use, for example the Boot, Feibes and Lisman technique (see § 6.A.06-6.A.08) to derive quarterly values.

Fig. 7.1 shows the aggregate annual series and the corresponding estimated quarterly series obtained by using the Boot, Feibes and Lisman technique. Clearly, the quarterly path is quite smoothed because of the lack of quarterly information and depends on the hypotheses underlying this approach.

7.10. For a correct understanding of these methods, it should be noted that:

- to be able to produce the current year estimates a forecast value of the current year is needed. All the four quarters of the current year are therefore estimated at the same time. Further, in order to improve the reliability of those estimates it may be useful to update regularly the forecasted annual value and then to re-estimate the quarterly figures;

- due to the unavailability of the quarterly data sources, any infra-annual movement (i.e. seasonal movements) cannot be kept by these procedures. For this reason, the resulting quarterly figures cannot be considered as seasonally adjusted but, more appropriately, they have to be considered, as “smoothed by definition”.

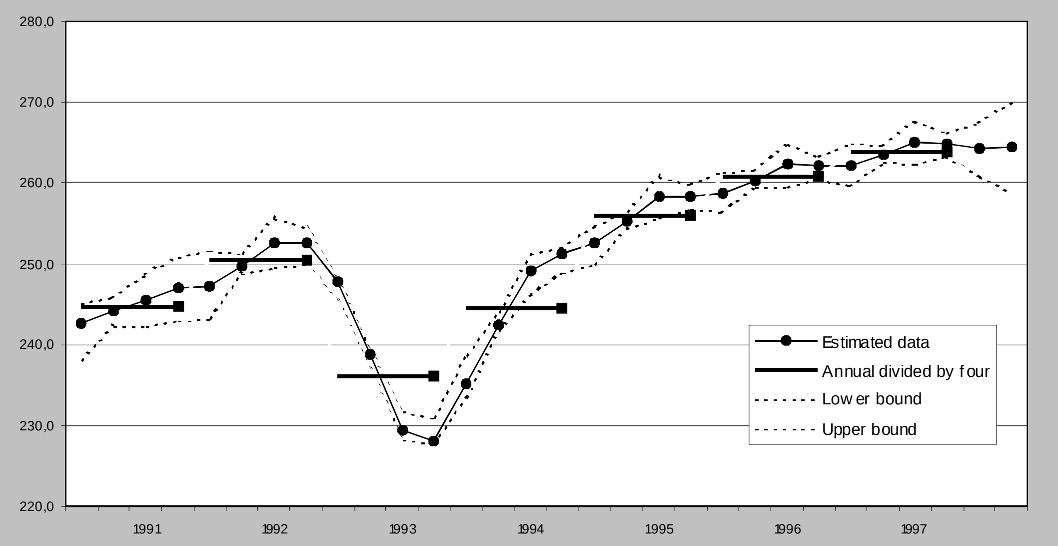
7.11. **Time series methods** represent an alternative solution to the same situation in which no quarterly information is available. Quarterly data are interpolated according to the time series approach (ARIMA model approach). The quarterly path is derived from the relation between the ARIMA models associated to the known annual series and the unknown quarterly series (for further details, see § 6.A.16-6.A.20). The quarterly ARIMA model can also be used to obtain extrapolations during the current year, before the annual data are available. These techniques overcome the limit of the smoothing techniques concerning extrapolation and represent a valid solution when only annual data are available.

Fig. 7.2 shows the estimates obtained by using the Wei and Stram technique (§ 6.46). Extrapolation for the first two quarters of year t+1 are also estimated by using the quarterly estimated ARIMA model.

As in the smoothing case, the quarterly path is quite smooth and is derived from the ARIMA structure of the involved series.

By consequence, the second remark of § 7.10 is valid also in this case.

Figure 7.2: Comparison between annual and estimated quarterly data (Wei and Stram)



In the figure are also illustrated the confidence interval associated to the estimated quarterly series. Clearly the upper and the lower bound tend to increase when they refer to the two extrapolated quarters.

Table 7.1: Aggregated and disaggregated ARIMA models (Wei and Stram)

Aggregated (annual) ARIMA model		Disaggregated (quarterly) ARIMA model	
Autoregressive order	1	Autoregressive order	1
Differencing order	0	Differencing order	0
Moving average order	0	Moving average order	2
Seasonal period	0	Seasonal period	0
Seasonal autoregressive order	0	Seasonal autoregressive order	0
Seasonal differencing order	0	Seasonal differencing order	0
Seasonal moving average order	0	Seasonal moving average order	0
Variance	1,3254E+09	Variance	9,3728E+07
Polynomial AR: AR (1)	+0,01230	Polynomial AR: AR (1)	+0,01230
		Polynomial MA: MA (1)	-0,85796
		Polynomial MA: MA (2)	0,17536

Trend extrapolation

7.12. Trend extrapolation is based on the idea that a quarterly series, strictly related to the target variable, is available till the last available year.

This case can be of practical application in two situations:

- basic information exists but cannot be used during the current year due to the high time-lag of availability;
- basic information was available till the recent past but for different reasons it is not longer available.

The usual techniques of extrapolation represent a common solution to both the situations described above.

7.13. The main extrapolation techniques which can be usefully applied to solve the problem are:

- univariate ARIMA techniques;
- univariate exponential smoothing techniques.

In both cases, when the new annual value becomes available, the preliminary results must be adjusted in order to respect time consistency requirements. Finally, it may be useful to observe that, if the past values of the quarterly aggregate exist in both unadjusted and seasonal adjusted form, it is possible to extrapolate both series by means of ARIMA models.

Fig. 7.3 illustrates the results obtained by applying the trend-extrapolation techniques. Forecasts for the first two quarters of 1998 are derived from the ARIMA model identified and estimated on the quarterly series available till end 1997. Clearly this method cannot forseen movements which are not linked to the path described by the path values of the series. For comparison purposes in Fig. 7.3 the real quarterly values (recorded at the end of 1998) are illustrated too.

Figure 7.3 Comparison between real data and forecasts

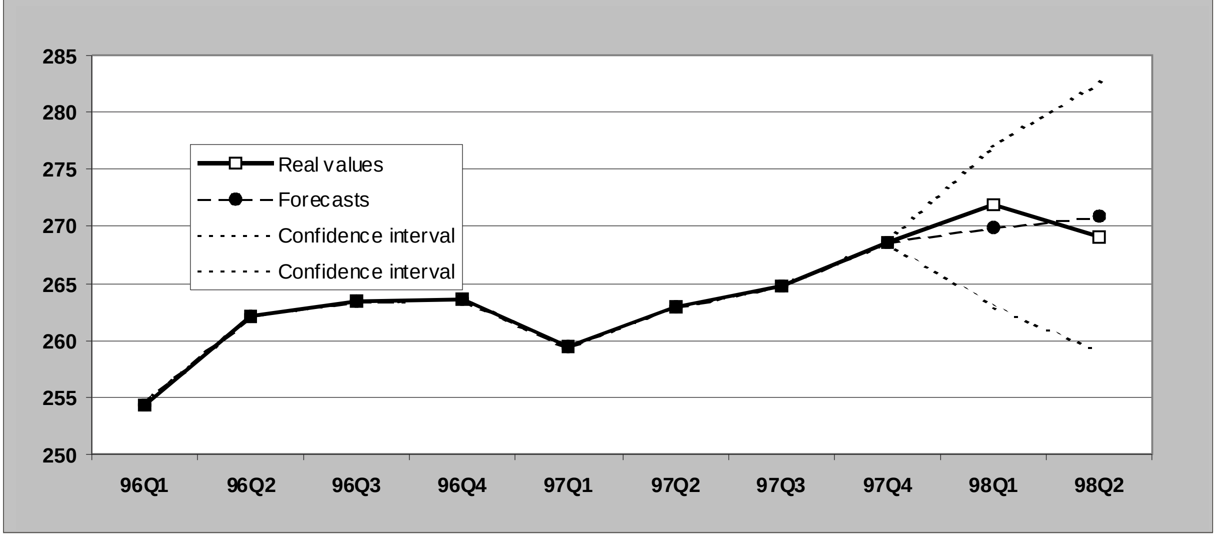
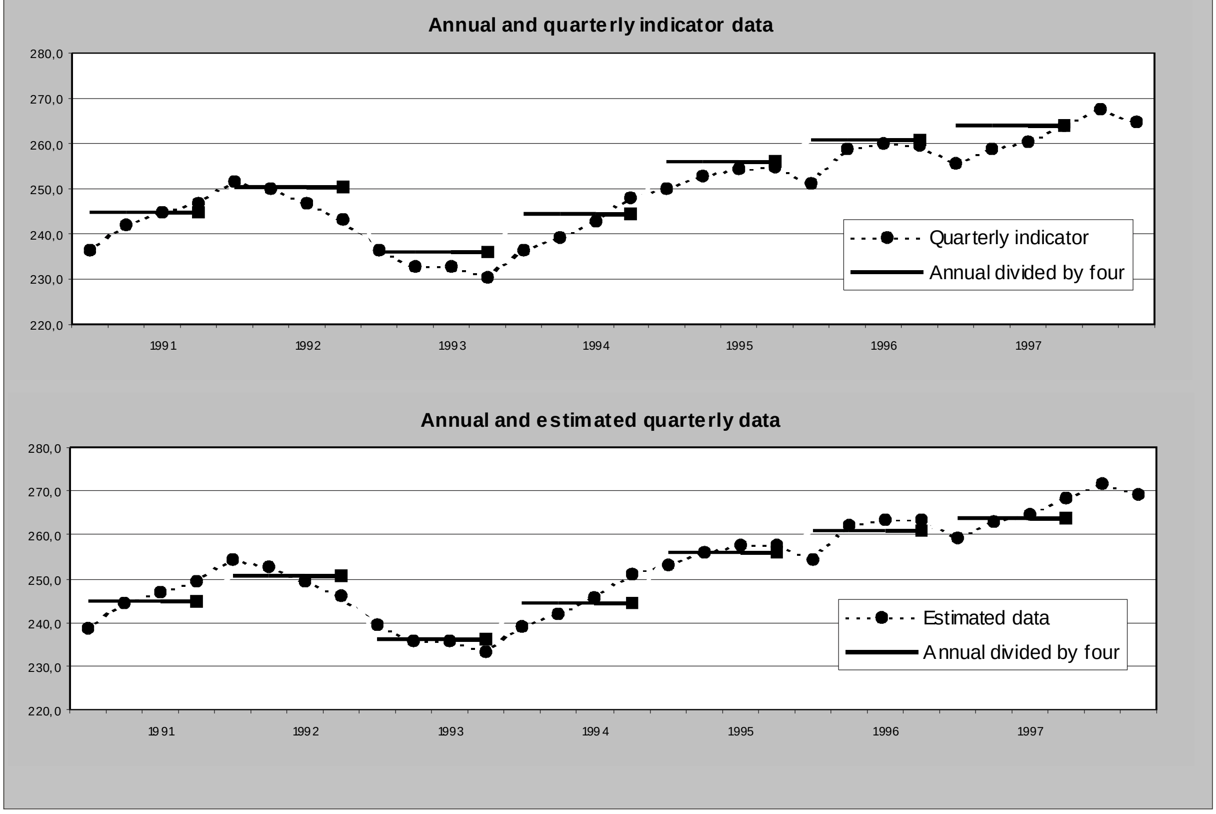


Figure 7.4: Annual data, quarterly indicator and quarterly estimated data (Chow and Lin)



Stage 4: quarterly data unsuitable to be used to produce an estimate of the aggregate

7.14. If there are existing quarterly data for the aggregate but they are neither close to the ESA 1995 concept of the aggregate, nor suitable for using in a model to produce an estimate of the aggregate, the accountant has to use other methods of compilation of the quarterly figures. Normally, the strategy to be followed in this case is to look for new and alternative data sources in order to find suitable quarterly information to be used in the compilation.

Stage 3: quarterly data not close to ESA 1995 concepts but suitable to be used as indicators

7.15. If the accountant has at his disposal quarterly data that are not close to ESA 1995 concepts, but that can be used in a model to produce an estimate of the aggregate, mathematical and statistical methods are the instrument to be used to compile the quarterly figures of the aggregate. The available information corresponds to related series (indicators) that constitute the basis of optimal methods, as described in Chapter 6 (§ 6.47-6.50) and in its annex (§ 6.A21-6.A.28).

Not only optimal methods can be used at this stage, but all the methods that involve the use of a quarterly indicator.

7.16. The main problem in using this approach is to decide if the available quarterly data are suitable to be used in a model. This means that the quarterly available figures have to be related to the target aggregate. To check the relation between quarterly indicator and the aggregate several criteria can be used: relations derived from the economic theory, statistical tests on the correlation between the two variables, national accounts compiler experience, etc.

7.17. As already stated in Chapter 6, optimal methods give the possibility of making extrapolations, if the related quarterly series are available for the extrapolation period. In Fig. 7.4 an example with the annual aggregate, the quarterly related series and the estimated quarterly values is presented.

Table 7.2 - Information associated to the values estimated by using optimal methods (Chow and Lin)

DATE	Estimated Value	Std Deviation	Reliability*	Low bound	High bound
1994 1	239 168,58	366,66	0,15	238 225,90	240 111,27
1994 2	242 116,18	296,90	0,12	241 352,84	242 879,52
1994 3	245 592,48	296,52	0,12	244 830,12	246 354,83
1994 4	251 056,75	368,74	0,15	250 108,72	252 004,78
1995 1	253 072,65	366,62	0,14	252 130,08	254 015,23
1995 2	255 880,34	296,38	0,12	255 118,36	256 642,32
1995 3	257 662,07	296,34	0,12	256 900,18	258 423,96
1995 4	257 802,53	367,11	0,14	256 858,69	258 746,37
1996 1	254 363,17	385,44	0,15	253 372,19	255 354,15
1996 2	262 151,30	300,00	0,11	261 379,99	262 922,60
1996 3	263 427,56	300,50	0,11	262 654,99	264 200,14
1996 4	263 535,84	368,93	0,14	262 587,32	264 484,35
1997 1	259 503,25	393,22	0,15	258 492,28	260 514,23
1997 2	262 920,65	308,99	0,12	262 126,22	263 715,07
1997 3	264 754,42	296,56	0,11	263 991,97	265 516,87
1997 4	268 499,56	424,73	0,16	267 407,58	269 591,54
1998 1	271 913,43	625,14	0,23	270 306,19	273 520,68
1998 2	269 068,25	681,89	0,25	267 315,10	270 821,40

* Reliability indicator: $100\ \sigma_j / \hat{y}_j$; j=1...n (Van der Ploeg, 1985)

7.18 As it can easily see in the first graph, the quarterly indicator under estimate the real quarterly series (i.e., on an annual basis the serie of the quarters do not match with the annual values). Anyway it gives a quarterly path that the estimated series in the second graph follows by respecting the time constraints too.

Table 7.2 illustrates the results obtained by using the Chow and Lin white noise model. This method supply also related information like standard deviation, confidence interval and a reliability coefficient.

Stage 2: quarterly data close to ESA 1995 concepts

7.19. If the quarterly available data are close to ESA 1995 concepts, only some adjustment have to be made to use them in compiling quarterly accounts. Typically, the adjustments concern the coverage of the estimated item or the accrual basis of compilation.

In order to be adjusted, the quarterly indicators can be put in a statistical model, or adjusted according to the usual techniques (grossing up techniques, coverage techniques, etc.). Coherence of the adjusted data with annual values can be assured by using statistical models.

7.20. A particular case of quarterly data close to ESA 1995 concepts arises when the quarterly available series are coherent in terms of definition, coverage and accrual basis, but they do not fulfil the annual temporal constraints. In this case, quarterly data can be considered as preliminary estimates that have to be adjusted to match annual data. The discrepancy between the aggregated quarterly data and the real annual data can be distributed according to two steps adjustment methods, as illustrated in § 6.38-6.44 and § 6.A.09-6.A.15.

Table 7.3 and Fig. 7.5 show an example of estimates obtained by applying two steps adjustment techniques.

Figure 7.5: Comparison between direct and two-steps adjusted data (Denton)

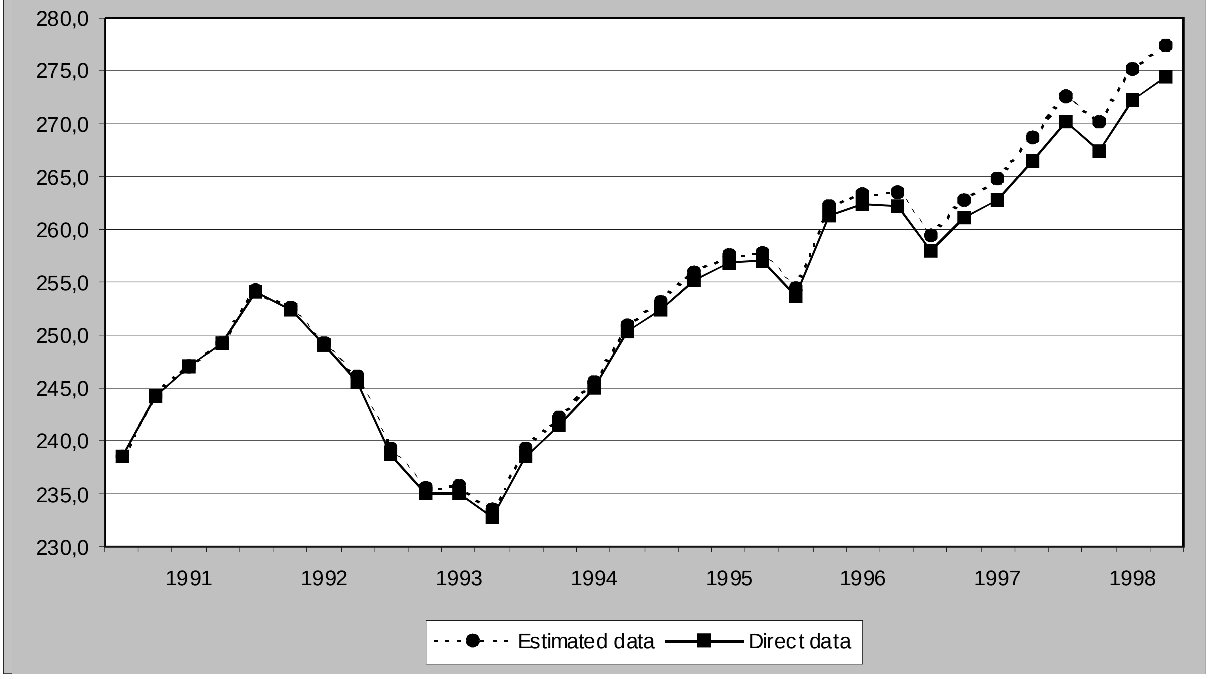


Table 7.3 - Two-steps adjustment method - comparison between direct data and adjusted data (Denton)

Year	Annual series	Quarter	Quarterly direct data	Difference	Two-steps adjusted data	Difference
		1991.1	238.6		238.6	
		1991.2	244.3		244.3	
		1991.3	247.1		247.1	
		1991.4	249.2		249.2	
1991	979.2		979.2	0.0	979.2	0.0
		1992.1	254.1		254.2	
		1992.2	252.4		252.6	
		1992.3	249.0		249.3	
		1992.4	245.6		246.0	
1992	1002.1		1001.2	1.0	1002.1	0.0
		1993.1	238.7		239.3	
		1993.2	235.0		235.6	
		1993.3	235.1		235.8	
		1993.4	232.8		233.5	
1993	944.1		941.5	2.7	944.1	0.0
		1994.1	238.5		239.2	
		1994.2	241.5		242.1	
		1994.3	245.0		245.6	
		1994.4	250.4		251.0	
1994	977.9		975.4	2.6	977.9	0.0
		1995.1	252.4		253.1	
		1995.2	255.2		255.9	
		1995.3	256.9		257.7	
		1995.4	257.1		257.8	
1995	1024.4		1021.6	2.8	1024.4	0.0
		1996.1	253.7		254.5	
		1996.2	261.2		262.1	
		1996.3	262.3		263.4	
		1996.4	262.2		263.4	
1996	1043.5		1039.5	4.0	1043.5	0.0
		1997.1	258.0		259.4	
		1997.2	261.1		262.8	
		1997.3	262.8		264.8	
		1997.4	266.6		268.8	
1997	1055.7		1048.5	7.2	1055.7	0.0
		1998.1	270.1		272.6	
		1998.2	267.5		270.2	
		1998.3	272.3		275.1	
		1998.4	274.5		277.4	
1998	1095.4		1084.3	11.1	1095.4	0.0

In the example, the quartelry direct data are derived from basic statistics that, whilst they cover exactly the aggregate in 1991, they win an increasing part of the phenomenon starting from 1992. Basic statistics are then not capable of covering the whole phenomenon in the last years. The two-steps adjustment method gives a solution to this problem and, at the same times maintains the same path as direct data (see Fig. 7.5).

Stage 1: data fully coherent with ESA 1995 concepts

7.21. If the basic sources are fully coherent with the ESA 1995 concept of the aggregate, two different approaches can be followed: (i) the data can be used directly in the accounts, with only the simple adjustment linked to grossing up, (ii) the data can be put in a statistical model to derive the figures for the aggregate.

7.22. The choice between the two approaches (Stage 1A and Stage 1B) is mainly linked to the philosophy of compilation of quarterly accounts. For those countries in which quarterly accounts are mainly compiled using direct information, the approach of Stage 1A represents the compilation procedure when they dispose of information fully coherent with ESA 1995. The only additional operations to be made, according to § 5.09, concern some classification changes for disaggregation.

Table 7.4: Parameter estimates and statistics in optimal methods

The value of the parameter is: xx,x			
Dependent variable:	AGGREGATED	Min SSR Par: -.99 to .99	
Variable	Estimate	Std Error	t-Stat
CONSTANT	xx,x	xx,x	xx,x
INDICATOR	xx,x	xx,x	xx,x
Valid Cases	xx,x	Degrees of freedom	xx,x
Total SS:	xx,x	Residual SS:	xx,x
R-Squared:	xx,x	Rbar-squared:	xx,x
STD error of est:	xx,x	Log-likehood:	xx,x
xx,x:	xx,x	Probability of F:	xx,x
Akaike Info Criterion:	xx,x	Heterosk condition number:	xx,x
Durbin-Watson:	xx,x	Jarque-Bera normality stat.:	xx,x
Box-Pierce statistic 1:	xx,x	Box-Pierce statistic 2:	xx,x
Ljung Box Q-statistic 1:	xx,x	Ljung Box Q-statistic 2:	xx,x

7.23. Stage 1B describes the situations of those countries in which the so-called indirect approach to the compilation of quarterly accounts is the main approach. The quarterly available data are used as input in statistical models to derive the quarterly figures of the aggregate, even if they are fully coherent with ESA 1995 concepts. The statistical model approach is an alternative approach that, as the direct approach, ensures time consistency and efficiency of the obtained quarterly data. Furthermore, statistical methods supply more information associated to the figures, like confidence intervals and reliability statistics. In addition, they supply a complete set of regression diagnostics which give to the user an idea of the fitness and of the adequacy of the chosen model. Table 7.4 presents a complete set of diagnostics associated to the optimal disaggregation methods.

7.24. If the available information is totally coherent with ESA 1995 concepts and represents exactly the quarterly figures of the aggregate, clearly the fact to put such information in a statistical model (approach Stage 1B) will produce the obvious expected results on the parameters of the regression model: the value of the constant is not significant, the regression parameter is very close to one and the autoregressive parameter associated to the error part of the model is small. Ideally, the autoregressive parameter should be zero, as well as the constant, and the regression coefficient equal to one.

Table 7.5 shows the result of the estimation of the quarterly aggregate by using as indicator the quarterly series itself.

Table 7.5: Parameter estimates and statistics

The value of the parameter is:

Dependent variable: AGGREGATED Min SSR Par: -.99 to .99

Variable	Estimate	Std Error	t-Stat
CONSTANT	0,00	3,79	0,00
INDICATOR	1,00	0,00	116528296624613,00

Valid Cases	7,00	Degrees of freedom	5,00
Total SS:	2481066540,24	Residual SS:	0,00
R-Squared:	1,00	Rbar-squared:	1,00
STD error of est:	0,00	Log-likehood:	-139,90
F (2,5):	1,00	Probability of F:	1,00
Akaike Info Criterion:	-42,91	Heterosk condition number:	-1,00
Durbin-Watson:	2,08	Jarque-Bera normality stat.:	0,70
Box-Pierce statistic 1:	0,27	Box-Pierce statistic 2:	2,15
Ljung Box Q-statistic 1:	0,41	Ljung Box Q-statistic 2:	3,79

CHAPTER 7 - Annex

ECOTRIM:
SOFTWARE FOR MATHEMATICAL AND STATISTICAL METHODS

ECOTRIM: software for mathematical and statistical methods

Introduction

7.A.01. Economic data estimation issues like those discussed in Chapters 6 and 7 are strongly concerned by most statistical agencies, which could find it useful to have at their disposal a computational support which permits them to use temporal disaggregation techniques like those illustrated in the previous chapters.

ECOTRIM is a program that supplies a set of mathematical and statistical techniques to carry out temporal disaggregation.

7.A.02. ECOTRIM is written in Visual Basic and C++. It offers a user friendly approach to temporal disaggregation. The user is asked to specify the techniques that he wants to run, besides the obvious information concerning the time series to be treated.

7.A.03. ECOTRIM offers the possibility to work in two different ways: it can be used in an interactive mode or in batch mode according to the accountant's requirements.

Interactive mode

The *interactive mode* allows the user to run an interactive session. This mode requires an active role of the user, that is, by using a set of windows, he has to specify to the program all the information needed and make the choices concerning the techniques that he wants to use to derive the quarterly series.

Batch mode

Alternatively, ECOTRIM can be used in a batch session. In this case the user writes a batch file, by using an editor or the specific tool offered by the program, according to a set of rules, and then runs it from the batch windows menu. The batch mode approach to the program is particularly suitable to treat large number of series. In fact, the batch command file can contain more batch jobs, each one corresponding to a set of instructions to perform the estimation of the quarterly values via temporal disaggregation techniques. So the program can be used in an automatic way to treat several series according to the procedures chosen by the user and specified in the batch command file.

7.A.04. In order to give an idea of the opportunities that ECOTRIM offers and that resume the methodological aspects that have been treated in the previous chapters, the main characteristics of the software are briefly illustrated following a user point of view (for more details see the manual associated to the program).

The main windows that ECOTRIM proposes to the user are the following:

a. Interactive mode;
b. Batch mode;
c. Graphs and display;
d. Tools windows (like options, status, etc.).

Interactive mode

7.A.05. The interactive window starts as a normal interactive program asking for the input data. Through a set of windows driven menus, the user must specify the input data (at least the aggregated series for example, the annual series, and the aggregation scheme for example, annual $\Rightarrow$ quarterly) that should be adequate to the aims of the use of the program. For example, if the user wants to apply a technique that requires related series, he has to load the related series, the same for the contemporaneous constraint and the preliminary estimates when they are demanded.

7.A.06. When all the input data are loaded, the user has to choose the temporal disaggregation technique that he wants to apply to the aggregated time series. A first important distinction is made between *univariate* and *multivariate* methods.

Univariate methods

7.A.07. The univariate methods allow treating the univariate disaggregation problem, that is to disaggregate a single series in order to fulfil temporal aggregation constraints. According to the information available, ECOTRIM offers two main options: (i) disaggregation without related series and (ii) disaggregation with related series.

- In the former case the only available information corresponds to the aggregated series and, sometimes, the ARIMA model of its generating process. The procedures offered by ECOTRIM are, therefore, mathematical procedures or ARIMA model based procedures:

  - Boot, Feibes and Lisman's procedure;
  - Denton's procedure;
  - Wei and Stram's procedure;
  - Al-Osh's procedure.

Whilst the first two methods are mathematical ones, the last two are ARIMA model based techniques and require the knowledge of the aggregated ARIMA model (or alternatively the use of the automatic ARIMA identification and estimation module).

- The disaggregation by related series uses the idea that one or more logically correlated high-frequency series are available (note that here it is not to consider the problem to verify this hypothesis). In this case ECOTRIM offers the following techniques:

  - AR(1) procedure;
  - Fernàndez's procedure;
  - Litterman's procedure;

  AR(1), Fernàndez and Litterman's are optimal procedures.

All the techniques produce the estimated disaggregated series and some of them offer other information like confidence intervals (not available for mathematical/adjustment approach), diagnostics or the disaggregated estimated ARIMA model (obviously, only for ARIMA model based approach).

The necessary input information to be used in a single method is directly asked to the user in windows that help and drive the choice.

Multivariate methods

7.A.08. As to the multivariate methods, ECOTRIM permits to estimate disaggregated series and to fulfil temporal and contemporaneous constraints. Both pure adjustment and optimal, in the least squares sense, techniques are available:

- White noise procedure;
- Random walk procedure;
- Rossi's procedure;
- Denton's procedure.

The first two options correspond to the optimal multivariate approach, while the remaining ones to the adjustment approach. It should be noted that in the last two cases preliminary estimated series are needed.

As in the univariate case, the necessary input information has to be supplied to the program. Specific windows drive the users in filling in the input information in order to achieve the desired disaggregation.

Graphs and display

7.A.09. The graphs and display option allows the user to see and analyse the results of the interactive session. By choosing this option, the user can plot the series that are involved in the temporal disaggregation process both in overlapping and non-overlapping mode. In this way, the user can verify the path of the series (aggregated, related, estimated, etc.), make comparisons between the results associated to different temporal disaggregation techniques or between the estimated series and the corresponding aggregated of related series.

Diagnostics are associated to the estimated series deriving from techniques that allow their calculation, as well as confidence intervals.

Facilities, like zoom for data and graphs, are offered by the program as well as the possibility to print the results and/or the graphs.

Batch mode

7.A.10. Whilst ECOTRIM interactive mode is essentially an instrument conceived to handle series by series and mainly developed for analysis and research purposes, ECOTRIM batch mode has been developed to handle the temporal disaggregation of a large amount of series.

For this reason the main element of the batch mode is a batch command file that stores a group of commands that resumes the instructions that a user should specify in an interactive session. Further, the batch file can be structured in several jobs corresponding to different set of data to be analysed.

ECOTRIM batch mode is particularly useful in a national accounting context that requires a highly automated approach to the temporal disaggregation problem.

The output of a batch session is a file containing the estimated series and a file containing the diagnostics and the history of the ECOTRIM session.

Future improvements and developing lines

7.A.11. ECOTRIM is a program that incorporates the most known temporal disaggregation techniques. The Windows 95/98 version has been developed incorporating the suggestions of the users and the experience cumulated using previous versions. Some advanced features are not yet in the program since they are still under theoretical assessment and study.

7.A.12. Some new interesting features in treating temporal disaggregation seem particularly suitable to be incorporated in ECOTRIM. With reference to recent papers which appeared in the dynamic model approach literature, the development of Kalman filter techniques and suggestions coming from certain National Statistical Institutes, in the future ECOTRIM will be enhanced with:

- dynamic model approaches;
- non-linear constraints, associated in particular to logarithmic transformations;
- development of Kalman filter techniques;
- specific accounting treatments;
- cointegration analysis aspects.

PART IV

CHAPTER 8

THE SEASONAL COMPONENT IN THE AGGREGATES

The treatment of seasonality and calendar effects is a key consideration for quarterly national accounts. This chapter introduces the underlying theory, the models and methods currently available for undertaking seasonal adjustment, and the various methodological problems involved, notably the constraint of the adjusted quarterly figures to a balanced set of annual data. Adjustments for calendar effects, and the source data for these adjustments, are also examined.

The seasonal component in the aggregates

8.01. Due to the periodicity at which they are recorded, quarterly series quite often show short-term movements caused by the weather, habits, legislation, etc., which are usually defined as seasonal fluctuations. These movements tend to repeat themselves in the same period (month or quarter) each year.

Although seasonality is an integral part of quarterly data, it may represent an impediment to effective analysis of the business cycle.

Causes of seasonality[1]

8.02. It is a very well known fact that many economic series display seasonality, that is, they have an observable component consisting of a fairly constant shape repeated at a particular frequency (for example every 4 quarters or every 12 months). This component is often treated as being so easily explained that neither an exact definition nor an explanation of its origins is required. Ignoring consideration of causation can lead to imprecise or improper definitions of seasonality and consequently to misunderstanding of why series require seasonal adjustment as well as to improper criteria for a good method of adjustment. There can also be implications for the evaluation of the effects of adjustment both on a single series and when relating two or more series. These considerations do not necessarily lead to better practical methods of adjustment but they should lead to a better understanding of how to interpret time series and econometric analysis involving seasonal components and seasonally adjusted series.

8.03. There are at least four, not totally distinct, classes of causes of seasonal fluctuations in economic data:

A. *Calendar*

The timing of certain public holidays, such as Christmas and Easter, clearly affect some series, particularly those related to production. Many series are recorded over calendar months, and as the number of working days varies considerably from one month to another, in a predetermined way, this will cause a seasonal movement in flow

1 § 8.02 - 8.07 are mainly derived from “Seasonality: causation, interpretation and implications”, C.W.J. Granger.

variables, such as imports or production. The working days problem could also lead to spurious correlation between otherwise unrelated series.

B. *Timing decisions*

The timing of school vacations, the ending of university sessions, the payment of company dividends, the choice of the end of a tax-year or accounting period are all examples of decisions made by individuals or institutions that cause important seasonal effects, as these events are inclined to occur at similar times each year. They are generally deterministic, or pre-announced, and are decisions that produce very pronounced seasonal components in series such as employment rates. These timing decisions are generally not necessarily tied to any particular time in the year but by tradition have become so.

C. *Weather*

Actual changes in temperature, rainfall and other weather variables have direct effects on various economic series, such as those concerned with agricultural production, construction and transportation, and consequent indirect effects on other series. It could be argued that these climatic factors are the true seasonal effect, being a consequence of the annual movement of the earth's axis which leads to the seasons. Weather can lead to major random effects, too.

D. *Expectation*

The expectation of a seasonal pattern in a variable can cause an actual seasonal effect in that or some other variable, since expectations can lead to plans that then ensure seasonality. An example is toy production in expectation of a sales peak during the Christmas period. Without the expectation-planning aspect, the seasonal pattern may still occur but might be of a different shape or nature. Expectations may arise because it has been noted that the series being considered has in the past contained a seasonal pattern, or because it is observed that acknowledged causal series have a seasonal component.

8.04. These four groups may be thought of as basic causes. They are not always easily distinguishable, may often merge together and the list of basic causes may not be complete. Some series may have seasonal components which are only indirectly due to these basic causes. Weather may cause a seasonal pattern in grape production which then causes a seasonal distribution in grape prices, for example. For many series, the actual causation of a seasonal effect may be due to a complicated mix of many factors or reasons, due to the direct impact of basic causes and many indirect impacts via other economic variables. Even if only a single basic cause is operating, the causal function need not be a simple one and could involve both a variety of lags and non-linear terms.

8.05. Two important conclusions can be reached from such considerations, (i) that the causes of the seasonal components can be expected to have differing properties, and (ii) that the seasonal components cannot be assumed to be deterministic. Although it would be interesting and perhaps worthwhile to perform a causal analysis of the seasonal component for every major economic series, this task would be both difficult and expensive. Nevertheless, it would be unreasonable to assume that all seasonal components are of the type included in a simple model and this must be acknowledged when attempting to seasonally adjust a series. Even though some of the basic causes can be thought of as deterministic series, the calendar and timing decisions, for example, there is certainly no reason to suppose that they will lead to deterministic seasonal components, as the reaction to these causes need not be deterministic. The other basic causes, weather and expectations, are not deterministic and cannot lead to deterministic seasonal. Although an assumption of a deterministic seasonal component may have some value, this value is usually very limited and leads to techniques very far from optimal. The consideration of causation also throws doubt on the idea of the seasonal being simply either an additive or a multiplicative component (§ 8.12 - 8.16).

8.06. Before turning to the problem of how to define seasonality, it is worthwhile considering briefly the types of economic series that are clearly seasonal and those that are not. The types of series that are adjusted are generally those concerned with production, sales, inventories, personal income and consumption, government receipts and expenditures, profits, unemployment rates, imports and exports. Series not seasonally adjusted include prices, other than farm and food prices, interest rates, exchange rates, index of consumer sentiment, liquid liabilities to foreigners and government assets. If it is possible to generalise about such a wide range of variables, it seems that those needing adjustment are usually variables requiring planning or long-range decision making, whereas the non-adjusted series are typically those that can quickly change in value and so require only a stream of short-run decisions. If one tries to write down the main causes of seasonal components in the first group of variables, it is easily seen that the proper specification of these causes is not a simple task and that this problem needs to be tackled by empirical analysis as much as by introspection.

The definition of the seasonality: the time series point of view

8.07. For our purposes, we here define as "seasonal" any pattern that repeats on a regular basis in the same month or quarter each year, no matter what its cause: climate, customs and traditions, administrative rules, or whatever. It may be helpful to define this apparently simple concept more mathematically. It is obvious that this definition should not be based on a specific model, as this model may not properly reflect reality, nor should it rely on the outcome of a particular method of adjustment, as the method may not be ideal and it also becomes difficult to evaluate that particular method. These limitations, together with the fact that the most obvious feature of a seasonal component is its repetitiveness over the seasonal period, strongly suggest that a definition can be most naturally stated in the time series domain. Specifically the frequency domain is the right framework in which this kind of definition can be stated, as spectral methods investigate particular frequencies and are essentially model-free.

8.08. Seasonality can now be considered more formally. Let X_t be a stochastic generating process and x_t, $t = 1, ..., n$ be a time series generated by this process. X_t is assumed to be stationary. Let $f(\omega)$ be the power spectrum of X_t and $h(\omega)$ the estimated spectrum derived from the observed x_t. Define the seasonal frequencies to be ω_s $k=1,2,...,[N/2]$, where $\omega_s=2\pi/N$, N is the number of observations of the series taken in a four-quarters period and $[N/2]$ is the largest integer less than $N/2$. For ease of exposition, the case of quarterly recorded data will be considered almost exclusively in what follows, so that the seasonal frequencies are just $2\pi k/4;\ k=1,2$. Further, define the set of seasonal frequency bands to be

$$\omega_s(\varepsilon) = \{\omega \in (\omega_s \kappa - \varepsilon ; \omega_s \kappa + \varepsilon), \kappa = 1,2\}$$

and so consists of all frequencies within ε of the seasonal frequencies.

Definition 1

The process X_t is said to have property S if $f(\omega)$ has peaks within $\omega_s(\varepsilon)$ for some small $\varepsilon>0$.

Definition 2

The series x_t is said to apparently have property S if $h(\omega)$ has peaks in $\omega_s(\varepsilon)$ for some small $\varepsilon>0$.

A process with property S is called a process with seasonal component.

Definition 3

A process S_t is said to be strongly seasonal if the power contained in $\omega_s(\varepsilon)$ almost equals the total power, for some appropriate, small ε.

Thus, the variance due to the seasonal band frequencies is nearly equal to the total variance of the process S_t. It follows that $f(\omega)$ is relatively small for ω in the region outside $\omega_s(\varepsilon)$ compared to ω in the region $\omega_s(\varepsilon)$. The choice of ε is unfortunately arbitrary and has to be left to the individual analyst. It can be strongly argued that the need for allowing the seasonal component to be non-deterministic implies that it is not correct to take $\varepsilon=0$.

The assumption of stationarity in these definitions is too restrictive. Although the spectrum is strictly based on this assumption, the problem can be removed in the case of actual data analysis if in the definitions one replaces the estimated spectrum by the pseudo-spectrum. The pseudo-spectrum is essentially the spectrum estimated by the computer as though the data were stationary. It can also be loosely thought of as the average of a time-changing spectrum. If this way out is taken, peaks in the pseudo-spectrum at the seasonal frequency bands will indicate that the series did have property S for at least some $\varepsilon \geq 0$.

Seasonality and quarterly accounts

8.09. An analysis of the treatment of seasonality in quarterly national accounts should be carried out to answer the following relevant questions:

- What do we want to measure when we apply a seasonal filter to a series?
- Is it better to produce a full set of seasonally adjusted accounts or to use a seasonal filter only on some key variables?
- What are the relationships between seasonally adjusted quarterly data, unadjusted quarterly data, and annual data?
- What are the effects of seasonal filtering on revisions?

The rest of this chapter is devoted to providing some answers to these questions.

8.10. Before starting a detailed discussion about the questions presented in the previous paragraph we have to note that seasonality is intrinsically an unobserved component in time series. Consequently all the methods developed to eliminate seasonal fluctuations actually only eliminate what they theoretically identify as the seasonal component. In addition, the problem of interaction between short-term non-seasonal fluctuations and seasonal fluctuations has not been extensively considered.

8.11. The best approach to the seasonal filtering would be a causal approach, that is to determine the seasonal adjustment according to the causes that generate the seasonality, but until now there has not been satisfactory progress in this direction.

8.12. The first problem concerns the use of the filtered data and consequently the type of measures of economic activities in which we are interested.

To achieve better comprehension of the problem, we consider the classical additive decomposition model of a time series:

$$X_t = T_t + C_t + S_t + K_t + U_t,$$

Where:

- T_t is the trend component;
- C_t is the cyclical component;
- S_t is the seasonal component;
- K_t is the calendar component;
- U_t is the irregular component.

These components are usually defined in the following way:

- *Trend* is a slow change in the level of the variable over a short-term period, generally associated with the structural causes of the phenomenon being considered.
- *Cycle* is a short-term fluctuation characterised by alternate periods of growth and contraction, in most cases related to the fluctuations of economic activity.
- *Seasonal* variations represent the effect of climatic and institutional events, which repeat themselves more or less regularly each year.
- *Calendar* component captures the differences determined by the calendar structure, e.g. the different number of working days per month or special effects like the Easter effect.
- *Irregular* fluctuations represent unexpected movements related to events other than those previously considered. They are supposed to be identically and independently distributed with mean 0 and variance σ^2.

The trend and cycle components are often considered together as the combined cycle-trend component due to the problems in separating them.

8.13. Besides the classical additive decomposition model presented in the previous paragraph, we can consider the classical multiplicative model:

$$X_t = T_t\, C_t\, S_t\, K_t\, U_t,$$

where the relations among the components is multiplicative. This model can easily been represented in an additive form using logarithms:

$$X_t = \log(T_t) + \log(C_t) + \log(S_t) + \log(K_t) + \log(U_t)$$

Here and below we will refer to the additive model.

8.14. Since the components are not observable and economic theory does not provide an exact definition of them, the model assumptions made in seasonal adjustment methods are somewhat arbitrary. Therefore the assumptions made to smooth a trend or to remove the seasonal component depend on the methods used.

8.15. If our aim is the elimination of seasonal fluctuations (thereby removing the relevant correlation or the seasonal lags) to obtain a series characterised by a good structure of the autocorrelation function to be used in univariate and multivariate time series models, we have only to eliminate all the seasonal fluctuations. Thus:

$$Y_{SAt} = T_t + C_t + K_t + U_t$$

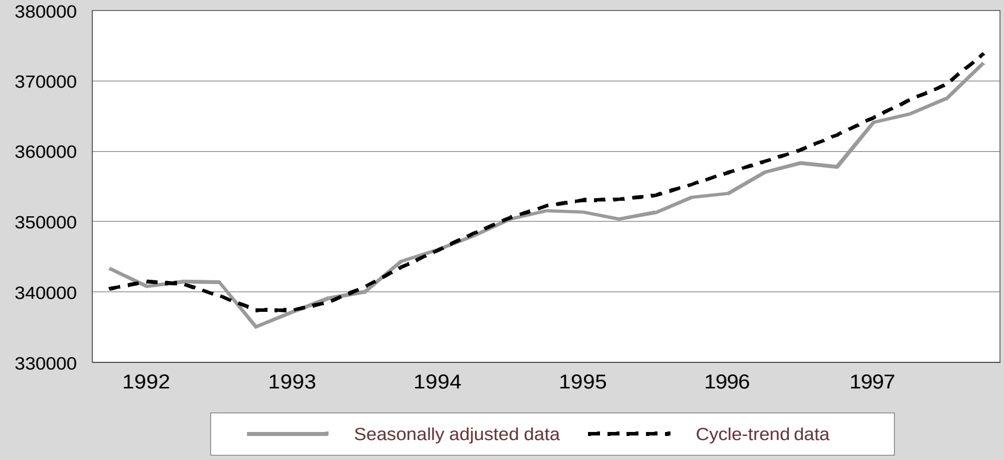
8.16. In fact, this model exactly measures the same phenomenon as that for raw data under the hypothesis that there are not seasonal effects. In this sense, it represents the exact counter-part of raw data figures.

8.17. Otherwise, if we want to measure the underlying cycle-trend component rather the seasonally adjusted level of the economic activity, so as to have an idea of how it evolves, we need a series in which all the fluctuations that can be considered either seasonal or irregular (U_t) are also eliminated:

$$Y_{CTt} = T_t + C_t + K_t$$

8.18. Another problem strongly related to seasonal fluctuations is the effect of the calendar component K_t (number of working/trading-days, Easter effect, etc.) in each quarter.

Figure 8.1: Comparison between cycle-trend and seasonally adjusted data (volume index of GDP - Western Germany - 1991=100, data adjusted using BV4 method)



The different number of working days can affect the level of the economic activity in a specific quarter. If we want to measure the intensity (growth rates) of the economic activity more than its level we have to make a correction, which is generally made before seasonal adjustment. In this case the seasonal filtered and cycle-trend series take, respectively, the form:

$$Y_{SAct} = T_t + C_t + U_t$$

and

$$Y_{CTc\,t} = T_t + C_t$$

8.19. These remarks show that there is no difference between the differently adjusted series (cycle-trend, seasonally adjusted, etc.); each series is actually strictly related to the user's requirements. For example, when we publish a first estimate of the quarterly growth rate of GDP, it may be better to compute this with seasonally adjusted data that has been corrected for working days.

Working/trading-day and calendar effect

8.20. As mentioned above, in § 8.12, in the classical additive decomposition model of a time series, the calendar component K_t captures the differences determined by the calendar structure. Three different elements are included in this component:

- calendar effects;
- working-days;
- trading-days.

Even if the calendar component cannot be clearly distinguished from the seasonal component, the estimation is necessary for comparisons purposes on a year-to-year basis. The calendar component is very often slightly moving and may disturb the stability of the seasonal figure.

8.21. *Calendar effect*

In a strict sense, the calendar effect is strongly related to the variations of the economic activity around some special dates in the year, like Christmas or Easter (Fischer 1995, Planas 1997). These special dates are usually associated with sales increases. While the Christmas effect on economic activity is always caught by the month of December (fourth quarter), the effect of Easter, as well as other moving holidays, may concern different months or quarters according to the year (Easter can effect March or April, that is the first or the second quarter). Different dates of such holidays (mainly Easter) from one year to another imply instability of the seasonal pattern related to the corresponding quarter or month. For this reason, Easter and moving holiday effects require a special statistical treatment.

The calendar effect is normally coughed via a quantitative translation of the effect on the different quarters or months caused by, for example, Easter. This effect is usually quantified by using dummy variables that reflect the impact on the different quarters/months. For example, if the Easter effect is supposed to start 10 days before Easter and to stop the Saturday before Easter, and this 10-day period is divided between March (4 days), and April (6 days), the dummy variables for the first and the second quarter will have a different weight (0.4 and 0.6, respectively).

8.22. *Working-days*

If daily series were used to measure business activities, an expected result would be that the activity varies over the different days of the week. Since daily series are however rarely available, National Statistical Institutes deal with monthly and quarterly series. Each month and quarter embody a varying number of Mondays, Tuesdays, ... and Sundays and, consequently the business activity varies accordingly.

The working-day effect catches the difference between the “working-days” (i.e. Monday, Tuesdays,..., Friday) and the weekend days (Saturday and Sunday) according to the idea that the two patterns are different. This effect is normally corrected by an adjustment based on the proportion of working-days and weekend days in the considered quarter or month. However, the proportional adjustment has proved to be not particularly efficient in catching such phenomenon.

8.23. *Trading-days*

Whilst the working-day effect highlights the differences of the business activity among the “working-days” and the weekend days, the trading-day effect catches the differences in the economic activity among the days of the week.

A regression approach, based on dummy variables is normally used to correct the trading-day effect. If it is correctly applied, the regression approach to detect the trading-day effect includes the detection of the working-day and of the calendar effect.

Choice between a fully or partially seasonally adjusted quarterly system of accounts

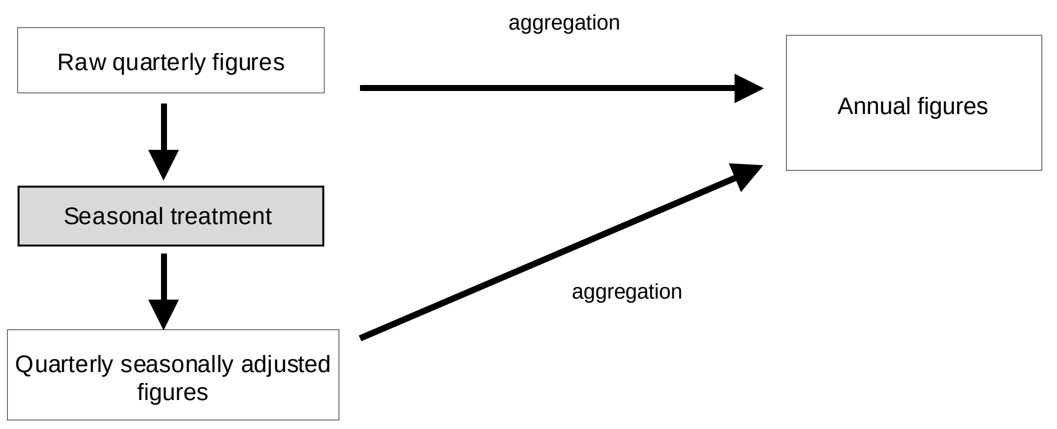
8.24. Some countries compile quarterly accounts both in raw and seasonally adjusted form, other countries compile just a partial seasonally adjusted set, and the remainder compile only seasonally adjusted or cycle-trend figures. The choice of which series to compile is complex and the opinions of the Member States are quite different on this matter.

8.25. Since Eurostat prefers the compilation of both raw and seasonally adjusted data, from a purely theoretical point of view it seems better to compile a complete set of seasonally adjusted data. The advantage of this approach is that the seasonal figures would be consistent from an accounting point of view. If this is not possible, it is anyway desirable to compile some complete seasonally adjusted accounts, so as to maintain the accounting relationships. In particular, if all the items of an account are seasonally filtered, it would not be necessary to filter the balance item which could be derived directly from the accounting relationships (but if the balance, e.g. value added, can be estimated more consistently in an independent way, it might be better to adjust it directly).

Relationships between quarterly seasonally adjusted data and annual data

8.26. If quarterly raw data and annual data are required to be coherent (i.e. additive), there is no reason why, from the user point of view this should not also be the case for seasonally adjusted quarterly data. In effect, seasonally adjusted data are a transformation of raw data. Raw data are related to annual data which are not affected by seasonality; if the sum of the seasonally adjusted values gives another annual value, there would be the paradoxical result of two annual figures representing the same aggregate. Fig. 8.2 shows this. Clearly, this consideration keeps into account a typical user point of view. From the point of view a pure theoretical approach additivity is not an intrinsic characteristic of seasonal adjusted data, and not at all of seasonally adjusted, working day corrected, figures (for more details see Chapter 9).

Figure 8.2: Relationships between raw data, seasonally adjusted data and annual data

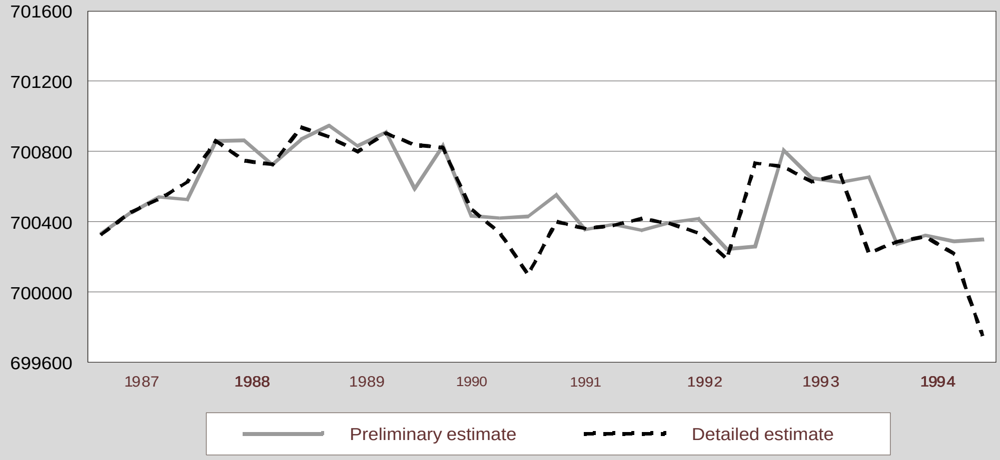


The possibility to impose the annual coherence constraint is now available in all modern methods of seasonal adjustment.

Seasonal adjustment and revisions

8.27. With the exception of some particular methods of seasonal adjustment, when a new observation is available all the series is revised, even if there are no revisions to the past values of the raw series.

Figure 8.3: Revisions of the first and second estimates of the second quarter 1980 (France GDP)



8.28. The impact of the revisions depends on the chosen seasonal adjustment method and on the variability of the series. Each revision implies a new balancing of the past values of the accounts and adjustments to ensure time consistency. This is another reason to constrain the seasonally adjusted data to match the annual aggregated raw data.

8.29. In practice, the modern methods of seasonal adjustment offer the choice between two approaches: the first is to rerun the procedure at each quarter, obtaining the revision scheme showed above; the second consists in running the procedure only once a year, for example in the last quarter, using the extrapolated seasonal factors to adjust the quarters of the following year. With the latter method the revisions appear only once a year, but they are generally of larger magnitude.

The choice between the two approaches generally depends on strategic decisions concerning the publication and the dissemination of the data.

Seasonal adjustment methods

8.30. At present several techniques are used by EU Members States to obtain seasonally adjusted or cycle-trend data. Two main groups of methods can be distinguished:

- moving average based methods;
- model based methods.

8.31. The former methods are based on different kind of moving averages[2], without an underlying explicit model. These methods were developed mainly on empirical basis. The repeated application of suitable moving averages eliminates the seasonal and/or irregular

2 A moving average is a weighted sum of the values of a series next to the values under consideration

components giving an estimation of the cycle-trend component. The most widely used method for seasonal adjustment is the Census X-11 (out its upgrades), which is moving average based method.

8.32. Model based seasonal adjustment methods estimate the trend, seasonal, irregular and cyclical components with signal extraction techniques applied to the underlying ARIMA model. Each component is represented by an equivalent ARIMA expression that is estimated by maximising the variance of the irregular component and, consequently, by minimising the variance of the other components. TRAMO/SEATS is a well known method that belongs to this group.

8.33. Users demand a “proper” estimate of the seasonally adjusted series or of the cycle-trend component and a method that gave virtually no revisions. Of course, this problem is strictly connected with the analysed time series.

An empirical comparison depends essentially on the different users’ priorities amongst the above criteria. In particular there is a trade-off between the correct identification of the cycle and the minimisation of the number of revisions.

CHAPTER 9

TOWARDS A CONVERGENCE OF SEASONAL ADJUSTMENT METHODS

This chapter looks at ways of working towards better comparability and harmonisation of seasonally adjusted figures for different countries. Several key issues that arise for all countries are identified and suggestions are made for good practices in dealing with these. The suggestions take into account the purposes intended for seasonal adjustment and the economic phenomena to which seasonal adjustment is applied.

Towards a convergence of seasonal adjustment methods

9.01. As illustrated in Chapter 8, several elements and choices influence seasonal adjustment methods. These degrees of freedom lead to different results when applying a seasonal adjustment method to a quarterly national account series. Naturally, the choice of different options depends on the purposes for which the seasonal adjustment is carried out and on what the seasonal adjusted series is intended to measure.

9.02. Because of the different considerations that influence the choice of the options in seasonal adjustment procedure, it is not easy to define an optimal approach to the seasonal adjustment. Ways forward are suggested both from a theoretical approach to the problem and from practical experience. Very often the choices depend on different consideration that do not have any theoretical or practical basis but which satisfy national accounting constraints as well as the expectations and needs of users.

9.03. The theoretical basis and the significance of seasonal adjustment have been illustrated in Chapter 8. The importance of seasonal adjusted and trend-cycle series and the differences between them, the influence of the pre-treatment (e.g. adjustments for outliers and corrections for working/trading days) and the methods suitable to be used for making seasonal adjustment are all elements to be decided when running the procedure.

9.04. The objective of the present chapter is to offer a set of suggestions that are reasonable for using to improve the comparability and the harmonisation of the seasonal adjusted figures between countries. The importance accorded to the seasonal adjusted data has already been underlined in the Chapter 8. Economic policy decisions are often based on seasonal adjusted data because raw data are not good enough for evaluating the short-term behaviour of the economy as good as seasonal adjusted data. Harmonised and comparable seasonal adjusted data are thus essential for a comparison between the short-term path of the economies of different countries. For this reason, the convergence of the seasonal adjustment treatments is an important step towards the harmonisation of quarterly national accounts data.

9.05. In the present chapter, Eurostat suggests a set of criteria to be used in carrying out the seasonal adjustment. As stated above, some of these suggestions derive from practical experience, some from theoretical results and others from national accounting and considerations of user needs. The issues that appear to be particularly important here are as follows:

- choice of seasonal adjustment method;
- change of seasonal adjustment method;
- transparency of procedures;
- consistency in aggregation;
- time consistency;
- publication of seasonally adjusted or trend-cycle data;
- revisions;
- methodical application of seasonal adjustment program;
- working/trading days corrections;
- treatment of uncertainty and publication of confidence intervals.

Choice of seasonal adjustment method

Problem Statement

9.06. National Statistical Institutes are currently using various different packages, most of which derive from model based methods or moving average-based methods. This diversity of approach clearly affects the quality and hence the credibility of results. It is therefore necessary to define a set of criteria for choosing the “best” method, depending on the purposes for which adjustment is intended.

9.07. The criteria for a “good” seasonal adjustment method can be distinguished between theoretical and empirical criteria according to the requirements specified for quality of the estimates and the objectives in view for the method to be chosen.

9.08. The theoretical criteria used can be summarised as follow:

- the method should be consistent with the information inherent in the data;
- the method should provide exact assumptions made for the estimation of the model, precise definitions of the components and a clear estimation concept subject to the optimisation criteria chosen;
- the estimation method should be adequate for the given assumptions;
- the method should provide additional information linked to the quality of the estimator;
- the method should provide statistical tools to check for adjustment failures and to deal with the problems entailed.

9.09. The empirical criteria are the following:

- adequacy of the model when a model based approach is used;
- idempotency: the seasonally adjusted series should not exhibit any seasonal feature, so that after using the seasonal adjustment filter once, the series should not change, or change unsignificatly, if the seasonal filter is applied again;
- variability of the seasonal figure;
- correlation between the methods available;
- difference in the annual totals for the original data and for the seasonally adjusted data;

- orthogonality of the seasonal and the non-seasonal component, measured by the correlation between the seasonal and the non-seasonal component;
- mean absolute percentage forecast error, for methods using forecasts;
- stability of outcome when making revisions;
- detection of turning points;
- filter characteristics.

Suggestion

9.10. The preferred methods for seasonal adjustment should be model based ones (for example, TRAMO/SEATS). The findings of several independent technical studies appear to point towards this conclusion. Other methods now in use should therefore be retired as soon as it is prudent and practicable to do so. However, filter-based methods such as X-11 and X-12 REGARIMA that have their own built-in quality standards are not entirely excluded from consideration.

Change of seasonal adjustment method

Problem Statement

9.11. Seasonally adjusted data are highly dependent on the seasonal adjustment method used. Any change in the method introduces changes into the data and, consequently, in the time series. Thus any change of method should be well evaluated and justified in order to reduce problems of this kind.

9.12. Users of statistics want and have the right to stable results. Analytical conclusions are drawn by comparing today’s statistics with those of the past. Any change of concept, as well as to the seasonal adjustment method, makes this temporal comparison difficult if not impossible. Even if the new concept/method is applied to the past data, the message inherent in the data may suddenly become different from before.

On the other hand, a situation may arise where the old concept/method is no longer valid. If, in the domain of seasonal adjustment, scientific research leads to considerably improved methods or if it can be shown that the results obtained by the current method are of consistently bad quality, a change of method is imperative.

Suggestion

9.13. These reflections leads to the conclusion that changes of seasonal adjustment method should occur only rarely. If a change seems necessary, it needs to be justified thoroughly.

Transparency of Procedures

Problem Statement

9.14. Seasonal adjustment is a data analysis process that is heavily dependent on the particular method that is used. It is important for any official statistical institution wishing to demonstrate its scientific independence and integrity that the analysis and the decisions based on this adjustment should be open and follow known rules. This is essential to construct a relationship of trust between data producer and data user. Transparency of currently used methods is the pre-condition for a sound seasonal adjustment policy.

9.15. It is very important to publish not only the final seasonal adjusted figures but also as much meta-information on the adjustment procedure as possible. The following list represents a complete set of meta-information linked to the seasonal adjustment:

- *Reference paper*

A reference paper should be produced as a separate publication in which the seasonal adjustment environment is described in full detail, including at least the following information:

  - seasonal adjustment method in use;
  - decision rules for the choice of different options in the program;
  - special constraints for time and activity aggregation;
  - other constraints in operation;
  - outlier detection and correction methods;
  - decision rules between different kind of data transformations;
  - revision policy;
  - description of the working/trading day adjustment;
  - contact address.

- *Publication of meta information*

In every relevant publication, the method in use and the reference paper should be mentioned as well as a reference contact for further details on the procedure.

- *Special annotations*

Any table containing seasonally adjusted data or trend data should be accompanied by footnotes. These footnote should highlight and explain significant outliers or data problems as well as any seasonal adjustment options in use which deviate from normal practice.

Suggestion

9.16. In each publication the seasonal adjustment technique used for the data must be drawn clearly to the user' attention, along with the seasonal adjustment meta-information in accordance with § 9.15 above.

Consistency in aggregation

Problem Statement

9.17. Time series are often formed by aggregating elementary series. Examples include national totals aggregated from regional data and GDP added up from branch or sector totals. If such a composite aggregated series is seasonally adjusted on its own, the result might not be identical to the sum of the seasonally adjusted elements. Inconsistencies will be apparent to users and of the statistics and their confidence will suffer.

9.18. National Statistical Institutes are often faced with the geographical aggregation problem: for example, if the national value is made up by the sum of the regional figures, the statistical office has to decide whether to add up the regional raw data and then apply the seasonal adjustment, or to add up the seasonally adjusted data in order to obtain the national aggregates. The Institutes then have to choose between two possibilities:

- either to use the seasonal elementary (regional) adjusted data and add it up, i.e. apply *indirect* seasonal adjustment;
- or to use the unadjusted elementary (regional) data and then apply the seasonal adjustment procedure to the calculated total i.e. apply *direct* seasonal adjustment.

The same choice applies to industry level totals calculated from branch values or to national accounts figures totalled from those for constituent branches.

9.19. It is evident that summing up several series and seasonally adjusting the total does not necessarily give the same result as seasonally adjusting and then adding up the individual series.

9.20. In order to decide whether the composite series should be seasonally adjusted using the direct or the indirect procedure, a criterion of smoothness is often used.

The following solutions can also be considered:

- If the discrepancy between direct and indirect seasonal adjustment is acceptable, the use of direct seasonal adjustment is preferred;
- if the discrepancy is significant, two solutions can be considered:
  - indirect seasonal adjustment;
  - distributing the discrepancy.

The procedure for the second solution can proceed along the following lines:

a) calculate the seasonally adjusted total less the sum of the seasonally adjusted components, i.e. the residual series;

b) add a portion of this residual series to each seasonally adjusted component according to a suitable criterion;

c) if, due to rounding, the series does not add up exactly, any small discrepancy can usually be allocated to the largest series, or shared among the two or three largest series, without causing serious problems.

Suggestion

9.21. In principle the direct method is preferable, since the seasonally adjusted series of the totals of the components, i.e. the composite series is clearly of a higher quality. For geographical aggregations this approach should always be used.

For aggregations in national accounts the consistency requirements of the users may be so strong as to oblige the use of the indirect method.

Time consistency

Problem Statement

9.22. The analysis of an economic phenomenon is based on the data of the corresponding time series and consequently on the sources from which the data come.

The recording of economic activities is usually made in respect of fixed dates during the accounting period. The same activity is often recorded both at high, medium and low frequencies, i.e. at monthly, quarterly and annual intervals.

If the measurements of the economic activity at different frequencies are not biased by errors, the sub-annual and annual raw data are perfectly consistent. This means that:

- for flow variables the sum of the quarterly figures is equal to the annual figure

$$Y_t = \sum_{j=1}^{m} y_{j,t},$$

where Y_t corresponds to the annual value, $y_{j,t}$, j=1,...,4 corresponds to the quarterly value, *m=4* is the aggregation order;

- for indices, the average of the quarterly figures is equal to the annual figure

$$Y_t = \frac{1}{m}\sum_{j=1}^{m} y_{j,t}.$$

The problem arises that this equation may not be valid for seasonally adjusted figures.

9.23. When the seasonal adjustment is applied to the sub-annual monthly or quarterly figures, it is often desirable, from the user point of view, that the sum or average of the seasonal adjusted figures corresponds to the sum or average of the unadjusted sub-annual figures.

This expectation is justified because seasonal movements are assumed not to affect the yearly total. As the purpose of the seasonal adjustment is to distribute the effects of seasonality within the year, the sum of the seasonal components during the year must be equal to zero. However, circumstances quite often arise in which this expectation is not met.

9.24. If there is evolving or moving seasonality in a series, as is often be the case, the seasonal effects will not net out over any yearly period. Even if a series has constant seasonality, rather than moving seasonality, any treatment applied to outliers will affect the yearly consistency. Any desired time consistency must in practice be imposed. Most packages currently used for seasonal adjustment have an option that forces the additivity between seasonal adjusted sub-annual values and their unadjusted sum or average. Introduction of this option can lower the quality results obtained from any seasonal adjustment method.

Suggestion

9.25. Imposing time consistency has no scientific justification but lowers the quality of results and good reasons can be advanced for not doing it. On the other hand, many users require time consistency.

It is accordingly defensible to impose annual time consistency on the sub-annual seasonally adjusted series in the short-term, provided that attempts are made to educate users to accept non-time consistent over the longer term.

Publication of seasonally adjusted or trend-cycle data

Problem Statement

9.26. Should seasonally adjusted or trend-cycle series be published?

For many years, economic time series have been decomposed into several components in order to help the users in their analyses. It should never be forgotten that this is the purpose of all time series decompositions. Seasonal adjustment methods are designed to decompose pre-treated time series into trend-cycle, seasonal and irregular components.

The trend-cycle is held to represent medium and long-term movements in a time series. The seasonal component captures more or less stable series patterns which are repeated over the years. The irregular component contains random factors which distort the time series to varying degrees. This component may also pick up short-lived socio-economic events such as strikes insofar as these are known to the user and can be detected and estimated. The trend-cycle and irregular components together comprise the seasonally adjusted series.

9.27. In the past, it was not possible to calculate the pure trend-cycle convincingly. Tools like moving averages of the seasonally adjusted series were only unsatisfactory proxies. Thanks to new analysis techniques and more powerful computers, it is today possible to estimate the actual direction of business cycles quite accurately by directly estimating the trend-cycle. The state of the art has developed in this way because the figures tell a clearer story if the irregular component can be removed.

9.28. The argument, that the seasonally adjusted series contains some additional information in the irregular component and is therefore, in certain contexts, preferable to the trend-cycle is a useful argument especially if the analyst has the following information:

- the original series;
- detailed economic knowledge;
- detailed experience in the use of seasonal adjustment methods;
- knowledge about all parameters used in the method.

9.29. Different philosophies and approaches underline the use of trend-cycle and of seasonal adjusted data.

Whether trend-cycle or seasonally adjusted data should be preferred for publication, especially for graphical representations, depends on several considerations.

9.30. *Trend-cycle data*

Trend-cycle data rather than seasonally adjusted data could be used for graphs since the difference in a statistical sense between the seasonally adjusted and trend-cycle data is the random effect, which is not possible to explain in an economic sense in the short-term.

The differences between seasonal adjusted and trend-cycle data result mainly from calculation problems and other factors such as the collection methods used.

The extent to which seasonally adjusted data are affected by external economic or random factors will vary depending on the type of data.

National Statistical Institutes should therefore publish interpretable data with the value added that corresponds to the extraction of the most important and explanatory information from the available data. This includes condensing and reducing data to avoid informational overload among users. The trend-cycle data would be more adapted to these purposes. Therefore, the graphs should contain this kind of data.

9.31. *Seasonally adjusted data*

Seasonally adjusted data may better capture some short-term phenomena. Some short-term movements are not random; they contain more information and could be interpreted by economic events as, for example, strikes.

Seasonal adjusted data, because of their nature, ask the user for a bigger effort in their interpretation but, in contrast to the trend-cycle data, which only contain medium-term information, they avoid the loss of short-term information.

9.32. Whether the irregular component of a series contains interpretable short-term information depends on the type of data and on the application of seasonal adjustment procedures. Advanced users with detailed background information could in that case interpret some of the unstable movements in the seasonal adjusted data.

9.33. As advanced user order complete data sets for their own calculations, it is reasonable that seasonally adjusted and trend-cycle data should be available to them via dedicated means of distribution.

Suggestion

9.34. Both seasonally adjusted and trend-cycle data should be produced and made available to the user.

Graphs should contain the trend-cycle data. In special cases, seasonally adjusted data should be shown if this can be justified by the special characteristics of the data or by the nature of the publication. Tables should represent seasonally adjusted data and/or trend-cycle data.

Revisions

Problem Statement

9.35. In using seasonal adjustment methods, the problem arises of whether the parameters of the seasonal adjustment procedure should be re-estimated each quarter or only once a year.

9.36. Estimation of trends and seasonal adjustment implies *revisions* in preliminary estimates for periods at the end of a sample.

There are two perspectives in the analysis of revisions: methodological considerations and publishing practices.

- methodological considerations show that revising an estimate (as new observations become available) is optimal in terms of estimation accuracy. Knowledge of the future helps in understanding the present: for example the direction of a current trend would be easy to determine using information on what it will be in the next periods. Revising improves the preliminary estimates, which thus become more informative. The magnitude of revisions is usually related to the stochastic properties of the series, and it is generally accepted that stable seasonal patterns imply smaller revisions than quickly evolving seasonal patterns.

- in the practice of publishing trends and seasonally adjusted series, revisions are usually seen as a problem and are to be avoided.

9.37. The policy problem is therefore on one side to find a balance between improving preliminary estimates and on the other side to publish information that is not too unstable over time. The magnitude of revisions is thus a matter of importance: a method that yields large revisions is not very attractive for a user.

9.38. The convergence of revisions also matters: revisions should not last too long. The frequency of revising previous figures is by now up to the publishers. The decisions taken by a publisher are of importance for the design of the seasonal adjustment and trend extraction procedures. Further, given that revisions are related to the way the future is dealt with, different methods imply also different statistical treatment.

9.39. The possible options are the following:

a) forecast the seasonal factors for the next year by linear combination with a priori weights and perform the adjustment during the next 4 months on that basis. At the end of the next year, update the series with new observations and re-compute the adjusted figures and trends;

b) use ARIMA forecasts for the future, but update the forecast of next year's quarters, as new observations become available. However, the model used for forecasting does not change during the year, and the model parameters are not re-estimated. Furthermore, none of the options in the analysis change throughout the year; a complete reset can be done only at the end of the year;

c) use forecasts for the future, as in (b) but re-estimate the parameters of the model used for forecasting as new observations become available. A change in the options and in the model specification can only occur at the end of the year;

d) proceed to concurrent adjustment: at every period, compute the optimal forecast needed, choose the best options of the treatment.

9.40. As well as technical considerations, publication strategies for revisions should be taken into account. Decisions must be taken on whether preliminary figures should be revised in publications each quarter, every few quarters or only once a year. A related issue is whether (and, if so, when) there should be a time limit beyond which revisions are curtailed.

Suggestion

9.41. Option (a) originated when computing power was limited and it is now outmoded, Option (d) is also rejected on the grounds that economic information may not be sufficiently taken into account. Options (b) and (c) are quite similar but the latter implies a bigger impact of revisions. Option (b) is therefore the preferred course of action.

Methodical application of seasonal adjustment programs

Problem Statement

9.42. Seasonal adjustment methods, as recommended in the present chapter, use models for the seasonal adjustment. The extension of the observed values to forecasts, the preliminary pre-adjustment (transformation, outlier detection, working/trading day correction) and the decomposition into unobserved components depend on a choice made either by the in-built algorithm or by the statistician using the package.

9.43. In the application of the programs some steps are mandatory for high quality adjustment. Output of sufficient quality can only be obtained by meeting two requirements, namely:

- procedures should be based on scientific principles;
- there should be adequate safeguards against any attempts to modify subjectively the information included in the series.

9.44. The first requirement is to base the choice of methods on a clear description of the concept of seasonality or trend. Although there is no general agreement on such a description, and although no totally precise definition of that concept exists outside the frame of a given model, some attempt can be made.

9.45. The seasonal component is due to an unobserved phenomenon that is largely thought to occur at a regular rhythm like the seasons; that is generally estimated using past experience, and that is considered to be either stable or regularly evolving through time. By removing this estimated seasonal component, the series adjusted for seasonal variations is obtained. For consistency reasons, it is generally assumed that this seasonal adjustment should not modify the level of the information when this is yearly.

This seasonally adjusted series is then considered to be composed of a trend component, a series that encapsulates real world events other than extraordinary ones of small amplitude and continuous occurrence that are contained in the irregular component.

9.46. However, several decisions have to be taken in a systematic way before the series can be published:

- *Outliers*

  Real series are difficult to model since they contain the impact of exceptional, very irregular events[1] that are of such a special nature that they cannot be modelled. There - fore, the statistician prefers to remove these observations, in order to avoid distortion of the statistical analysis.

  The different kinds of outliers of interest here are considered as follows;

  – *additive outliers*: isolated extreme values, due to an exceptional event, that may be known by the statistician.
  – *level shifts*: sudden changes in the average level that cannot be explained by the history of the series itself but are due to external factors such as changes of legal framework or of statistical measurement.
  – *transitory changes*: level shifts of limited duration only.
  – *innovation outliers:* values that affect all the successive observations through the memory of the system.

- *Additive or multiplicative seasonal behaviour*

  The next step is to agree a behavioural relationship between the seasonal influence and the non-seasonal component of the characteristic under consideration. The most frequent hypotheses are the following:

1 Either due to the real world (strikes, natural events) or the changes or accidents in the statistical measurement.

a) the seasonality is additive: the periodic, seasonal, influence only adds or subtracts a certain amount for all similar periods throughout the years. This applies particularly to series that maintain a similar yearly average level through time.

b) the seasonality is multiplicative: in an expanding (or contracting) reference population, it is logical to consider that seasonality only amplifies and reduces with high frequency the general evolution of the series.

In practice, tests are necessary to choose between these two hypotheses using the fundamental idea of the stability of the magnitude of seasonal component.

- *Transformation*

In the absence of any further information, it is quite logical to propose the simplest model to take into account the factors described above.

However, since there may be arguments about the functional relationship between all these explanatory factors and the observed series, a convenient degree of freedom is given by an initial transformation of the data, before adjusting the seasonal adjustment, and working/trading day model.

The classical functional relationship proposed are the usual mathematical transformations: log, square root, inverse, and more generally the Box-Cox transformation.[2]

- *The choice of a model*

Many methods require the choice of a model, for:

– the pre-adjustment;
– the extension of the series by forecasts;
– the decomposition into seasonal/trend/irregular components.

Although the subject is much debated, it seems that many statisticians recommend using the following principles:

– models should be simple and serve only to give the best possible representations of a reality whose complexity goes beyond the classical hypotheses: this is the parsimony principle.

– models should not be fully data driven: a model needs to be validated by testing it under different circumstances and checking that the modelling structure has some robustness. Alternative models of similar quality that can generate series for the seasonal, trend-cycle and irregular components should be kept available for use if needed. Given that the validity of a model relies on its underlying stability, it is also advisable to avoid changing every month or every quarter of the model used for a regular production activity.

2 x à $f_a(x)=[x^a-1]/a$ for a not equal to 0; $f_a(x)=\log(x)$ for $a=0$

- *How to choose the reference model once a year*

Here too, the validation of the model should be made with care according to the following procedure:

a) by removing the last one or two years, identify and estimate the best model;
b) compare the actual values with the forecasts of the model and the associated confidence intervals;
c) in the case of values outside of this confidence interval, treating them as outliers if they are isolated, or changing the model if it has a systematic character;
d) re-estimate the model with the full length of the series: check the stability of respectively the outliers, other pre-adjustment for working/trading day corrections etc. and the new estimate of the decomposition model. If the order of the ARIMA model changes, investigate the reasons for this.

9.47. The general rule should be to apply the parsimony principle: do not re-estimate too often or increase too much the order/complexity of the models if the explanatory power does not increase.

A series which causes changes in the estimated ARIMA model too often is probably very badly represented by an ARIMA model and may have a complicated seasonality pattern. If there is no stable model better adapted to describe the series, it might be worth considering giving up the seasonal adjustment, especially if the estimated seasonal component is unstable and/or very poorly identified.

9.48. The procedure for selecting the models in general must be made available to the users, and any change in the model that might have important consequences on the seasonally adjusted or trend-cycle series should be reported to users.

Suggestion

9.49. Decisions about treatment of outliers, selection of additive or multiplicative models, the ARIMA model and transformations of technical series need to be based on scientific tests appropriate to the specific situation. Dependence on the automatic default options included in standard packages should never be total.

Working/trading-day corrections

Problem Statement

9.50. The working/trading-day correction of flow series is an important step in the short-term analysis of time series. The different number of working/trading-days in a given calendar period can influence a time series by several percentage points. The differing incidence of holidays and other causes of absence from work within a calendar period can have the same effect. Time series analysis for such purposes as monitoring the business cycle must therefore take this effect into account.

9.51. Only the correction of these effects offers the user the possibility of making meaningful comparisons of a given quarter with its counterparts in previous years. When comparisons are extended from the national to the international levels, knowledge of these effects is all the more important. Corrections of these effects can only be done properly with detailed knowledge of the working/trading day calendars and of other working/trading day characteristics of particular countries.

9.52. Two theoretical possibilities for working/trading day correction are represented by the proportional approach and the regression approach. The proportional method has often been demonstrated to over-adjust the working/trading-day effects. Preference should therefore be given to the regression approach including appropriate additional regressors for special holidays or other special events in a country.

9.53 Another issue arises when considering the consistency of the working/trading day correction in the context of the seasonal adjustment. Whether for seasonal variations alone or for both seasonal variations and working/trading-days, a way must be found to make non-adjusted yearly totals consistent with infra-yearly adjusted series.

9.54. If some series are both "adjusted for seasonal variations" ("SA series") and "adjusted for seasonal variations and working/trading-day variations" ("SA+TD series"), then "seasonal variations" estimated by both methods should be the same. The series is first adjusted for working/trading-days and later for seasonal variations, and the correction for working/trading-days is then removed. Alternatively, the series is first adjusted for seasonal variations, and the resulting series is then adjusted for working/trading-day variations.

Obviously, if the series adjusted for seasonal variations (SA series) must satisfy the constraint that the sum of unadjusted series is equal to the sum of SA series, then this constraint is not satisfied in general by SA+TD series.

9.55. When deciding on the model to be used, consideration should be given to whether the length of the month ought to be given special attention. If applied directly as proposed above, February figures of SA series would always be too low, since the adjustment for working/trading-day variations would incorporate not only the composition of the month (i.e. the mixture of working/trading and non-working/trading days) but also the length of the month. Therefore, it would be necessary to adjust at the same time for length of the month, composition of the month and pure seasonal variations. The SA series would only be adjusted for purely seasonal variations and length of the month. The SA+TD series would incorporate the "composition of the month" effect.

9.56. Fixed non-working/trading-days should be registered as such. For example and by convention, holidays like Christmas can be considered as phenomena of seasonality.

9.57. Concerning occasional commemorations of special events or moveable holidays like Easter a debate is still open. It is debatable if, say, the Easter effect has to be assimilated to seasonal or to working/trading-day variations. For consistency with § 9.56, it should be attributed to seasonality. However, this would imply the use of a model of some sort even if no working/trading-day correction is made. It would therefore seem sensible to attribute the "commemorations" and moveable holidays effects to working/trading days variations.

Suggestion

9.58. All working/trading-day corrections should be applied by using a regression approach rather than by an approach based on proportional working/trading day adjustment.

Uncertainties and confidence intervals

Problem Statement

9.59. The data published are measures of flows or stocks of physicals units, in volume or in value. They can be expressed as straightforward numbers, indexes, growth rates or in other forms. As with any empirical measurements, they embody errors, which can be for example due to the survey sample design, to processing errors, missing data or response errors. In other words, there are uncertainties attaching to the socio-economic events the data describe. Furthermore, the estimation of the seasonal adjusted series implies an estimation error. The problem is whether to inform the public about uncertainties attaching to the published figures.

9.60. The publication of confidence intervals for seasonally adjusted series and trend estimates would be relevant information for the public. The need for such information has been emphasised in the scientific literature. Nowadays, model based packages make available confidence intervals for seasonally adjusted series and trend estimates, but these confidence intervals are only related to the unobserved component estimation error. Although this information does not cover all the uncertainties in the data treatment process, it provides a message of interest regarding the specific error related to the decomposition procedure.

Suggestion

9.61. It is advisable to advise the public of uncertainties attaching to published figures. National Statistical Institutes should make available information about the standard deviations and the confidence intervals. The form in which that information might be diffused is a matter for the Institute. It should nevertheless be made clear that the standard deviation currently available only relates to the estimation error in the seasonal adjustment procedure.

Summary of main Eurostat suggestions

9.62. This chapter has discussed the main issues that arise when dealing with seasonal adjustment of quarterly accounts. Suggestions have been made as to how these aspects might be dealt with. It will be useful to bring together, in this summary section, some of the main features that have emerged.

- Perhaps the main point to be re-iterated is that both raw and seasonally adjusted quarterly figures have to be compiled. In principle, all the series related to quarterly accounts aggregates have to be seasonally adjusted. Compilers have to test the presence or absence of seasonality in each specific aggregates and decide, according to the results of the tests, if the series are or not affected by a seasonal component.

- Seasonal adjustment have to be made by applying the methods proposed in § 9.06-9.10, i.e. model based methods (TRAMO/SEATS) or moving average based methods (X-12 REGARIMA). The choice of the seasonal adjustment method, as well as any change or improvement, has to be explained to the users in a methodological note.

- Explicative notes that illustrate the main choices made during the seasonal adjustment procedure should accompany each publication of seasonally adjusted series. A detailed methodological publication should complete the information put at users' disposal.

- If the unadjusted series are additive (i.e., the sum of the unadjusted quarterly figures is equal to the annual figure), it is suitable to maintain additivity also for seasonally adjusted data. As stated in § 9.22-9.25, there is no theoretical reason to impose such additivity, but the necessary consistency between unadjusted and seasonally adjusted data has to be kept into account as a strong requirement of the users. If time consistency is not respected, data have to be completed by an explanatory note.

- Similar remarks apply to accounting additivity. If the raw series are linked by an accounting constraint that corresponds to a specific aggregated, whether seasonally adjust the aggregate or the components depends on the quality of the available information. The indirect method (i.e., to adjust the components series and then to aggregate them to obtain the accounting constraint series) should be preferred but the direct approach (i.e. seasonally adjust the aggregated series and the components and then distribute the discrepancy) could be more appropriate in some occasions.

- For quarterly accounts purposes, seasonally adjusted data seem to be preferable to cycle-trend data. Anyway, cycle-trend data are a useful instrument to carry out the analysis of noised data and to detect the trend of the aggregate, so they are complementary to seasonally adjusted data.

- The working days correction is highly recommended for short-term analysis purposes (for example, growth rates rather than levels for the econometric models) in order to improve the comparability of the figures. Their compilation is then a useful complementary addendum to seasonally adjusted data.

PART V

CHAPTER 10

TIME CONSISTENCY BETWEEN QUARTERLY AND ANNUAL ACCOUNTS

Since quarterly accounts are part of the system of national accounts, they should be coherent with the annual accounts. For this reason, the sum of the four quarters should be consistent with the annual data. This requirement is both a logical and a user-driver requirement. But this process has a number of degrees of freedom. The chapter recommends that when annual data become available, the quarterly data are adjusted so as to retain the original quarterly path as far as possible and to avoid needless introduction of an artificial 'step' between the fourth quarter and the first quarter of the following year.

Some solutions are introduced, ranging from adjustment 'by eye' to more complex time series methods (e.g. Bassie, Denton, Henderson etc .). It is stressed that the process of ensuring time consistency should be applied across all national accounts data, and should ensure that the constraints of account balancing are respected.

Time consistency

Introduction

10.01. This chapter deals with the issue of aligning quarterly estimates to firmer annual data. It describes the problems in general terms and suggests certain methods that might be employed to achieve consistency between the two sets of figures.

10.02. As mentioned in Chapter 1, quarterly accounts provide both an up-to-date picture of developments in the economy, and also the first estimates of the annual figures. In some countries, for certain variables, the annual estimates are simply the sum of the quarterly figures. The absence of additional, annual data may reflect the view that sufficiently reliable and comprehensive estimates can be derived from the quarterly information collected. Alternatively, it may represent a gap in the statistical system. Unless annual data are revised as part of the annual balancing process, the need for alignment therefore does not arise. In the main, though, quarterly estimates will have been based on data collected in surveys which are likely to be both smaller in size and containing less detail than for the annual inquiries.
Where quarterly data are not adequate, the firmer information provided by the annual surveys is considered essential as the basis for the national accounts figures. Annual data are also obviously required for those variables for which no quarterly data have been collected.

10.03. The problem, as outlined above, is seen as one of improving the quality of the quarterly data and of the accounts overall through what might be termed ‘retrospective’ alignment. In other words, a set of quarterly accounts has been established which, when amalgamated for a calendar year, implies a corresponding annual set of figures, and these quarterly-based accounts have to be made consistent with the new annual data.

However, the alignment process also has an important consequence for the quarterly estimates being made for the latest year. If the quarterly figures for the year t are revised in the middle of year $t+1$, in the light of firmer annual information for year t, then the effect of this alignment must be taken into account in deriving the quarterly estimates for year $t+1$. For example, if, for a particular variable, the quarterly figures are seen to be (regularly) understating growth, then it may be sensible to adjust upwards the quarterly estimates for year $t+1$ in anticipation of a (likely) revision when annual data for year $t+1$ become available. This aspect is considered further later in this chapter.

Main principles of time consistency

10.04. On the main question of time consistency, three main principles of aligning quarterly and annual figures can be identified.

Alignment and path of quarterly estimates

10.05. First, the alignment should seek to preserve, as far as possible, the path shown by the estimated quarterly figures. A seemingly obvious way of doing this would be to apply the same proportional adjustment to each of the four quarters of the year. However, this approach has one major disadvantage, which should rule out its use in all but a few situations. The disadvantage is that, if the adjustment is not small, the approach leads to an undesirable and distorting 'step' adjustment between the fourth quarter of the previous year and the first quarter of the year being adjusted. Most economic activity is continuous, and the quarters may be regarded as a convenient way dividing it up for measurement and monitoring purposes. In this situation the step change should be avoided.

However, for certain transactions, the calendar is of relevance in that it will determine the commencement of a particular economic, financial or structural change in the economy. In these cases, tax and interest payments may be examples, a uniform proportional adjustment over the four quarters of the year is the correct approach.

The reference year is often the financial or fiscal year rather than the calendar year. So the proportional adjustment may not the classical national accounts year.

10.06. Where, as for most variables, uniform proportional adjustment is not appropriate, various approaches can be used for alignment.

<u>Manual approach</u>:

The simplest approach is to adjust the quarterly data, manually, that is 'by eye', combining direct knowledge of the series with an ability to smooth manually. This may be used where the differences between the annual and quarterly data are small, and where few series need to be adjusted. The approach might involve approximate adjustments, by eye.

<u>Ratio approach</u>:

The ratio of the annual to the sum of the quarterly data could be interpolated over the quarters of the year. These ratios are then applied to the original quarterly series, with final small changes being made to ensure that the annual total is correct. The methodology can be applied to both seasonally adjusted and non-seasonally adjusted data.

10.07. <u>Seasonal adjustment procedure</u>:

A second way of aligning quarterly and annual data is through the seasonal adjustment procedure. Clearly, though, it is necessary first to align the non-seasonally adjusted data. Its usefulness is thus limited, but, nevertheless, it is a convenient way of making these two important adjustments to the data. The most known and used software for seasonal adjustment (for example, the X-11 family and TRAMO/SEATS) offers the option for handling and assuring the coherence between quarterly and annual data (see Chapter 8).

The adjustment of the quarterly figures to the annual data is made with reference to the real annual data for both raw and seasonally adjusted but not working/trading day corrected data. If a working/trading day correction has been made in the seasonal adjustment procedure, the coherence between quarterly figures has to be made with reference to the corresponding working/trading day corrected annual data.

From a purely theoretical point of view, there are no reasons to impose time consistency to seasonal adjusted data since the algebra does not directly imply it. The rationale is often a user requirement leading to more accounting coherence. Alignment of seasonal adjusted data has obviously the advantage to respect a logic requirement: the sum of seasonal adjusted data corresponds to the sum of the non-adjusted data that in turn corresponds to the annual figure. This logic identity derives from the definition of the seasonal component as a component whose effects sum to zero in the year (see Chapter 8).

10.08. *Mathematical and statistical techniques*:

A third approach is strictly related to the mathematical and statistical techniques illustrated in Chapter 6. The problem of the consistency between quarterly and annual accounts is exactly the same as in the two step adjustment procedure described in § 6.38.-6.44. The quarterly available figures are like the preliminary estimates that do not match with the annual estimates. The resulting discrepancies have to be distributed according to some criteria. In Chapter 6, two adjustment procedures able to handle the discrepancies, have been presented: Bassie (see § 6.34. for more details) and Denton (see § 6.36. for more details).

Alignment and various forms of the estimates

10.09. The second issue, which needs to be borne in mind, arises because alignment needs to be made to various forms of the estimates - current and constant prices data and in non-seasonally adjusted and seasonally adjusted form. In practice, the issue will relate mostly to those variables where current and constant price estimates are estimated and aligned independently. Where this approach is followed, the principle is similar to the one mentioned above, namely to ensure that the quarterly profile of the new implied price index does not depart too much from the corresponding series evident in the original quarterly figures However, if new price data are available, the profile of the implied series should be reviewed. In respect of seasonally adjusted series, the above considerations would obtain, through the implied seasonal factors, only where the non-seasonally adjusted and seasonally adjusted series were aligned independently. However, the recommended approach here is to revise the unadjusted series and then carry out a further seasonal adjustment.

Balancing and alignment

10.10. The third issue is, perhaps, the most important of the three. It is that the alignment process needs to ensure that, not only are the quarterly figures made consistent with the annual figures, but also that the various quarterly data sets at current and constant prices, and for non-seasonally and seasonally adjusted data still balance. Put another way, the issue may be seen as the balancing of the quarterly data with the additional constraint that the quarterly estimates sum to known annual figures. Ideally, therefore, the achievement of consistent annual and quarterly data should be considered as part of the balancing process, which is carried out retrospectively on an already balanced set of data, but with the additional constraint of respecting the annual totals. The position of alignment in the balancing process is considered in Chapter 11 in which some mathematical and statistical techniques conceived to treat both the coherence and the balancing problem at the same time are presented (see § 11.61 - 11.66 and Annex 11.A). Then, this third issue is mainly a practical issue which the techniques illustrated in Chapter 11 are designed to address.

Alignment of the current quarters

10.11. The second aspect of time consistency to be covered here relates to the role of the alignment process in the context of the estimates for the current quarters, rather than for the past year. The issue is how best to use the information about the relationship between the annual and quarterly figures from the retrospective alignments to improve the quality of the estimate for the subsequent quarters, until the next annual set of data becomes available.

As a simple example, consider the case where the quarterly based estimates for a particular variable have to be adjusted upwards, in the light of the annual data, in each of the last two years, by say 2 and 4 per cent. In determining the quarterly estimates for the latest period, the compiler should first try to ascertain the reason for the bias in the quarterly estimates and then take appropriate action. This action might involve improving the quality of the quarterly series. It should certainly involve considering the inclusion of some form of bias adjustment in the latest quarterly estimates. Obviously, two year's data is not a very strong basis for deciding whether to make such an adjustment, and, if so, what its magnitude might be. However, a decision has to be taken on the available evidence. In the example considered, other things being equal, the compiler might include an adjustment of say 3 per cent in the latest quarterly estimates.

It should be remembered that, not to make any adjustment, also constitutes a decision, albeit an implicit rather than an explicit one.

This is a typical problem linked to the revision process of quarterly figures and to its analysis in order to improve the estimation of the quarterly data according to the information coming from the different versions of the same figure. This case arises in particular for the preliminary estimates of the current year (see Chapter 12). It is clear that the availability of new versions of annual figures implies a revision of the quarterly figures which should still remain coherent with the corresponding annual value. In Chapter 12 a detailed analysis of the treatment of this kind of situation is presented.

CHAPTER 11

THE BALANCING OF QUARTERLY ACCOUNTS

This chapter recommends that there should be a single definitive measure of GDP, that full balancing should be undertaken to ensure that no statistical discrepancies are left in the data (either in raw or seasonally adjusted data), and that all variables should be subject to adjustment. It discusses the general statistical issues arising from the balancing process including the use of supply/use or input/output tables, adjustments to other variables related to national accounts, and the effects on consistency with the annual figures and on the process of revision.

The chapter introduces multivariate mathematical and statistical techniques for adjustment and disaggregation. It also recommends that the organisational arrangements for balancing should include a work programme for introducing balancing procedures, a clear timetable allowing sufficient time to undertake thorough balancing, and information for the users of the statistics on the balancing process. The chapter is supplemented by two annexes. The first annex is a formal presentation of balancing by mathematical and statistical methods. The second annex describes a framework for the quarterly balancing process.

The balancing of quarterly accounts

Introduction

11.01. The balancing process is an integral and vital part of the methodology used for compiling the national accounts statistics. In its operation, the process attempts to make optimum use of the diverse range of information which is collected and used for deriving the national accounts. In broad terms, balancing seeks to fit the statistical data from the production, expenditure and income measures of GDP, and possibly financial accounts, into one or other of the theoretical frameworks (supply/use, input/output, sectors) which underpin the accounts. The end-product of the balancing process should be a fully articulated and balanced set of accounts, with a single, definitive estimate of GDP, and component series across the three measures which are fully consistent with this estimate. This chapter will look at some general principles and procedures of balancing, and also consider issues of particular relevance to balancing quarterly data. Some operational and related issues are also raised.

11.02. The way in which estimates of GDP and other national accounts components are made in practice will depend much on the range and quality of the information available. For example, very few countries have the full range of largely independent production, expenditure and income data, even annually. In the main, it would appear that annual GDP figures are compiled on the basis of production estimates, such information being fairly readily available from statistical surveys or administrative sources. Many countries also have annual expenditure data which, in addition to being of interest in their own right, will also be used in the determination of GDP. However, income data, perhaps mostly obtained from the administration of the tax system, are at present compiled in comparatively few countries. The range of financial information available also varies widely, but these data are usually collected only once a reasonable statistical system has been established for measuring the ‘real’ economy.

11.03. Generally speaking, quarterly information is less detailed and less accurate than annual data. This reflects, in part, a need to have some limit on the statistical burden on contributors, which should not to be overcharged with statistical obligations to compile basic statistics to be used in quarterly accounts, and also the less detailed requirements of the quarterly statistical system, in terms, for example, of level of breakdown. Having said that, some countries appear to be placing increasing emphasis, at least for some variables, on developing the quarterly information as the main data source for the accounts. Provided information is sufficiently reliable, this approach clearly avoids the problem of revisions.

11.04. Balancing can be undertaken in a number of ways. The most widely-used approach is based on the *industry/product framework of input-output both supply and use tables and the symmetric tables.* This methodology provides the means of establishing a definitive GDP figure and also consistent estimates of the component series, based on data collected from production, expenditure and income sources.

The balancing process may also be based on the framework of the *institutional sector accounts*, which bring together data contributing to the three measures of GDP with associated information on financial transactions.

It is also worth mentioning that partial balancing for particular commodities may be undertaken through the use of the *commodity flow approach*. However, where this approach is used to estimate demand from supply consistency between production and expenditure is achieved but the procedure is not strictly balancing.

Given the likely restricted availability of financial accounts data, particularly quarterly data, the main emphasis in this chapter will be on the use, for balancing, of the supply/use or input-output tables.

11.05. It should be stressed that it is by no means a prerequisite for balancing to have a comprehensive range of largely independently-estimated data. Indeed, it could be argued that the less the data available, the greater the need to try to include them into the structure of the accounts, if the data are reliable. Where data are scarce, the very fact that they should fit into the framework is a crucial piece of additional information which should not be ignored. It is very desirable, therefore, that some attempt is made to incorporate the information available within one of the particular frameworks of the accounts mentioned above. Such an approach will almost certainly improve the quality of the estimates, for both component series and the aggregates. Balancing should be undertaken for both current and constant price information, in order to provide an integrated and consistent set of accounts, and which, in doing so, also makes optimum use of the price data.

11.06. The issues of balancing which are relevant for annual data will also largely apply to the quarterly process. However, there are a number of other factors which affect what might be done quarterly.

One of the main points, as mentioned earlier, is that the range and quality of quarterly information which is available will generally be much less than for the annual estimates. As suggested above, arguably, this increases the need for bringing together all the available data within a known framework. At the same time, it will inevitably mean some simplification for the quarterly approach, such as a much less detailed input-output or sector accounts framework, compared with what is done annually, and quarterly balancing will, most generally, be undertaken only after annual balancing has been established.

A second important difference is that quarterly balancing can be undertaken for both unadjusted and seasonally adjusted data. The need to deal with these two sets of data, as well as current and constant price figures, and the greater statistical variability of the quarterly data, will all add to the time and operational complexity of the whole balancing process. However, as mentioned above, there will be some simplification in the detail of the process compared with the annual approach.

A third, related point which needs to be borne in mind is that timeliness is perhaps a more important part of the quarterly statistical round than it is for the annual figures.

11.07. Finally, it is useful to draw a distinction between two roles for the balancing process. The first role relates to balancing data for the current or latest quarter. The second role involves starting with established sets of balanced data for the four quarters of the year, and then making the quarterly figures consistent with firmer annual figures which become available. The introduction of these alignment adjustments is likely to require a re-balancing of the quarterly accounts. The bulk of the discussion in this chapter is really about balancing for the latest quarter, rather than about balancing subject to the constraints of annual figures. However, annual adjustment apart, the methodology corresponding to the two roles is the same. The issue of alignment is discussed in Chapter 10 on time consistency. The extension to retrospective balancing is considered in the present chapter in §11. 51-52.

Key principles of balancing

11.08. Mention was made earlier of certain principles which should underlie the balancing process to be used in the national accounts. These should apply equally to annual and quarterly data. Three important issues can be stated:

- First, as mentioned above, even though GDP may be estimated independently from production, expenditure and income sources, as available, there should be a single, definitive measure of economic activity.
- Secondly, once such an estimate has been established, the component information should be adjusted so that each of the separate production, expenditure and income measures is consistent with the overall GDP estimate. Put another way, the accounts should be fully balanced, with no statistical discrepancies or residual errors.
- The third principle is that, in order to achieve balance, all component series, and not just selected variables, should be subject to possible adjustment.

These principles are considered briefly in the paragraphs which follow.

11.09. On the first principle, it would clearly be very confusing to users and others to have more than one figure for GDP in the public domain. It is fair to say that there is probably little dispute with the idea of a single estimate of GDP. In practice, the definitive figure should be based on information from the production, expenditure and income measures, as available.

On the second principle, however, the extent of the adjustment procedure varies. For some countries, although a single GDP is established and figures for certain variables are adjusted, there is caution about eliminating completely the discrepancies in the separate measures, and residual errors or statistical discrepancies remain in the various estimates.

This practice is normally justified on grounds of not wishing to make too large changes to the basic data, and of not knowing where precisely any such adjustments might be made.

11.10. It is also often argued that such adjustments may be viewed as largely arbitrary and lacking transparency for users outside government. Further, large adjustments to figures may often be thought of as distorting the basic information which is actually collected and compiled. All this could have a major adverse effect on the public confidence which might be placed in the figures.

Finally, and of obvious importance, there are the practical aspects of balancing, whereby operational and timing difficulties may seem to preclude carrying out anything other than a simple adjustment procedure.

11.11. On the other hand, accounts which contain residuals and are not balanced and do not fit into the measurement framework might be seen as 'unfinished', with the discrepancies largely reflecting the general quality of the underlying data. It is hard to accept that such accounts can be seen as providing a consistent and comprehensive picture of what is happening in the economy. Thus, the basic statistics are not being used in the optimum way and the best service is not being provided to users, who expect the national accounts experts to derive estimates which accord with the framework of the accounts.

It should also be observed that the basic statistical information which is included in the balancing process has already undergone a number of not always firmly-based adjustments. For example, where administrative sources of data are used, it may be necessary to modify figures so that the definitions accord with those required for the national accounts. Within surveys, there is the need for imputation for non-response or the effect of statistical grossing. The further adjustments made within the balancing process may therefore be seen as the final stage in a continuum of statistical estimation, and it is logical for this to be carried through in its entirety to achieve full balance.

Not to balance fully therefore involves an arbitrary decision on where to draw the line.

11.12. It should be said that full balancing is certainly not a subterfuge for manipulating data in support of a particular viewpoint. There is clearly more opportunity to manipulate the interpretation of the data when different GDP measures are available (although the existence of more than one measure could equally be seen as a contribution to transparency in the compilation process). Suspicions which users may have on this score should be allayed by careful presentation of results. Moreover, any concerns which exist on the part of the collectors and compilers of the statistics should be dealt with by appropriate education. Some aspects of the issues of presentation and education are discussed at the end of this chapter. However, the main argument to be advanced is simply that full balancing will provide the best set of national accounts data, making best use of all the information available.

Where operational problems arise, compilers should attempt to overcome them as best as possible. Amongst other things, this will include ensuring that sufficient time is available for the vital process of balancing. The need for balancing should therefore be a key feature in the determination of the overall timetable for the production of the estimates, and not fitted in as best as can. Again, some issues are raised later (see § 11.70-11.71).

11.13. On the third principle concerning which variables are adjusted in the balancing process, again country practice varies. Where annual input-output tables are compiled, some countries tend towards unrestricted adjustment. In others, adjustment may be limited to a few of the less reliable variables, for example changes in inventories within the expenditure measure, and operating surplus within the income estimate. Occasionally, in respect of these two components, the variables may not even be measured, estimation being made simply as a residual from total GDP. The arguments put forward for restricting the adjustments to a few variables only are very much the same as those mentioned above in relation to the extent of the balancing process. In particular, there is the uncertainty about the magnitude of any adjustments, and also, with more variables being adjusted, the greater the complexity of, and the time needed for, the whole balancing process.

A further operational problem may arise in respect of information which is compiled and published outside the main national accounts production round. A particular example concerns the existence of monthly data of a quarterly series which may well be published before the overall balancing process can be undertaken. As such, these variables may need to be regarded as definitive and not adjusted in the balancing process. This issue is considered, further, later (see § 11.72-11.73).

11.14. Despite the various statistical and operational problems raised above, it is not considered adequate to restrict adjustments to a few series only. Such an approach will not provide the best estimates of aggregate and component series for the year or the quarter. Further, it will also mean that the time series of the one or two variables which are adjusted will not be very meaningful, since all the ‘errors’ in the variables not being modified will be incorporated, implicitly, in the estimates of those figures which are adjusted. It is recommended, therefore, that all variables should be considered for possible adjustment in the balancing exercise. It may be decided, for good reasons, that some variables are not adjusted, but all should be considered. The practical problems of following this approach are recognised and are not underestimated, but again attempts should be made to overcome them, for example by allowing more time for the balancing process.

11.15. There is one other point, relevant to both the consistency issue and the range of the adjustment process, which might be made. Given the complexity of data collection and estimation in the national accounts, whatever resources are used, there will always be inconsistency in the various measures. Thus, most generally, the basic figures will be unacceptable and there will be a need for some form of adjustment to them. If the principle of adjustment is accepted, then the issue would appear largely to be one of the extent to which it is carried out. Partial balancing leads to some improvement in the overall quality of the estimates. However, as argued above, estimates which are not fully balanced do not make best use of the available information and do not therefore provide the best representation of what is happening in the economy.

11.16. It will be useful to summarise the outcome of the consideration of the three main principles. It is recommended that, despite the practical and other problems mentioned earlier, the arguments are strongly in favour of a single figure for GDP, and for achieving complete consistency in the published accounts, with no statistical discrepancies, and with all variables subject to possible adjustment. Only this approach can provide the most meaningful set of economic data. The onus is on the compiling statisticians to use their expertise to see that this is done. A number of problems, both statistical and operational, will need to be overcome. Other matters to be addressed will include informing users about the balancing process and, most crucially, maintaining confidence in the estimates. Some of these problems are considered further below (see § 11.75-11.79).

Other main features of balancing

11.17. Before looking at the specific issues for quarterly balancing, it is necessary to consider a number of other features of the balancing process. These are presented largely as recommendations as to how balancing should, in principle, be pursued. However, as will be evident in what follows, the extent to which they can be incorporated within balancing practices in individual countries will depend very much on the availability of statistical and other information.

11.18. First, the balancing process for both total GDP and the component series should be based on the accuracy of the data included in the (quarterly) accounts. To consider a simple example, if it were thought that GDP estimated from the production side was twice as accurate as the expenditure estimate then, other things being equal, the weights of the two estimates in total GDP might be broadly in the ratio of 2:1. In practice, as will be discussed later, the estimation of GDP is not as simple as this, since balancing will need to be considered in the detailed framework of the accounts being used. As a result, the final figure for GDP may not be the same as this estimate, although the difference should only be small. A broadly similar accuracy-based approach can be adopted for all variables to be adjusted in the accounts. Thus, if, for example, household consumption was estimated less reliably than gross fixed capital formation, then it would carry a larger relative adjustment.

11.19. It will be useful to consider further this key aspect of the balancing process. It is well recognised that the proper derivation of accuracy measures of the national accounts data is an extremely difficult process, so complex that few countries have even approximate estimates. There are likely to be very few variables in the accounts where the only source of error is the conventional standard error deriving from statistical sampling. Indeed, for most variables, non-sampling errors, which could well lead to bias in the estimates, are likely to be more important than sampling errors.

11.20. Nonetheless, it is important to have some, albeit approximate, indication of the accuracy of the data going into the accounts. This is good statistical practice and serves purposes other than for the balancing process. Two other important uses, for example, are as a basis for deciding on sample sizes for the statistical inquiries used to collect data, and secondly as an aid to interpretation of the published statistics. These uses require some absolute measure of accuracy. Ideally, absolute estimates are also required for the balancing process, if only to ensure that adjustments do not fall below a certain level of accuracy.

As a second best solution, however, balancing can utilise a relative assessment of accuracy, for example, that household consumption is, say, half as accurate as gross fixed capital formation, without needing to know the specific accuracy of each variable. In the absence of any firm quantitative information, which will represent the usual position in most countries, estimates of accuracy should be pursued through discussion by compilers, who should make their best, judgmental assessment. By this means, it should be possible to form some broad consensus view on the relative accuracy for all parts of the account. Having this material as a basis for balancing is certainly better than having no information at all. The accuracy of data sources should be regularly assessed because of the potential for changes in the underlying generating processes, which can rapidly lead to a change in reliability.

11.21. It is worth making the point that revisions are often seen as a measure of accuracy in the national accounts. This is true to a certain extent but it is essentially in the context of how far the initial information represents a reliable estimate of the final figure. However, such measures do not reflect statistical accuracy, and the absence of revision to quarterly data, say because annual figures are just not available, is clearly no indication of the basic quality of the data. Perhaps the main role of revisions is in seeing whether initial estimates might be biased and, if so, making some adjustment to try to anticipate them. The issue of revisions is discussed in Part VI of this Handbook.

11.22. It should be noted that the issue of the accuracy of the data is also relevant to another aspect of the balancing process. As will be explained later, part of balancing involves making use of information based on the structure of economic activity provided by the latest annual input-output tables, for example what proportion of output might go to household consumption. It becomes necessary, then, to make an assessment of the likely accuracy of such 'structural' estimates against that of the directly-measured data for the current quarter.

11.23. A further important feature about balancing is that, as well as achieving balance in the levels of the variables for a particular quarter or year, it is also vital to consider the related growth rates of the variables. In other words, it would not be acceptable to balance data for, say, two successive quarters if the results showed estimates of growth between the two periods which differed greatly from the original figures or was otherwise implausible. Thus, accuracy estimates are also required for growth rates, and, again, adjusted data should not generally fall outside the specified accuracy range. The estimate of accuracy in changes can be derived in two ways. The first way is by statistical formulae based on estimates for the levels and the likely statistical correlation between levels data. The second way of doing this is a judgmental one similar to that for the levels, noting that some statistical relationship should exist between errors in levels and changes. Similarly, for a longer period of interest, it is crucial that the adjusted components are plausible as time series. Data in this form are important in their own right for economic analyses. In practice, the need to consider balancing as a three-dimensional, rather than a two-dimensional, process clearly adds to the complexity of the whole exercise.

11.24. Another point to be borne in mind is that the data used in the balancing process should, as far as possible, be free of measurement bias. Where such biases are thought to exist for example as a result of a less than complete coverage of statistical registers, or reflecting inadequate definitions of variables the basic figures should be adjusted before being incorporated in the balancing process. This issue is discussed further in relation to quarterly balancing in § 11.35.

11.25. The final feature to be identified is that, where possible, balancing should be undertaken, simultaneously, for both current and constant price data. In doing so, the methodology should incorporate the possibility of some adjustment to the component price information. In other words, the implied price series, derived from the ratio of the adjusted current to constant price data, are allowed to vary within reason from the original figures. In this way, not only are the current and constant price information made to fit into the framework of the accounts, but proper use is made of the available price data. Again, this is considered in more detail below, in relation to the quarterly balancing process, where there is the added complication of the existence of non-seasonally adjusted and seasonally adjusted data.

11.26. The principles discussed above largely apply to balancing of both annual and quarterly data. The chapter now goes on to suggest particular issues of, and procedures which might be followed for, quarterly balancing.

Issues and procedures for quarterly balancing

11.27. The main issue to be addressed arises from the fact that quarterly balancing can be undertaken for both non-seasonally adjusted and seasonally adjusted data. While the former provides the basis of the figures for compilation, the seasonally adjusted data are the much preferred form for interpretation and analysis. Thus, seasonally adjusted data should certainly be balanced. Further, it is also regarded as essential, in principle, to balance the non-seasonally adjusted estimates, thus providing a fully integrated and consistent set of data over the whole accounts. Indeed, for some countries the focus is more on balancing the non-seasonally adjusted data, largely because it represents the basic data, and is not affected by seasonal adjustment. However, balancing non-seasonally adjusted data raises a number of practical difficulties which are addressed below.

Meaningfulness of the set of quarterly figures to be balanced

11.28. The first issue is the need to have a meaningful set of quarterly figures which are to be balanced. For some variables, the figures appearing in the accounts will largely reflect administrative and other arrangements which exist for making payments. Three examples are interest payments, taxes on operating surplus, and recurrent taxes on land, buildings and other structures. Similar problems may arise where information is recorded on a cash, rather than an accrual basis. The question, given all this, is what constitutes a meaningful quarterly series.

11.29. The question has been considered in Chapter 3 on the accounting rules. In brief, for the seasonally adjusted series, for most variables it should be possible to establish an acceptable profile through the seasonal adjustment process. The problem of the meaningfulness of the quarterly figures relates, mainly, to the non-seasonally adjusted series.

In principle, with the exception of dividend payments and compensation of employees, all series, in both non-seasonally adjusted and seasonally adjusted form, should, as far as possible, appear on an accrual basis. Two possible solutions might be considered:

- in some cases, it will be possible to relate the variable of interest to an ‘explanatory’ variable. One example here would be to determine the quarterly non-seasonally adjusted profile for taxes on operating surplus by using the corresponding series of the operating surplus itself;
- where the first method is not possible, the quarterly non-seasonally adjusted series can be determined by some form of interpolation.

11.30. Partly reflecting the above, but also for other reasons, the non-seasonally adjusted quarterly figures will usually be somewhat more variable than their seasonally adjusted counterparts. Further, differences in the timing of the recording of the same transaction, and other deficiencies in quarterly recording, as discussed in Chapter 4, will be much more pronounced for unadjusted data than for the seasonally adjusted estimates, where seasonal adjustment will reduce the impact of regular timing differences.

The greater inconsistencies in the unadjusted, rather than the seasonally adjusted, data resulting from these two factors will be evident both within and between the production, expenditure and income measures. The timing issue and the other problems mentioned above are likely to mean that the non-seasonally adjusted quarterly series for GDP, based on the separate production, expenditure and income data, are likely to be significantly different. It is, however, necessary to determine the definitive non-seasonally adjusted quarterly GDP figure to which data are balanced.

11.31. A further potential problem with balancing quarterly non-seasonally adjusted data, which was touched on above, relates to the way in which information about the structure of economic activity of the previous year is used as a basis for making estimates for the current quarter. Reflecting seasonality, and other matters mentioned above, the assumptions needed for example, the allocation of an industry’s output to household consumption are likely to be rather more tenable for the smoother, ‘average’ seasonally adjusted quarterly estimates than for the erratic non-seasonally adjusted data. Thus much caution will be needed when using these data in the balancing process.

11.32. This particular problem will be most relevant in the first year in which quarterly balancing is undertaken. After this, it should be possible to establish firmer quarterly supply and use tables which can provide the framework for the ‘structural’ estimates which enter the balancing process. In other words, the estimates of non-seasonally adjusted data for a particular quarter made within the balancing process can, where appropriate, be based on the supply/use framework of the same quarter of a year earlier.

11.33. Another statistical feature of quarterly balancing relates to the need to achieve balance for both the seasonally adjusted and unadjusted data. If these data are balanced independently, it will be necessary to ensure that the (implied) seasonal factors, following balancing, do not depart too much from the original factors derived from the seasonal adjustment process for the individual series. This requirement may be regarded as analogous to that obtaining for current and constant price figures and prices. If balancing is undertaken, first, for non-seasonally adjusted data, the modified figures can then be seasonally adjusted, and the above requirement is no longer relevant.

11.34. It is clear from what has been said above that quarterly balancing of non-seasonally adjusted data is, potentially, a much more difficult process than balancing seasonally adjusted data, and special care will need to be taken with this part of the exercise. Nonetheless, as mentioned before, some countries place more emphasis on the balancing of non-seasonally adjusted, rather than seasonally adjusted data. One reason for preferring balancing unadjusted figures is that these represent actual data, and seasonal adjustment bring a degree of subjectiveness to the estimates.

The issue of the sequence of adjustments is considered further in § 11.41- 11.43.

11.35. One final issue needs to be raised. As mentioned in § 11.24, the data going into the balancing process should, as far as possible, be free from measurement bias. Unless this is achieved, the definitive estimate of GDP will not be a central estimate, while the balancing of, and estimation for, the component series will be less than optimal. For the component series, although balancing may be seen as a way of making some adjustment for bias, it is far preferable that the process should seek to allow only for statistical error.

11.36. In addition to these general points which have been made about bias, there is a specific matter relevant to the quarterly estimates. These estimates, as well as providing a short-period profile of economic activity, also serve as early estimates of the annual data. Thus, any bias evident in the quarterly figures will affect the initial estimates of the annual data. Where bias is thought to exist in the quarterly figures, adjustment factors should be applied to the quarterly data for the current year. These adjustments can be based on the long-run relationship between the annual and quarterly estimates, and on any other relevant information. In practice, the incorporation of such adjustments may also be seen as part of the procedure for aligning the quarterly and annual figures, with the former including any alignment factors which need to be projected into the future. The alignment procedure is discussed in Chapter 10, and the role of alignment in the balancing process is considered in § 11.51-11.52.

11.37. An important feature in the determination of bias is the evaluation of the pattern of revisions made to series arising from later data. The approach to monitoring and using revisions within the accounts and the policy for incorporating them in the published estimates are considered in Chapter 14. One particular feature is that balancing may lead to a revision to a particular component even though no new information has become available for that component. Some key points arising from quarterly balancing are mentioned briefly at the end of that chapter.

The quarterly balancing process

11.38. This section looks at how the key statistical and operational aspects, mentioned above, might impact, in practice, on the quarterly balancing process, including suggestions for the framework which might be used and how balancing might be undertaken. The discussion will be presented essentially in terms of balancing for the current period. Retrospective balancing is considered in § 11.51-11.52.

11.39. As mentioned in § 11.04, the most appropriate framework for the balancing process is provided by the structure of the input-output tables. These comprise either the separate supply and use tables, or the full symmetric product by product or industry by industry matrices. The symmetric matrices are generated from the supply and use tables, incorporating further assumptions about the structure of industries' consumption and production of goods and services. In practice, partly for this reason, it is suggested that quarterly balancing is undertaken through the supply and use matrices, rather than the symmetric input-output matrix. For the annual accounts, fairly detailed information on industries and products can be used in assembling the tables. However, reflecting a more restricted range of information, the framework to be used for quarterly balancing will need to be much more aggregated. The precise format will depend on the range of data available, and in the light of individual countries' needs, but the aim should be to use a matrix containing something of the order of 10-20 industries/products (a more disaggregated supply-use table is needed for constant prices than for current prices).The classification could be based on the single letter level of NACE Rev.1 (as with Classification A17 in Annex IV of ESA 1995), perhaps with some breakdown for manufacturing, which appears there as one industry, and also some distinction for capital goods (as in the Council Recommendation on Aggregations for Economic Analysis, No.96/162/EC of 8 February 1996). A balance will need to be struck between the greater homogeneity of a more detailed disaggregation and the resulting demands on data and the time needed for undertaking the work.

11.40. Annex B to this chapter provides an illustration of the kind of supply and use framework which might be used for quarterly balancing, but without proposing a specific industry classification, and explains how the component variables might be estimated. It is important to ensure that the various estimates going into the supply and use tables are properly and consistently valued.

The 'structural' information presented in Annex B may be regarded as applying to both current and constant price data, and also non-seasonally adjusted or seasonally adjusted figures. However, as mentioned earlier, care needs to be taken in using the annual structure of the input-output tables for balancing non-seasonally adjusted quarterly data. The format adopted for balancing can be readily modified to meet any specific individual countries' requirements, in the light of needs for statistics and data availability.

Steps of the balancing process

11.41. The first step in the quarterly balancing process should be to establish some indication of the likely level and growth of total GDP.

The separate bias-free information from production, expenditure and possibly income sources, as available, should be 'weighted' together to form a provisional, first estimate of definitive GDP. The weights for this purpose should reflect the compilers' judgement on the relative accuracy of the various measures. This can be undertaken for both current and constant prices, as required, and in relation to both levels and growth rates. The plausibility and consistency of the derived figures should be ensured as far as possible, perhaps also in comparison with qualitative indicators.

At this stage, the GDP estimate is to be regarded as a 'target' in the balancing process rather than a definitive figure. However, in the absence of any new data, the final estimates for total GDP made after the balancing process should not be too different from this provisional estimate.

11.42. A particular feature of quarterly balancing is the requirement to balance data in non-seasonally adjusted and seasonally adjusted form, as well as in current and constant prices. Full balancing thus requires four main data sets, as well as three supporting sets of information, covering the current and constant price seasonal factors, together with prices. The seven data sets, in full, are:

a. Current prices not seasonally adjusted;
b. Constant prices not seasonally adjusted;
c. Current prices seasonally adjusted;
d. Constant prices seasonally adjusted;
e. Current prices seasonal factors;
f. Constant prices seasonal factors;
g. Prices not seasonally adjusted.

11.43. Of these, the first four are to be balanced, with the information on seasonal factors and prices providing the 'link' between the various data sets. Data for the four main matrices can be assembled along the general lines outlined in the Annex 11 B, using largely independent sources and particular estimation methodologies.

It should be noted that the data set of prices included above relates to the original, non-seasonally adjusted data. Most prices are unlikely to be seasonal, and only a few like agricultural products will be strongly seasonal. However, it is for consideration whether a data set of seasonally adjusted price information should be established which would be appropriate to the relationship between the seasonally adjusted current and constant price estimates.

The balancing steps in practice

11.44. Although mention has been made earlier of the need to balance these matrices simultaneously, in practice some order to the process must be followed.

There are various arguments for and against each of the possible combinations of current/constant prices and non-seasonally/seasonally adjusted data. The main issues related to seasonally or non-seasonally adjusted data have been discussed in § 11.27-11.34.

In respect of the price dimension, the quarterly national accounts statistics will largely be based on current price information. Some direct measurement of constant price information will be possible as with volume measures of output, but more often estimates will need to be derived mostly by deflating the corresponding current price figures.

In practice, countries which undertake balancing adopt a variety of different approaches. For some, the starting point is the data set of current price, seasonally adjusted figures. For others, the emphasis is on the constant price, non-seasonally adjusted data. It is therefore not appropriate to recommend that balancing should be undertaken in a particular sequence. This decision should be left to individual countries in the light of the way they compile the accounts and depending on other issues at national level.

The key point is that, whatever sequence of adjustment is adopted, all four accounts (a to d in § 11.42) should be balanced. The description, here, of a possible balancing process will be based on the use of the current price, seasonally adjusted estimates (that is matrix c) as the starting point for balancing. The sequence for 'simultaneous' balancing might then run as described in the paragraphs which follow.

11.45. The initial balancing should be undertaken for the quarterly, current price seasonally adjusted figures. Once balance has been achieved, the balanced information should be deflated to yield a constant price seasonally adjusted array. This can be compared with the basic constant price seasonally adjusted figures (matrix d), from which a 'best' matrix of constant price seasonally adjusted is derived, based largely on the compilers' judgement.

The next step is to repeat the same procedures for the non-seasonally adjusted data. The whole process will yield four balanced and consistent matrices of national accounts data. These can be further examined for overall plausibility and further, expectedly small, adjustments made, as needs be. Some details of how the balancing might be achieved are set out below.

11.46. On the basis of the suggested framework and approach to data estimation set out in Annex 11.B, the first steps in the balancing process should be the comparison of:

i) the first preliminary estimate of GDP with the estimates implied by the data in the tables;
ii) the estimates of supply and use for each product;
iii) the outputs and inputs of each industry, if available.

A further set of relevant 'structural' information will be provided by making estimates of the components of use for each product. This will be done by breaking down the total use according to the pattern of demand shown by the supply/use framework, for both the latest year and also the same quarter of a year earlier.

11.47. The quarterly balancing process should probably focus on balancing supply and use for each product, that is item (ii) above. This will involve a close assessment of the levels and growth rates of the individual series and their relative accuracy. It is of relevance to note that, for the quarterly figures, estimates of growth are likely to be more reliable than that of levels.

Consideration will need to be given also to deflators and seasonal factors. Some judgement will also be necessary on the comparison between the directly-measured information and that which can be estimated from the latest input-output framework. The use of other information from this latter source, for example ratios of output to value added and of taxes and margins to supply, is also an important part of the whole process.

11.48. The balancing exercise, particularly if it extends over a number of days, should be an iterative process, moving in stages to a level of GDP and a fully reconciled set of data, and consulting with data suppliers at each stage. The process needs to take into account the various constraints and criteria which need to be satisfied. Balancing at a detailed level may lead to adjustments which will revise the level of GDP established, provisionally, at the outset. This is a legitimate part of the balancing procedure.

Key assumptions

11.49. In using supply and use tables for quarterly balancing, a number of key assumptions need to be made.

The main ones involve determining, for each quarter, the industrial structure of (i) production and (ii) intermediate consumption, which are used as a basis for deriving product data from the estimates made for industries.

A third, similar assumption relates to the ‘structural’ estimates of final use derived from the supply/use framework. In the absence of any other information or evidence to the contrary, the structures of production, intermediate consumption and final sales of the previous year can be taken as obtaining for each quarter in the current year. Since changes in these structure will generally occur relatively slowly, this is likely to be a broadly acceptable assumption. However, as mentioned above, such assumptions will be much less pertinent for non-seasonally adjusted data than for seasonally adjusted figures. The reason for this is that seasonality in production and consumption will mean that the quarterly structure of the non-seasonally adjusted figures will be different from the annual structure. For the non-seasonally adjusted data, it will be necessary to consider the supply/use table for the same quarter a year earlier.

11.50. There are other points to be made about an assumption of stable economic structure.

- First, as discussed in Chapter 3, there may be certain industries where the industrial mix of outputs and inputs may vary over quarters in a way which, ideally, should not be ignored, even for the seasonally adjusted data. Thus, in deriving the various product-based estimates, it may be necessary in some quarters to modify the proportion shown by the previous year’s tables.

- A second issue, also discussed in Chapter 3, is that the ratio of intermediate consumption to output may vary significantly over the quarters of the year. The electricity industry was mentioned as an example where this problem might arise. Again this may need to be taken into account in deriving the figures of intermediate consumption, based on estimated output, for each industry.

Retrospective balancing

11.51. The procedures discussed above will lead to four sets of balanced accounts for the four quarters of a year. However, some time after these accounts have been derived, firmer annual data will become available for some of the variables, and the quarterly estimates will need to be aligned to the new annual figures. If time consistency is achieved largely independently for each variable, then the individual quarterly accounts will, most probably, need to be re-balanced. This can be done in two ways:

- if the process of alignment does not involve large or many changes, then it should be possible to modify the quarterly data manually;
- however, the more likely situation is that there will be many changes, some of which will be large, and, ideally, a full re-balancing will need to be undertaken. In principle, retrospective balancing may be seen as the same process which has been discussed earlier, but with the additional constraint that quarterly totals add to the known annual figures.

11.52. The above largely describes the theoretical position. In practice, in the absence of a computer program which can undertake balancing and alignment simultaneously (see § 11.57), it will be necessary to rebalance the aligned quarterly estimates manually. Given the amount of work which might be involved, it is worth observing that the 'annual' exercise is probably far less time-critical than that for the 'current' quarterly balancing. The end-product of the work is a set of quarterly accounts which are fully time consistent with the annual data.

In carrying out this process, it should be noted that the framework used for quarterly balancing is likely to be more aggregated than that used for the annual data.

One final issue for consideration where supply and use tables are used for quarterly balancing is whether the symmetric input-output matrices are also compiled each quarter.

Alternatives to supply and use tables

11.53. The procedures described above rely on the availability of annual supply and use tables to provide the basis for, and the framework within which, balancing can be undertaken. If such tables do not exist, there are other possible courses of action.

The supply and use oriented procedure

11.54. The first and more likely course would involve some of the key stages of the methodology for the supply/use approach, as described above, but without the detail of the adjustment procedure. It may, for example, be possible to use the commodity flow approach for some commodities. The thrust of the approach might be built on the following two key stages:

- first, a figure for total GDP should be derived, by weighting together estimates from production, expenditure and income, as available;

- then, component data, at the aggregate level, for example household consumption, can be adjusted so that each of the (three) measures accords with the definitive GDP.

These adjustments are made by allocating the residual over these components, ideally in relation to their estimated accuracy. The approach can be undertaken for current and constant price data, and also non-seasonally adjusted and seasonally adjusted figures, again taking into account prices and derived seasonal factors. Clearly this approach lacks a definitive framework for the adjustment process and the ability to bring together and make consistent the detailed information on production and expenditure. However, in the absence of the supply and use information, it is certainly worth undertaking in some form or other.

The institutional sector oriented procedure

11.55. The second course would be to balance the estimates within the framework of the institutional sector analysis of transactions in products and the distributive and financial transactions.

Here, balance would be achieved at the level of the individual sector (or for the whole economy), through the two estimates of net borrowing/lending. These estimates are derived from, on the one hand, the production, expenditure and income data making up the production, distribution and use of income, and capital accounts, and on the other from the information on financial transactions. These estimates should be the same. In practice they are not the same, and balancing seeks to establish identity in the estimates derived from the two sources.

One way of proceeding would be first to establish a rough estimate for total GDP, as described above for the other methods, and also for net lending/borrowing, in the light of the accuracy of the two overall sets of financial and non-financial data. The various component series can then be adjusted to yield the net lending/borrowing figure (or something close to it). However, it is important that the adjustments lead to a derived measure of GDP which is not too far removed from the estimate established from the basic data. Again, the adjustments should be made on the basis of the relative accuracy of the component series.

It should be noted that this approach can be made only for current price data, since the financial information is not available at constant prices.

11.56. Two particular points should be made about this approach:

- there are certain disadvantages in endeavouring to balance data essentially on a figure of net lending or borrowing. Such a figure is the difference between various large numbers, and the errors in such data will feed through to the net balance. However, this concern will be largely mitigated by adherence to the constraint on GDP, as proposed above;
- the data requirements of such an approach are, if anything, more demanding than what is needed for the supply/use method.

Further, it is likely that, before setting up a system of financial accounts, countries will wish to have established a satisfactory basis for measuring the real economy. Thus, financial accounts are unlikely to be widely available quarterly. As a consequence, in practice, this kind of framework for balancing the accounts will generally be used in addition to, rather than instead of, the use of the input-output analysis.

Balancing techniques

11.57. There are various approaches which might be used for balancing, ranging from manual adjustment, through simple Random Allocation Sampling (RAS) techniques, to complicate mathematical procedures for dealing with large matrices. The manual approach relies, essentially, on the implicit judgement of the compiler to assess which particular series might be adjusted and by how much. The computerised methods will generally use a least squares estimation approach, perhaps subject to various constraints. The more sophisticated methodology might take into account the accuracy of the variables and incorporate correlations in the adjustment process, for example between dividends and interest receipts and financial flows.

Of the various techniques which have been used for balancing, one of the more recent is the approach which was undertaken, experimentally, in the United Kingdom before the use of annual input-output tables. The approach aimed to balance expenditure and income data on the one hand with financial data on the other, subject to certain constraints on aggregates.

The methodology is described in the United Kingdom publication "Economic Trends" No. 469, November 1992, which also provides references to literature describing other approaches.

11.58. As hinted above, one other point on the mechanics of balancing is whether a manual or computerised approach should be adopted. There are obvious benefits in the latter approach, particularly in reducing considerably the time needed for the work, and thus allowing more opportunity to examine and resolve problems with the data.

However, while computerisation might be possible for undertaking part of the balancing exercise, and to help with aspects such as graphics, it is unlikely that purpose-built software exists at present for carrying out the whole process. Thus, balancing will need to be undertaken manually, and the modus operandi of a systematic and iterative approach should be established. Although there should be a rigorous and objective basis for adjustment, the use of intuition and feel should certainly not be ruled out. Particular procedures will need to be developed in individual countries.

11.59. Where mechanical approaches are used, it is important that compilers scrutinise, very closely, the balanced figures and ensure that they are happy with the results. If adjusted figures look implausible, attempts should be made to find out why, and further, perhaps manual, adjustments made. One benefit of the manual approach is that it probably enables a better understanding to be obtained of the overall structure of the accounts and how they have been balanced. One possible procedure would be to have manual balancing for the initial stages, during which time most the large adjustments which might be necessary to the figure will have been made. Then mechanical balancing can be introduced for the final stage.

11.60. Before moving on, it is important to re-iterate the point that the procedures described above represent, essentially, the theoretical approach to the balancing process. Their implementation, in full or even part, will need to be undertaken over a number of years, and will require much experimental work. It is desirable that countries draw up work programs on how they propose to move towards implementation of the quarterly balancing approach. It is also important that experiences of the work are shared between countries.

Balancing by using mathematical and statistical methods

11.61. Mathematical and statistical methods offer a sophisticated but very practical instrument to be used in the balancing procedure. They can be used in the balancing process to carry out the final steps in order to obtain the balanced estimates.

The use of these methods shall be considered in the general balancing process. This means that an exclusively mechanical use of the techniques outside of the process described in the previous paragraphs makes no sense in the compilation of the accounts.

11.62. According to the theoretical mathematical and statistical methods presented in Chapter 6, the balancing problem can be considered as a problem of estimation subject to temporal and accounting constraints. From a formal point of view, one is interested in estimating a number of individual variables starting from variables which are aggregated over units and time. This problem can also be treated by involving a system of variables rather than a single variable.

11.63. Several techniques have been developed to carry out balancing according to the mathematical and statistical methods. Two classes can be distinguished:

a. methods that adjust multivariate preliminary estimates fulfilling the temporal and accounting constraints;

b. methods that use a set of quarterly indicators to obtain indirect estimates of the unknown aggregates.

Similarity to the univariate case presented in Chapter 6 is quite evident: the univariate two-steps method have their multivariate counterpart in (a), whilst optimal univariate methods correspond to (b).

In both classes, mathematical and statistical balancing techniques are conceived to obtain estimates that fulfil both temporal and accounting constraints. A formal presentation of mathematical and statistical methods which can be used in the quarterly balancing process will be found at Annex 11.A to this chapter.

Multivariate two-steps methods

11.64. The starting point of multivariate two-steps methods is that a set of preliminary estimates for the aggregates of an account is available. The aggregates are subject to an accounting constraint that the preliminary series do not fulfil (e.g., the preliminary estimates for the components of GDP on the demand side do not sum to GDP, whose estimate has been obtained, for example, starting from output sources). Each series satisfied the temporal constraints (when annual figures are available).

The problem consists then in distributing, according to a suitable criterion, the discrepancy between the quarterly preliminary values and the expected accounting quarterly constraint (often represented by a quarterly series).

As in the univariate case, the distribution is made by minimising a quadratic loss function according to the same approach proposed by Denton, extended to the multivariate case (see Annex 11.A for more details).

Multivariate optimal methods

11.65. As in the univariate case, the multivariate optimal approach supplies the estimates of a set of aggregates related by an account constraint according to a statistically optimal approach. The main idea is the same as in the univariate case: the related quarterly series are used in a multivariate regression model to obtain the estimation of the aggregate quarterly series with respect of both the temporal (versus the annual known aggregate series) and quarterly contemporaneous-accounting constraints (e.g. the constraint may correspond to the quarterly series of GDP).

The optimal multivariate estimation approach offers a natural and coherent solution to the interpolation, balancing and extrapolation problems.

11.66. The method derives from the univariate technique of Chow and Lin. Two different techniques have been developed, the difference being the structure of the error in the regression model. The two forms of the stochastic error process considered are:

- multivariate white noise;
- multivariate random walk.

The extrapolation is carried out according to the same principles of the univariate case: given the new values of the related series, the optimal nowcasts are directly obtained from the quarterly regression model.

Some organisational issues of the balancing process

11.67. The final part of the chapter looks at a number of other, non-statistical features of the balancing process, largely in response to some of the concerns which have been mentioned earlier. Some solutions are proposed to the problems raised, although the exact nature of what is done will depend very much on the circumstances obtaining in individual countries. The main issues are:

i) the general organisational arrangements for the carrying out balancing, including the involvement of compilers in the work;

ii) the need to accommodate the process in the general timetable for preparing the quarterly estimates;

iii) the education of users and others about the balancing process, including whether information on the adjustments should be made available outside the National Statistical Institute. Some other issues are also covered.

Organisational arrangements

11.68. On the organisational arrangements, the recommendation is to appoint a team dedicated to undertaking the balancing work. The precise nature of the responsibilities of the team should be made clear at the outset, in particular in relation to decisions about the way in which the adjustments are made. The team might undertake its work through a series of bilateral or wider discussions with compilers, in which issues related to their particular series and any possible adjustments can be considered. On the basis of these discussions, the team can assemble a further matrix of data, not necessarily fully balanced, but certainly exhibiting greater reconciliation than was evident in the initial estimates. This can then be discussed at a meeting of all interested parties. The meeting would seek to agree a final, balanced set of figures. Responsibility for final decisions on balancing, for example where there is disagreement about the size and location of adjustments, needs to be vested in one individual. As mentioned before, the whole process is essentially an iterative one, utilising, at each stage, the information available to try to form the optimum view of the overall economic position shown by the figures. In some cases balancing will be undertaken with a given set of data, in others new data may come to hand during balancing.

11.69. It is considered vital to use to the full the expertise of compilers in the balancing process. Their experience is crucial to the whole exercise, not only to improve the quality of the end-product, but also to enable them to get a wider perspective on the national accounts and how the economy is behaving. This enhanced knowledge should, itself, lead them to make improved estimates. Compilers should investigate particular problems which emerge at the various stages of the balancing process, discussing them, as appropriate, with the suppliers of the information, and seeking to achieve some resolution. Thus the suppliers, too, also have an important, perhaps indirect, part to play in the balancing round. This ‘consultative’ approach attempts to avoid simply taking information and adjusting it in a way with which compilers and suppliers would not necessarily agree and indeed may even wish to disown. However, it is useful for the national accountants to set quality standards for the information supplied to them, thereby reducing the burden on them of following up data problems with suppliers.

The quarterly timetable

11.70. One of the main practical issues is that the balancing process will be seen as, and almost certainly is, a potentially extremely time-consuming exercise, which is difficult to fit into an already tight quarterly timetable. Where balancing is not, at present, undertaken, or where it is present but it can be improved, there will be a natural reluctance to delay publication of statistics to accommodate the extra work. However, the introduction or enhancement of the balancing process, with the associated improvement to the statistics, should involve some re-appraisal of the whole timetable for compiling the figures. This will, almost inevitably, raise the conflict between timeliness and accuracy of the national accounts statistics. One factor which is often underestimated is that an enormous amount of resources goes into collecting, compiling and bringing together all the data which make up the estimates. Balancing will be a relatively small part of the whole statistical process, but its role in ensuring that the information is assessed and used in the optimum way is of much greater importance. It is considered imperative that adequate time for the balancing work is included in the compilation round. If existing timetables cannot be changed, then the time required for balancing should be found from some other stage in the estimation process.

11.71. Balancing should appear as one of the final actions in the quarterly timetable. However, there is much merit in undertaking a preliminary balancing exercise earlier in the timetable to allow time for the investigation of particular problems, rather than leaving everything to the final stages. The appropriate place in the timetable for this first, exploratory assessment will depend on the flow of data, including the timing of the availability of certain monthly data (see below). It will also be essential to ensure that a reliable set of data can be assembled to make the balancing process worth while, although a preliminary look at figures will seldom go unrewarded. Thus, the stage at which preliminary balancing might be undertaken, and also what precisely might be done, will be a compromise between, on the one side, providing sufficient time to investigate and resolve any problems and, on the other, the quality of the data.

11.72. A number of problems are likely to arise in respect of monthly data which form the quarterly estimates, or the quarterly figures themselves, where such series are collected and published separately from the quarterly national accounts timetable. Two possible examples of such series are the monthly statistics of overseas trade and of industrial production. In particular, the timing of the availability of the relevant series could mean that data for two months or even complete quarters may already have been published before the balancing process for the quarterly accounts is undertaken. The inclusion of such series in the balancing exercise could well lead to the series being revised in the quarterly accounts fairly soon after they had been published in their own right.

11.73. In endeavouring to resolve this problem, two main considerations should be borne in mind. First, if a high priority is given to minimising revisions to data, the information which has recently been published should be included in the national accounts in this same form. In other words, such data are regarded as definitive for the balancing process, with no adjustments to them permitted. If, on the other hand, revisions are thought to be less important, then the estimates, although already published, can be considered for possible adjustment, in the usual way, as part of the balancing process. If appropriate, revised figures for the series will appear in the published quarterly accounts.

11.74. Before deciding on a particular course of action, as suggested above, a re-assessment should be made of the whole quarterly timetable. Consideration of this particular problem will raise the issue of the timeliness of the monthly data and the quarterly national accounts estimates. Specifically, one question which might arise is whether it is necessary to delay the timing of publication of key monthly data to ensure that the estimates can be considered in the wider context of the full national accounts, and possibly be modified and improved. The solution to this problem must be left to individual countries, depending on the particular timing, availability and quality of the data. However, whatever timetable is adopted, it is desirable that, whenever national accounts data are published, be they monthly or quarterly figures, all the information available is assessed at the time of publication in order to determine the best estimates.

Education of users and presentational issues

11.75. Although balancing is only one part of whole estimation process, it is difficult to avoid it being regarded as a procedure of some special importance, with a special focus. This is likely to raise certain problems related to the need for, and nature of, the adjustment process, and also to the magnitude of the adjustments made.

11.76. One such problem is that the balancing process might be seen by some as a mean of manipulating the data, possibly at worst for political purposes. Such perceptions should be actively countered because they clearly put the whole statistical system into question. It is fundamental to the integrity of the national accounts statistics, indeed statistics generally, that users have confidence in the estimates and are adequately informed about the statistical processes. In respect of balancing, if there is a lack of understanding by users, it is a crucial responsibility of statisticians to explain clearly what is being done and the reasons why such adjustments are necessary. There should certainly be a document explaining why the adjustment process is needed and describing how it is undertaken. Information should also be disseminated through seminars and other formal and informal meetings. Incidentally, this mission to explain should not be confined just to users but should be extended to suppliers of data as well.

11.77. A second, in some ways related, issue is that users may wish to know the magnitude of the adjustments which are made as part of the balancing process. As was mentioned earlier in this chapter, balancing is essentially the final stage in what can be regarded as a continuum of adjustment needed to compile the national accounts. If an indication is required about the adjustments being made to data, it is arguable where to draw the line in the whole estimation process. Limiting the indication to the adjustments made during balancing is a convenient, though still arbitrary, decision. In reality, the provision of information of this kind does little more than indicate the quality of the data underlying the national accounts. It might be inferred that, the smaller the adjustments, the better the overall quality of the data. However, this will not be the case if, for example, the estimates contain larger adjustments which are made before the balancing process. Further, providing details of adjustments is tantamount to having the equivalent of two sets of national accounts data in circulation at the same time. Although the basis and other relevant features of the two data sets could be explained, it is inevitable that there would be misinterpretation or misuse of the information.

11.78. Given all these considerations, it does not appear that there would be much to be gained from making information on the balancing adjustments generally and widely available. However, it should be recognised that there is likely to be some value in restricted dissemination of the information. For example, compilers will benefit from discussions of the details of the balancing process with experts outside the National Statistical Institute. There is also the important consideration that, if information on the adjustments was denied totally, it is likely that suspicions would be aroused on the probity of the estimation process. It is suggested, therefore, that, in addition to giving such information to outside experts, it is also provided to meet strong and bona fide requests made by others. However, as far as possible, to limit potential misunderstanding, the material should be provided for personal rather than general use. All releases of such material should be accompanied by a short description on any key points related to the particular quarter, together with some indication of the accuracy of the data being adjusted.

Other

11.79. Finally and briefly there are a few other issues worth raising. To begin with, the balancing process has a number of important implications for the statistical system.

- One particular consequence is that regular balancing, with all series being reviewed, may lead to more revisions to data than hitherto. The revisions policy adopted will need to determine how this is to be dealt with.
- Secondly, it is vital to learn lessons from the balancing exercise about the general quality of the estimates. The process should include investigation into the main problem areas in the accounts, with reasons for inconsistencies being pursued.
- Further, attempts should be made to improve the quality of the basic information identified as weak by changes in collection or estimation practices.
- Finally, where balancing is being introduced for the first time, or major improvements are being made to existing practices, it will be very sensible to have a trial run of procedures before using the process to generate the published statistics. If possible, changes to time-tables might also be tested before being actually implemented.

Summary

11.80. It will be useful to bring together the main principles and issues related to balancing, as discussed in this chapter.

First, the four key general principles are:

i) there should be a single, definitive estimate of GDP (see § 11.09);

ii) full balancing should be undertaken, that is no statistical discrepancies should remain in the estimates (see § 11.09-11.12);

iii) all variables should be subject to possible adjustment (see § 11.13-11.14);

iv) quarterly balancing should be undertaken for current and constant price estimates, and also non-seasonally adjusted and seasonally adjusted data (see § 11.25, 11.44-11.45).

11.81. Secondly, there are a number of general statistical issues:

i) balancing of information on production, expenditure and income should be under-taken through the framework of the supply/use or input-output tables. It may also be possible to use the structure of the institutional sector accounts, incorporating, in addition, information on financial transactions (see § 11.04 and 11.39);

ii) the basic data included in the balancing process should, as far as possible, be free of measurement bias (see § 11.24 and 11.35);

iii) balancing for a given period also needs to take account of growth rates and the time series nature of the variables (see § 11.23);

iv) adjustments should be made not only to the basic national accounts variables, but also to the information on prices and seasonal factors (see § 11.25,11.33, 11.42-43);

v) adjustments should be based on the estimated accuracy of the component data, and should not generally fall outside the estimated error range (see § 11.18-11.20);

vi) the appropriateness of the information included in the balancing process which based on the previous year's framework needs to be carefully assessed, particularly for the non-seasonally adjusted data (see § 11.22, 11.31-11.32, 11.49-11.50);

vii) quarterly balanced matrices should be made consistent with the firmer annual data (see § 11.51-11.52);

viii) the introduction of balancing may necessitate some modification of the policy on revisions (see § 11.79).

11.82. Thirdly, the main operational issues are:

i) countries should draw up a work programmes on the introduction of quarterly balancing procedures (see § 11.60);

ii) arrangements and responsibilities for the balancing work should be clearly established, with the compilers having a key role (see § 11.68-11.69);

iii) the balancing process is a complex operation and sufficient time must be allowed for it in the quarterly timetable (see § 11.70-11.74);

iv) the need for and nature of the balancing process must be clearly communicated to users (see § 11.75-11.78);

v) major changes to procedures should be trialled before being formally introduced (see § 11.79).

CHAPTER 11 - Annex A

BALANCING BY USING MATHEMATICAL AND STATISTICAL MODELS

Balancing by using mathematical and statistical models

A formal presentation

11.A.01. Following the notation of the annex to Chapter 6, detailed consideration is given here to the mathematical approach to the disaggregation and extrapolation problems in the multivariate context of the balancing problem.

To be estimated are *M* unknown $(N \times 1)$ vectors of quarterly data, $\mathbf{y}_j$, j=1...,M, each pertaining to one of *M* basic (i.e. disaggregated) time series which have to satisfy both contemporaneous and temporal aggregation constraints.

11.A.02. The solution of this problem entails consideration of a number of procedures that, as in the single variable case, can be characterised as either *pure adjustment* or *least-squares optimal*. The information set common to both cases is given by the following *M+1* aggregated vectors:

- $\mathbf{z}$, $(N \times 1)$ vector of quarterly contemporaneously aggregated data;
- $\mathbf{y}_{ja}$, J=1,...,M, (nx1) vectors of annual data.

11.A.03. Consider the two distinct situations:

a. *M* preliminary quarterly time series, $\mathbf{p}_j$, , $j = 1, \ldots, M$, are available, Where $\sum_{j=1}^{M} \mathbf{p}_j \neq \mathbf{z}$ and/or $\mathbf{B}\mathbf{p}_j \neq \mathbf{y}_{ja}$;

b. a set of quarterly related indicators is used to obtain indirect estimates of the *M* unknown time series.

The distinction is not necessarily as strict as it seems, in that preliminary quarterly series could have been individually obtained by using related indicators.

11.A.04. Assuming that each basic series satisfies a multiple regression relationship with a number of known related indicators, a least-squares optimal solution, consistent with the aggregation constraints, can be obtained. This approach will be developed by discussing some specific error covariance pattern.

Consider the $[(\mathrm{N}+n\mathrm{M})\times 1]$ vector

$$\mathbf{y}_0 = \begin{bmatrix} \mathbf{z} \\ \mathbf{y}_a \end{bmatrix}$$

where

$$\mathbf{y}_a \begin{bmatrix} \mathbf{y}_{1a} \\ \mathbf{y}_{2a} \\ \vdots \\ \mathbf{y}_{Ma} \end{bmatrix}$$

The following accounting constraints hold:

$$\sum_{j=1}^{M} \mathbf{y}_j = \mathbf{z},$$

$$\mathbf{B}\mathbf{y}_j = \mathbf{y}_{ja}, \quad \text{j=1,...,M.}$$

The complete set of constraints between the series to be estimated and the available aggregated information can be expressed in matrix form as

$$\mathbf{H}\mathbf{y} = \mathbf{y}_0$$

where

$$\mathbf{H} = \begin{bmatrix} 1'_M & \otimes \mathbf{I}_N \\ \mathbf{I}_M & \otimes \mathbf{B} \end{bmatrix} = \begin{bmatrix} \mathbf{H}_1 \\ \mathbf{H}_2 \end{bmatrix},$$

$\mathbf{1}_M$ is a $(\mathrm{M}\times 1)$ vector, all elements of which are equal to unity and

$$y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_\mathrm{M} \end{bmatrix}.$$

11.A.05. Note that the contemporaneous aggregation of temporally aggregated series implies

$$\sum_{j=1}^{M} \mathbf{y}_{aj,t} = \sum_{i=1}^{4} \mathbf{z}_{4(t-1)+i} = \mathbf{z}_{a,t}, \quad \text{t=1,...,n,}$$

and then, given this relationship between the *M+1* aggregated vectors, matrix **H** has rank $r = \mathrm{N} + n(\mathrm{M}-1)$, n aggregated observations being redundant.

Multivariate adjustment

11.A.06. Suppose we have M preliminary series, $\mathbf{p}_j\ 1,\ldots,M$, that need to be adjusted in order to satisfy the accounting constraints. This has to be accomplished by distributing the discrepancies

$$\mathbf{z} - \mathbf{H}_1\mathbf{p}$$

and

$$\mathbf{y}_0 - \mathbf{H}_2\mathbf{p},$$

where

$$\mathbf{p} = \begin{bmatrix} \mathbf{p}_1 \\ \vdots \\ \mathbf{p}_j \\ \vdots \\ \mathbf{p}_M \end{bmatrix},$$

according to some reasonable criterion. In the following we deal with two multivariate adjustment procedures: (i) proportional adjustment; (ii) Denton's multivariate adjustment.

11.A.07. The proportional adjustment procedure is very simple and widely used, although less generally applicable than the Denton method, because it assumes only contemporaneous constraints have to be fulfilled (that is, $\mathbf{Bp}_j = \mathbf{y}_{aj}$, j=1,...,M).

11.A.08. A simple and fairly reasonable way to eliminate the discrepancy between a contemporaneously aggregated value and the corresponding sum of disaggregated preliminary quarterly estimates consists in distributing such a discrepancy according to the weight of each single temporally aggregated series with respect to the contemporaneously aggregated one.

11.A.09. Denton's multivariate adjustment generalises the univariate procedure shown in § 6.A.13 by taking into account some technical devices about (i) the treatment of starting values (Cholette, 1984, 1988) and (ii) the nature of the accounting constraints.

Multivariate optimal estimation

11.A.10. If there exists a set of quarterly indicators related to the unknown disaggregated series, it is possible to specify M regression models

$$\mathbf{y}_j = \mathbf{X}_j\beta_j + \mathbf{u}_j, \text{ j=1,...,M}$$

with

$$\mathrm{E}(\mathbf{u}_j) = 0, \qquad \mathrm{E}(\mathbf{u}_i\mathbf{u}_j') = \mathbf{V}_{ij}, \quad \text{i,j=1,...,M},$$

where, $X_j, j = 1, \ldots, M$, are $(\mathrm{N} \times \kappa_j)$ matrices of related series. The M models can be grouped as follows:

$$\begin{bmatrix} \mathbf{y}_1 \\ \mathbf{y}_2 \\ \vdots \\ \mathbf{y}_M \end{bmatrix} = \begin{bmatrix} \mathbf{X}_1 & 0 & \cdots & 0 \\ 0 & \mathbf{X}_2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \mathbf{X}_M \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_M \end{bmatrix} + \begin{bmatrix} \mathbf{u}_1 \\ \mathbf{u}_2 \\ \vdots \\ \mathbf{u}_M \end{bmatrix},$$

or, extending the notation used in § 11.A.05,

$$\mathbf{y} = \mathbf{X}\beta + \mathbf{u}$$

where $\mathrm{E}(\mathbf{u}) = 0$ and, $\mathrm{E}(\mathbf{uu'}) = \mathbf{V} = \{V_{ij}\}$, i,j=1,...,M.

11.A.11. The observed, aggregated regression model is given by:

$$\mathbf{y}_0 = \mathbf{X}_0\beta + \mathbf{u}_0$$

Where $\mathbf{X}_0 = \mathbf{HX}$. The aggregated disturbance vector, $\mathbf{u}_0 = \mathbf{Hu}$, has zero mean and singular covariance matrix $\mathrm{E}(\mathbf{u}_0\mathbf{u}_0^{'}) = \mathbf{V}_0 = \mathbf{HVH'}$.

11.A.12. The quarterly estimates can be obtained as a solution of a linear prediction problem in a generalised regression model with singular covariance matrix (Di Fonzo, 1990):

$$\hat{\mathbf{y}} = \mathbf{X}\hat{\beta} + \mathbf{L}\left(\mathbf{y}_0 - \mathbf{X}\hat{\beta}\right),$$

$$\hat{\beta} = \left(\mathbf{X}_0^{'}\mathbf{V}_0^{-}\mathbf{X}_0\right)^{-1}\mathbf{X}_0^{'}\mathbf{V}_0^{-}\mathbf{y}_0,$$

$$\mathrm{E}\left[(\hat{\mathbf{y}} - \mathbf{y})(\hat{\mathbf{y}} - \mathbf{y})'\right] = (\mathbf{I}_N - \mathbf{LH})\mathbf{V} + (\mathbf{X} - \mathbf{LX}_0)\left(\mathbf{X}_0^{'}\mathbf{V}_0^{-}\mathbf{X}_0\right)^{-1}(\mathbf{X} - \mathbf{LX}_0)',$$

With $\mathbf{L} = \mathbf{VH'}\,\mathbf{V}_0^{-}$, where $\mathbf{V}_0^{-}$ is the Moore-Penrose generalised inverse of the singular matrix $\mathbf{V}_0$. The above relationships are natural extensions of the optimal univariate counterparts worked out by Chow and Lin (1971).

11.A.13. In practice, matrices $\mathbf{V}_{ij}$ are unknown and must be estimated according to proper assumptions on the $\mathbf{u}_j\,'s$. Two cases seem to be interesting from both a theoretical and a practical point of view: (i) multivariate white noise; (ii) multivariate random walk.

11.A.14. In the multivariate white noise case we assume

$$\mathrm{E}\left(\mathbf{u}_i\mathbf{u}_j^{'}\right) = \sigma_{ij}\mathbf{I}_N, \qquad i, j = 1, \ldots, M,$$

$$\mathrm{E}(\mathbf{uu'}) = \sum \otimes \mathbf{I}_N, \qquad \sum = \{\sigma_{ij}\}.$$

The elements of $\sum$ can be estimated using the ordinary least squares residuals of the temporally aggregated regressions $\mathbf{y}_{aj} = \mathbf{X}_{aj}\beta_j + \mathbf{u}_{aj}$. Furthermore, in this case the inversion of $\mathbf{V}_0 = \mathbf{HVH'}$ can be notably simplified: by a suitable partition of $\mathbf{V}_0$, only a $[(\mathrm{M}-1)(\mathrm{M}-1)]$ matrix needs to be inverted (Di Fonzo, 1990).

11.A.15. The multivariate random walk case is a straightforward generalisation of the univariate approach of Fernàndez (1981). This model is based on the following assumptions:

$$u_t = u_{t-1} + \varepsilon_t, \quad t = 1, \ldots, \mathrm{N},$$
$$u_o = O, \quad \mathrm{E}(\varepsilon_t) = O,$$

$$\mathrm{E}\left(\varepsilon_r\varepsilon_s^{'}\right) = \begin{cases} 0 & if\ r \neq s \\ \sum & if\ r = s' \end{cases} \quad r, s = 1, \ldots, \mathrm{N},$$

where $\mathbf{u}_t$ and ε_t are $(\mathrm{M}\times 1)$ contemporaneous disturbances vector. These assumptions imply $\mathrm{E}(u_t) = 0$ and $\mathrm{E}\left(u_r u_s^{'}\right) = \sum \bullet min(r, s)$, that is $\mathrm{E}(\mathbf{uu'})$, where $\sum$ can be estimated as in the multivariate white noise approach.

Extrapolation

11.A.16. When $N > 4n$ we need to estimate data for which the relevant temporally aggregated values are not available. In this case it has to distinguish whether the contemporaneously aggregated information is or is not available. In the former case we talk about *constrained extrapolation* while in the latter we have a *pure extrapolation* problem. In both cases we look for the best linear unbiased estimator of

$$\mathbf{y}_{j,4n+i} = \mathbf{X}_{j,4n+i}\beta_j + \mathbf{u}_{j,4n+i}, \quad J=1,...,M, \quad i=1,...,r,$$

where $\mathbf{X}_{j,4n+i}$ is a $(\kappa_j \times 1)$ vector of the K_j related indicators for the *j*-th series at time *4n+i* and $u_{j,4n+i}$ is a zero mean unobservable random error.

11.A.17. In the pure extrapolation case the parameter vector need not be re-estimated, the extrapolation being given by a straightforward multivariate generalisation of the univariate solution shown in § 6.A.26.

11.A.18. If a contemporaneously aggregated series is available, the complete set of estimates must instead be re-calculated (Di Fonzo, 1990).

A framework for quarterly balancing

11.B.01. The aim of the balancing process outlined here is to endeavour to fit all the estimates, made from the production, expenditure and income measures, as available, into the supply and use framework. This annex provides an example of an outline framework which might be

CHAPTER 11 - Annex B

A FRAMEWORK FOR QUARTERLY BALANCING

used for the balancing exercise, and describes how the basic estimates might be made for balancing.

11.B.02. An illustration of the kind of supply/use table which might be used for balancing is shown at the end of this annex. It is the standard presentation, although the number of industries/products used, about 10-20 is suggested, will need to be determined within the framework of the classifications set out in ESA 1995. The way in which the initial estimates might be derived is outlined below. The letters relate to the matrices or vectors of data, as identified in the framework. The brief description in this annex can, in principle, be applied to any one of the data sets current or constant prices, and non-seasonally adjusted and seasonally adjusted data but with appropriate modification for the particular form of presentation and availability of data. As mentioned in the main text, it will be necessary to ensure the meaningfulness of the non-seasonally adjusted data. Finally, all values should be measured in accordance with the ESA 1995 recommendations (i.e.. basic prices for outputs, purchasers' prices for inputs, free-on-board for internationally traded goods) to ensure that they are consistent.

A. Matrix of estimates of domestic production

The column vector of estimates for output for individual industries can be based on quarterly data on output or sales, or other sources. The product composition for each industry can then be estimated using the structure of the annual domestic production matrix and summed across all industries to yield the row of product totals. Note that there may be problems in using the annual matrix for estimation for non-seasonally adjusted data. If possible, the matrix for the same quarter a year earlier should be used.

B. Matrix of estimates of intermediate consumption

The column vector of estimates of purchases by individual industries can be made by applying an estimate of the ratio of intermediate consumption to gross output to the figures of output estimated for matrix A. The product composition for each industry can then be estimated using the structure of the annual intermediate consumption matrix and summed across all industries to yield the column of product totals. Again, there may be problems in using the annual matrix for estimation for non-seasonally data, and use should be made of the quarterly matrix of a year earlier.

C. Vector of estimates of final consumption of households and NPISHs

D. Vector of estimates of final consumption of general government

E. Vector of estimates of gross fixed capital formation

F. Vector of estimates of changes in inventories

G. Vector of estimates of exports of goods and services

H. Vector of estimates of imports of goods and services

I. Vector of estimates of trade and transport margins

J. Vector of estimates of taxes less subsidies on products

Estimates, by product, for all the above variables should be derived by a mixture of actual quarterly data and estimation, possibly using the annual supply/use table. The meaningfulness of some of the non-seasonally adjusted information may need to be examined.

K. Vector of estimates of value added

These estimates, by industry, which ideally should come from the income measure of GDP, are unlikely to be available on a quarterly basis. However, balancing can still be undertaken without them, though clearly, if they exist then they should be used.

11.B.03. The framework requires that the estimates satisfy two identities. These are:

- for each product:

Total supply (A+H+I+J) = Total use (B+C+D+E+F+G);

- for each industry:

Total inputs (B+K) = Total outputs (A).

Also note that, in aggregate, GDP at market prices is derived from the matrix or vector totals as follows:

- Production A-B+J;
- Expenditure C+D+E+F+G-H;
- Income K+J.

Table 11.B.1: Supply/Use table

	PRODUCTS	INDUSTRIES	H/H + NPISH	Govt.	GFCF	INV	Exports	Σ
PRODS		B	C	D	E	F	G	U_1 $\vdots$ U_N
INDS	A							O_1 $\vdots$ 0_M
Val Add.		K						
Imports	H							
Margins	I							
Net taxes On products	J							
Σ	$S_1 \ldots S_N$	$I_1 \ldots I_M$						

- For each product

  Supply (S=A+H+I+J) = Use (U=B+C+D+E+F+G)
- For each Industry

  Inputs (I=B+K) = Outputs (0=A)

GDP (**Production**) = A-B+J

GDP (**Expenditure**) = C+D+E+F+G-H

GDP (**Income**) = K+J

An example of balancing exercise

11.B.04. The following example highlights the application of the balancing principles in the context of an input-output table. The components of the three approaches are involved in the exercise whose aim is to obtain a single estimation of the GDP.

11.B.05. The hypotheses are as follows:

a) The following figures have not to be adjusted (they are considered as reliable and fixed and they are put in bold in table 11.B.02):

- Industry output (total);
- Net taxes on products;
- Imports;
- Other net taxes on production;
- Exports;
- Government consumption.

b) In this example, the adjustment of the single items should be made according to the following rules:

- Income component: roughly proportional to the size of item.

Table 11.B.2: Original data

<table>
<tr><th colspan="2" rowspan="2"></th><th colspan="3">Products</th><th rowspan="2">INDS</th><th rowspan="2">H/H + NPISH</th><th rowspan="2">Govt.</th><th rowspan="2">GFCF + INV</th><th rowspan="2">Exports</th><th rowspan="2">Σ</th></tr>
<tr><th>P1</th><th>P2</th><th>Σ</th></tr>
<tr><td rowspan="3">Products</td><td>P1</td><td></td><td></td><td></td><td>120</td><td>50</td><td>10</td><td>10</td><td>40</td><td>230</td></tr>
<tr><td>P2</td><td></td><td></td><td></td><td>180</td><td>70</td><td>10</td><td>25</td><td>40</td><td>325</td></tr>
<tr><td>Σ</td><td></td><td></td><td></td><td>300</td><td>120</td><td>20</td><td>35</td><td>80</td><td>555</td></tr>
<tr><td colspan="2">INDS</td><td>200</td><td>300</td><td>500</td><td></td><td></td><td></td><td></td><td></td><td>500</td></tr>
<tr><td colspan="2">Net taxes on products</td><td>10</td><td>5</td><td>15</td><td></td></tr>
<tr><td colspan="2">Compensation of employees</td><td></td><td></td><td></td><td>110</td></tr>
<tr><td colspan="2">Operating surplus</td><td></td><td></td><td></td><td rowspan="2">60</td></tr>
<tr><td colspan="2">Mixed Income</td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Other net taxes on production</td><td></td><td></td><td></td><td>10</td></tr>
<tr><td colspan="2">Imports</td><td>40</td><td>25</td><td>65</td><td></td></tr>
<tr><td colspan="2">Σ</td><td>250</td><td>330</td><td>580</td><td>480</td></tr>
</table>

- Expenditure components; absolute adjustment in ratio; households consumption 2, GFCF 1, inventories 2.
- Output components: proportion: P1 38%, P2 62%.

c) the final estimates of GDP according to the three approaches must be the same.

d) the adjustment has to be made with whole numbers.

The balancing procedure

11.B.06. According to the figures displayed in table 11.B.2 and 11.B.3, the three approaches to the GDP give the following results:

a) output approach: GDP = 215
b) expenditure approach: GDP = 190
c) income approach: GDP = 195

11.B.07. According to § 11.41, the final estimation of GDP can be obtained by fixing the level of GDP as the average of the figures derived from the three approaches, that is (215+190+195) = 200.

In order to achieve this result, the following discrepancies should be distributed:

a) output approach: -15
b) expenditure approach: +10
c) income approach: +5

Table 11.B.3: Balanced data

		Products			INDS	H/H + NPISH	Govt.	GFCF + INV	Exports	Σ
		P1	P2	Σ						
Products	P1				126	52	**10**	12	**40**	240
	P2				189	72	**10**	29	**40**	340
	Σ				315	124	**20**	41	**80**	580
INDS		200	300	**500**						**500**
Net taxes on products		**10**	**5**	**15**						
Compensation of employees					113					
Operating surplus					62					
Mixed Income										
Other net taxes on production					**10**					
Imports		**40**	**25**	**65**						
Σ		240	340	580	500					

xxx data modified during the balancing procedure.

CHAPTER 12

THE TREATMENT OF THE CURRENT OBSERVATIONS

This chapter makes some recommendations concerning the estimation of the quarterly values of the aggregates during the current year and the estimation of the first release of the annual value starting from the quarterly figures.

The first part of this chapter deals with some considerations about timing, reliability and dissemination policy concerning the estimates for the quarters of the current year.

The production of the first estimate for the fourth quarter gives the ability to sum the four quarters to obtain a preliminary estimation of the annual national accounts figures. This chapter considers the three possible scenarios for using current observations: the model of directly summing the four quarters and revising the quarters later when annual data are available, the model of simultaneously estimating the fourth quarter and the annual accounts, and the model of producing separate annual and quarterly accounts, then reconciling them. The chapter identifies the potential traps involved and the ways in which adjustments can be made to ensure that the estimation process produces a best unbiased estimate for the year. The recommended approach is that quarterly data should be directly summed to produce a preliminary estimate for the year. The discussion takes account of the time consistency process discussed in Chapter 10.

The treatment of the current observations

Introduction

12.01. One of the main requirements for quarterly accounts is consistency with annual accounts. This subject has been extensively discussed in Chapters 10 and 11. This chapter will discuss the problems associated with the estimations of quarterly data during the current year and also the preliminary estimates of annual figures. The relationships between quarterly and annual estimates of national accounts figures are crucial ones in the process of compilation of quarterly accounts.

12.02. This problem is clearly explained in ESA 1995, § 12.06. In this paragraph, after the introduction of the concept of time consistency, the problem of time priority between quarterly and annual estimates is presented as follows: “However, for the current year there is a problem of time priority between quarterly and annual data as quarterly data are normally available earlier than the annual figures”.

12.03. The estimates during the current year constitute the most relevant information for decision-makers concerned with the design of short-term economic and monetary policies. These estimates also play an important role in the context of short-term analysis and forecasts. These considerations justify the relevance of the topics discussed in this chapter. Since, quarterly figures are estimated during the current year without any time constraint, they can be considered as extrapolations until the availability of the new annual estimates. Starting from this consideration, the compilers have to solve two related problems:

- how to produce good quality estimates for the quarters during the current year;
- how to identify the best preliminary estimates of annual figures.

The estimation of the current quarters

12.04. In compiling the figures related to the current quarters, that is the quarters of the current year, all the available information has to be introduced into the estimates to have a correct picture of the economic situation unless of course, it is bad quality information that can lead to biased results.

In many cases compilers and some users prefer to provide quite smoothed figures in order to reduce the variability between quarters. The risk with this solution is that some new features are treated as outliers and will be eliminated, which does not contribute to a good representation of the real economic situation. Using this approach when annual independent estimates are available, it is necessary to make more adjustments than in the case in which the data are not particularly smoothed. It might be useful to observe that, even if the figures are correct on annual basis, the quarterly path can appear too smoothed and not so informative for short-term purposes. There is a balance to be struck: erratic movements in series caused by errors in data also do not give a good picture of econometric conditions.

12.05. Some recommendations to improve the quality of the current estimates can be made as follows:

- cross-check the information set with all the external information judged useful by the compilers;
- use personal knowledge of the economic situation in order to make some corrections or modifications to the preliminary estimates;
- use past experience to improve the level of accuracy of the current estimates.

12.06. The first recommendation is discussed in some details in Chapter 13 in the context of the validation process. It is important to note that some external variables, like those in qualitative surveys, include some elements of anticipation that commonly-used basic statistics do not have. This recommendation accordingly deserves particular attention.

12.07. The use of personal knowledge and judgement has been discussed in Chapters 5 and 11. If correctly used, these can be very useful. However, too much reliance on them can have undesirable consequences for the current estimates.

12.08. Past experience may be synthesised by the revision process. If the analysis of this process reveals some stochastic regularities, it is possible to use these to correct the current estimates. This issue will be discussed more in Chapter 15.

12.09. One important problem related to the accuracy of the current estimates concerns the strategy of dissemination which countries adopt. The timetable of publication and the number of releases for each quarter depend on the characteristics of the information set and on the external constraints imposed on National Statistical Institutes. For these reasons, the situation is very different between countries. Harmonisation is difficult here because so many factors are involved. Nonetheless, a number of recommendations can be given to EU Member States as well as to others who wish to use this handbook.

12.10. **Recommendation**

In order to obtain timely information of good quality within the timetable of Annex B of the ESA 1995 Regulation, the recommendation is to publish two estimates per quarter. The first estimate should be the flash estimate (further discussed in Chapter 16) concerning GDP and its main expenditure aggregates. The second estimate should follow the ESA 1995 Annex B timetables concerning the complete system of accounts, including, when possible, the additional voluntary tables.

Additional restrictions concerning flash estimates may be added: for example, it is possible to decide to publish seasonally adjusted data, volume data and seasonally adjusted data in volume. National Statistical Institutes can define the optimal combination of data to be published in the first release taking into account all the relevant needs of the users.

Concerning Annex B of the ESA 1995 Regulation, which also provides the legal framework for quarterly accounts, one remark seems helpful at this point. The timetable of Annex B, in which the delay for supplying Eurostat with quarterly figures is fixed at 120 days after the end of the quarter, must be interpreted as a maximum limit. Past experience demonstrates that a large majority of countries can provide quarterly figures earlier.

The estimate of the preliminary annual figures

12.11. When the year is finished, the National Statistical Institutes have to decide on the publication date for the preliminary annual figures, the method to estimate them and also the number of releases during the year. It may be useful to remember that all the estimates produced before the end of the year must be considered as forecasts and, for this reason, fall outside the scope of this handbook.

12.12. All possible solutions to these problems depend essentially on three not necessarily independent factors:

- the degree of independence between the information sets used in compiling quarterly accounts and those used for annual accounts;
- the number of releases which are planned for year *t* during year *t+1*;
- the requirements of key users.

In this chapter, the focus of attention will be on the first two points since the third one is independent of any statistical consideration.

12.13. The degree of independence is, in some cases, inversely correlated with the rapidity of annual estimates. It is clear that, in many cases, the publication of earlier estimates for the year must be based on the information coming from quarterly accounts. On the other hand, if the annual estimates are available with a short delay, these estimates need to be corrected once additional information, defined only on an annual base, becomes available. Clearly, quarterly information is available earlier than the annual one. In particular, after the end of the year information is already available concerning the first quarters that can be used in obtaining a good estimate for the year. This is the case with the first estimate for the year *t* actually published by Germany in January of year *t+1*.

12.14. The number of releases planned during the year *t+1* for the year *t* may vary considerably between countries. The differences are determined by the peculiarities of the various information systems and also by policy requirements (see § 12.15). In any case, it is clear that one preliminary estimate of the year can be produced at least when all the quarters are available, but in some cases the preliminary estimate can be produced earlier.

12.15. A final factor that can play a role in the decision concerning the timing and the number of estimates for the current year is policy requirements. In many EU Member States, legislation imposes a date for the publication of annual results of national accounts. In the perspective of European Monetary Union, this factor has to be taken in account. In fact, the timetable for availability of the first annual estimates included in Annex B of the ESA 1995 Regulation as now been adopted. For this reason, the solution proposed in this chapter is designed to give Member States an efficient and reliable scheme for using all the available information in a better way.

12.16. Before presenting the Eurostat proposal it may be useful to explain the present situation in the EU Member States. For this reason the following paragraphs present some different possibilities based on the experience of Member States. The approaches used by the Member States are traditionally three:
(i) the preliminary estimate of the year is obtained as the sum of the four quarters,
(ii) the preliminary estimate is obtained independently of quarterly figures and
(iii) the preliminary estimate is first obtained independently of quarterly figures and is afterwards adjusted in concert with them.

12.17. The first approach is common to many countries such as the United Kingdom, Denmark and the Netherlands. Following this approach, the preliminary estimate of the year is obtained in the case of flow variables by summing the four quarters of the year. This preliminary estimate does not include any element derived from the annual information set. For this reason, this preliminary estimate must be corrected when annual information becomes available. In order to ensure time consistency between quarterly and annual accounts (see Chapter 10), the quarters must be adjusted to the new annual figures. This adjustment will be automatically performed if the data are calculated by using one of the mathematical or statistical methods (for example the Chow and Lin technique) presented in Chapter 6. If different approaches are used in the compilation process, it is necessary to use one of the adjustment techniques described in Chapters 10 and 11.

12.18. According to the second approach, the annual figures are estimated before the availability of the fourth quarter. This is the case of the first estimate produced by Germany and of the estimate produced by Italy. The two cases are quite different, however following the first estimate, Germany produces two additional estimates in accordance with the approach presented in the previous paragraph. Italy produces only one estimate: in this case the fourth quarter is obtained after the annual figures have been computed thereby ensuring time consistency.

12.19. Using the third approach, the fourth quarter of the year is estimated independently of the annual figure. In this situation, there are two different annual figures one of which is obtained by summing the quarterly data. In order to have only one annual official figure, a concerted approach is needed. The result of this concerted approach is the harmonisation of the results: the growth rates of the two annual series are the same as are the levels of the main aggregates. This approach is used in France. Once this reconciled annual estimate is produced, no additional estimates for the same year are made.

12.20. **Recommended approach**

The basis of the recommended approach is in ESA 1995, § 12.06: "... This problem may be solved by agreeing that the provisional estimates of annual figures are obtained by the aggregation of quarterly figures. When new annual information becomes available resulting in a revision of the provisional figures, the quarterly data have to be modified accordingly. Within the same systems, the annual accounts are a by-product of the quarterly system and there is no separate annual calculation".

12.21. This solution implies that, in a given year, countries must produce at least two estimates for that year. The first estimate concerning the main aggregates should be produced when the fourth quarter is available, that is four months after the end of the year. The second estimate with more detailed data should usually be produced nine months after the end of the year. This conforms to the transmission timetables of the ESA 1995 Regulation.

12.22. Finally it may be useful to observe that since the Member States should produce two estimates each quarter including the first one as a "flash estimate", an additional estimate for the year can also be made part of the recommendation. This additional estimate for the year can be obtained when the flash estimates for the fourth quarter are available. It follows that this estimate will involve only GDP and its main components.

CHAPTER 13

THE VALIDATION OF QUARTERLY ACCOUNTS

The quality of quarterly accounts is of importance to ensure efficient economic decisions and improve understanding of a large set of complex economic interactions. In order to ensure credibility and legitimacy of the disseminated figures, compilers have to develop procedures to validate their description of the current economic situation.

This validation corresponds to a close examination of compilation processes in the three dimensions of their work: statistics, accounting and economics. Since the process of compilation and validation of quarterly accounts merges the accounting, statistical and economic knowledge, the three aspects are not so easily detectable and they form a unique vision whose sub-division is here introduced for didactic purposes.

Each dimension follows its own logic, but the different logic does not have similar roles in the way the accounts are be compiled. In this manner, economic logic is subordinated to statistical and accounting internal consistency. Statistical logic is subordinated to accounting principles. It would indeed damage the credibility and the legitimacy of quarterly accounts to use an economic theory to organise the use of statistical information during their compilation.

The process of validation considered in this chapter is strictly part of the processes of compilation and quality control that preceded the publication of the figures. It completes the steps described in the previous chapters and it is completed by the "validation" after publication, usually referred to as revision, which is described in the following chapters.

The validation of quarterly accounts

Introduction

13.01. The aim of the process of compilation of quarterly accounts is to supply the users with a set of reliable quarterly figures derived from the available information and within a reasonable delay. The importance that quality assumes highlights the relevance of the control and the validation of both the process of compilation and the figures themselves. Clearly, there is a trade off between reliability and early availability. The compilers, within the constraints that this trade off imposes, have to ensure a good level of quality of the figures. A continuous monitoring of the process of compilation and of the results of this process (quarterly data) has to be carried out. This control generally takes the name of validation. All the controls made in terms of quality of the data to be or already published are included in the validation process.

13.02. In this process two dimensions can be distinguished: (i) validation before publication of the figures and (ii) validation after publication. In this handbook, the former is referred to as *validation* in a strict sense while the latter is referred to as *validation related to revisions*.

The process of validation in a strict sense is an integral part of the process of compilation and it subsumes the controls made on the process of compilation and the quality control on the figures.

Validation related to revisions is a part of the process of revision and is carried out after the publication of the figures. It is usually based on more basic information that becomes available during the post publication interval.

Why validation matters

13.03. By validation, is meant first that released figures should appear to be well-grounded, in accordance with the usual rules and well-known principles. Secondly, they should be interpretable, in accordance with users' intuitive appraisal or able to be explicitly argued and able to overcome objections. Validation aims to enable the use of quarterly national accounts in public debate and economic analysis.

13.04. Quarterly national accounts validation aims partly at ensuring credibility of the data. Credibility is a twofold concept: (i) it corresponds to an ability to describe in an understandable or explainable way from a global point of view what various economic agents can observe in their different and restricted economic sectors of activity; (ii) it also corresponds to the time consistency of the estimations. Time consistency of the estimates is strictly related to statistical accuracy and the revision process. The size of revisions should be small enough to make the first estimates relevant and reliable. First estimates then can be used in a decision process. This results from cross-checking with alternative statistical sources and explaining the reasons for revisions, whether due to the nature of statistical treatments or to the incompleteness of statistical sources at the last release date. This also means that it is sometimes necessary to provide users with some well-grounded caveats about certain figures and their use.

13.05. National accounts validation aims also at ensuring the legitimacy of figures. National accounts are a public good, compilation of them is costly and a lot of people are involved. They provide measures that rely on a set of conventions and principles. Their legitimacy corresponds to their ability to properly describe an ever-changing economic world. New products are created and new relationships between economic actors are established. National accounts compilers have to introduce necessary flexibility in their methods to catch the consequences of these modifications. They also have to test for the appropriateness of the rules and principles on which national accountancy is based. They have to report the problems they meet to the persons in charge of defining accounting concepts and to the annual accountants (if national accounting compilation involves separate quarterly and annual teams). This adaptability will lend greater legitimacy to the economic description provided by quarterly national accounts.

It may be difficult to draw a parallel between national accounting and business accounting; nevertheless both account systems must be genuine and their results must pass an audit examination, showing no irregularities. This examination is based on the respect of accounting rules but also on relevance of necessary assumptions. Validation of quarterly national accounts must take the place of this audit.

13.06. In compiling quarterly accounts, national accountants merge accounting, statistical and economic knowledge. As a part of the compilation process, validation of quarterly national accounts obviously covers these three dimensions. It follows an iterative process that involves statistics, accounting and economic analysis. Each time that new information becomes available, or that a statistical treatment or an accounting rule becomes significant, a detailed study must be done. If a correction is introduced, a new compilation must take place and the validation process continues until all the new elements are included in the figures and the new problems are resolved.

For the sake of simplicity, we consider the three dimensions separately, having in mind their interconnections.

Statistical validation

13.07. Compilers collect information on the statistics they use and should be aware of these faults. Their knowledge of survey methodology (sample size, sampling procedure, availability of register, etc.) used to compile synthetic indicators helps them to assess the information they collect. Where a chronic bias exists, they adjust for it, as best as they can and warn the users (both intermediate and final users) of possible mismeasurement, stipulating the cause of the bias. This information may play a role in the reconciliation process that takes place after data collection. For instance, when a measure is known to be sensitive to the size of the enterprise population, which is correlated with business cycle phases or may be due to an institutional or political change, they have to try to assess its short-term effect. When they have exogenous information at their disposal on this aspect, such as number of births or deaths of firms, they should adjust the statistic, as best as possible, and give a rough estimate of the size of the bias to the users. Similarly, when they know that a new large plant starts to produce, they must collect information to estimate the impact of this new plant on national output.

13.08. Facing an outlier, compilers try to collect information to determine the reason for it. If such information exists, they can use it appropriately in the statistical adjustments that must be applied to the data and refer to it in the commentary that will accompany the data on the day of release. For instance, when the time series must be seasonally adjusted with the help of software in which a model is estimated to build up forecasts and backcasts, it may be of interest to omit the last observation in the estimation step when it is an outlier. By doing so, we obtain forecasts that are not altered by the nature of this last observation.

13.09. By the knowledge of the system of weights used to aggregate sectoral information, compilers can measure the growth rate contribution of each regrouping to that of the main aggregates or the whole economy. This may be particularly important (i) when indices and accounts computation do not use the same constant price reference year, (ii) when different classifications are used by different statistical offices or by the statistical department of professional unions or associations, and (iii) when one kind of index uses the same system of weights during a complete year and those obtained in quarterly national accounts implicitly use the weights associated to the previous quarter (this may be observed for instance for some price indices, according to their definition); then large changes in the relative distribution of weights can introduce a significant gap between quarterly and annual measures.

13.10. In the automated statistical process of seasonal adjustment or corrections for calendar effects in which classical statistical inference becomes difficult, compilers may give greater importance to the stability of the treatment for problematic series. Indeed, when using software that involves automatic model selection from a more or less restricted set of models, it may be necessary to manually choose the model to ensure a stable treatment of the data between consecutive dates. We can then avoid the artificial revisions that arise because the time series under study cannot be properly approximated by a model in the class of models considered by the software.

13.11. When some information usually used by compilers is missing (due to delay or structural change in the statistics), a statistical procedure will have to be used to estimate the missing basic information. Different kinds of model can be used. When no complementary quantitative information related to the phenomenon is available, autoprojective models may be used. Otherwise, simple linear models can be used in forecast exercises. In both cases, compilers must pay a lot of attention to estimation procedures. They have to ensure that the selected framework is appropriate by the use of some test procedures[1] so that they obtain efficient estimates and efficient forecasts. In order to assess the performances and relevance of a selected specification, its use must last several periods. It would be damaging to change specifications too frequently, experience must be gained.

Accounting validation

13.12. One of the main features of accounting validation is that the data need to conform to the national accounts framework, including the sub-analyses (i) by industry, through the supply/use and input-output tables, and by (ii) institutional sectors, through the current, capital and financial accounts. Compilers have to check that the constraints imposed by the internal consistency of an accounting system are satisfied. For example the following accounting relations should be checked:

- the relationship between expenditure of households and VAT;
- the plausibility of figures of output per head;
- the household saving ratio;
- the relationship between producer prices and consumer prices;
- the plausibility of the value added to gross output ratios.

Depending on the level of detailed analysis provided by the accountants and the method used to compile constant price estimates, the balance of each detailed table must be checked. When the work of reconciling is only done at an aggregated level, compilers analyse the discrepancies that result from this step by examining the disaggregated levels. When the discrepancies become as large as the change in the sum of disaggregated levels between two consecutive periods, compilers should warn the users of detailed figures.

13.13. When the compilation of quarterly national accounts does not rely on the explicit use of input-output table or integrated sectoral account table, compilers may check the consistency of large changes in variables at a detailed or intermediate level with the result obtained at an aggregate level. For instance, a large change in the production of a particular good may have consequences for the distribution of value added between trade and services activities and other sectors. It may be of interest to analyse this situation and check the conformity of the figures with the value of the input-output technical coefficient.

1 For instance, test for parameter constancy or residual autocorrelation.

13.14. Accounting concepts are not always intuitively related to the economic phenomena they try to describe or at least to the public's intuitive understanding. Compilers have to be able to put forward understandable explanations for these situations. For instance, economic analysis of insurance activity, and particularly household insurance consumption, may be difficult to explain to ordinary people due to the convention used in this branch of constraining to the accounting equations from the sector approach.

13.15. Changes in economic relationships or the introduction of new products must lead compilers to question the statistics they use or their way of dealing with an economic event. When a new event occurs, they have to refer to the people in charge of the production of statistics. An economically interpretable answer to this question must be looked for. If the new phenomenon has a rapid non-negligible impact, and in the absence of modified statistics, compilers must choose a strategy for dealing with it. They can define a way of continuing to provide figures that are economically meaningful. They can also warn the users that some aspects of economic activity that should be included in the description of the economy, such as those defined by the set of rules and principles in use in national accounting, are not taken into account in the figures which are produced. The first approach should be preferable in most cases.

Economic validation

13.16. Economic validation has two aspects: (i) it refers to cross-checking different kinds of economic information and (ii) it also corresponds to the detailed study of the economic change described by the figures and its concordance with the empirical knowledge of the economic mechanisms observed in the past in the country.

13.17. Compilers may double-check the information they get about the change in some economic activity or sector by collecting all the information from the statistical sources related to the activity or sector under economic study. This requires knowledge about the quality of these statistics and the methodology used in their compilation, but also about the structural organisation of the economy, from a technical point of view when an input-output table is not explicitly used in the quarterly compilation, and from an institutional one when the integrated account sector table is not used. The comparison between these different statistics may be relatively complicated. It depends on the statistical treatments applied to each of them, on the classification used, and on the reference year. Quarterly national accountants must have complete and reliable information about the methods used to compile them and on the statistical treatments applied to them. Where accessible methodology is lacking, the use of the statistics concerned should be avoided.

13.18. The additional information may be quantitative and may play the role of an alternative statistical source. It can be explicitly used when the usual basic information is lacking. The comparison will usually be informative if we work with seasonally adjusted data, or data corrected for calendar effects. Indeed, it is sometimes difficult to observe seasonal phenomena precisely. We may prudently assume that the sampling scheme does not always capture seasonal changes in the reference population. For example, when household consumption is measured from household spending, as given by retail trade turnover, the sample does not change with the holidays periods but household consumption may take place in other stores. Working on seasonally adjusted figures allows the statistician to overcome this problem but at the cost of an unstable treatment. The choice of the pair of variables to study is made a priori by economic factors. A simple chart of various transformations of both variables allows the compilers to see if information can be inferred from the statistic under study and used to improve the latest account estimation. The statistical study over a long period of the quantitative relationship that exists between the two variables would allow the compilers to assess the kind of information that can be used to improve the estimates. For instance, quantitative statistical procedures can be used to check if the size of the revisions can be significantly reduced by the explicit use of the data under study in the compilation process. Of course, compilers must emphasise that the stability of the quantitative relationship is crucial. If the estimated relationship does not satisfy a stability test (see Annex 13.A), it cannot be used. Different, more or less elaborate, kinds of quantitative relationships might be used, but we must nevertheless emphasise that compilers should give greater priority to simple models, which are easily used and easily explained.

13.19. Special interest should be given to qualitative surveys (for example, business surveys), which are a source of statistical information, are rapidly available, usually only slightly revised, and summarise qualitative appraisal of the economic situation.

From a general point of view, they provide interesting qualitative information about the short-term development of economic activity and can play the role of replacement information when the usual basic information is lacking.

Suppose a graph is produced by plotting a balance of opinions from a "a state of trade" survey (see Chapter 4 about methods of quantifying such surveys) and another is produced by plotting the quarterly growth rate or the year-on-year change of an economic variable directly related to the object in question. The curves produced will often bear a close relationship to each other.

Qualitative opinion survey information can then be used to validate the short-term change described by the quarterly national accounts figures. We can sometimes use a calibration procedure to estimate a quantitative relationship between the balance of opinions for various questions and the quarterly growth rate or the year-on-year change of the economic variables that measure various activities (production, say, of manufactured goods or services, ...). For instance, stable quantitative relationships may sometimes be estimated between the output of a given product and the opinions of entrepreneurs on their past demand for the product.

Estimation of the price change for output can also be built up with a calibration procedure from the balance of opinions on the past movements of output prices.

Nevertheless, some caveats may be useful. The quantitative relationship that can be estimated from the balance of opinions sometimes shows that the nature of the information it contains is relatively elaborate; answers sometimes seem to take calendar effects into account and the variable used for comparison must be similarly adjusted. Otherwise, qualitative information can be obtained on the change of various economic variables such as prices or output by analysing the related balances of opinion. Compilers may also obtain indirect information on gross fixed capital formation by studying the balance of opinion for wholesale trade demand of equipment goods from the wholesale trade survey. A complete set of business surveys provides very useful information for validating the economic description of the quarterly national accounts.

13.20. In cross-checking different sources of information, compilers have to distinguish between what the accounts should show in economic terms, and what information contained in the statistics can help the users to resolve the apparent inconsistency between different statistics. For instance, household car or pharmaceutical consumption is not always properly described by the numbers of car registrations and the reimbursement amount paid by the health administration. In the event of a strike or a problem in processing registrations, the relationship between the statistics and the accounts can be altered.

13.21. Similarly, when the statistics used to compile an aggregate are not homogeneous, compilers have to be careful to assist users in the economic interpretation they make of the data.

For instance, when consumption is compiled from expenditure statistics and quantity statistics, short-term fluctuations of the saving ratio must be interpreted with care.

Household spending corresponding to quantities may occur during another period of time and this can corrupt the observed changes in the saving ratio. For instance, households in some countries do not pay their electricity bill for their real consumption of the current month but on an average monthly consumption basis (or a half-year basis) computed from the previous year’s consumption and corrected at the end of the year. Very cold weather leads to large electricity consumption that may not be matched by concomitant spending. So when quantity measures are used by compilers, the measure of the saving ratio follows real household consumption and does not describe its changes from a financial point of view.

13.22. The second aspect of economic validation deals with the similarity of the economic mechanisms described by the quarterly national accounts with what has been observed in the past. This means that a systematic analysis of every change must be performed when the amplitude is unusual. The statistical sources must be questioned and a clear statistical explanation must be provided. Compilers look for information on the data collected. Then the complete set of important shocks must be considered as a whole, and their relations with the propagation of a subset of simultaneous shocks must be analysed. Their likelihood must be assessed in comparison with the available estimations of short-term elasticities. This is not always possible since different shocks at various dates may be superposed, but as far as possible compilers must conduct a rough quantitative analysis of the first-rate effects.

13.23. Compilers usually do not have a lot of time to compile quarterly national accounts if they want to satisfy users’ demand for timely data. To accentuate the new salient features of the economic description provided by the accounts, in the sense of innovative information compared with what could be expected in the past, compilers are helped by using recently published detailed forecast exercises.

Gaps between the forecasts and the account estimates must be studied to determine whether the forecast was erroneous or whether the estimate is based on weak information. If the forecast is erroneous, it may be interesting to analyse the reasons for the error and maybe, in this way, focus attention on an economic phenomenon that needs to be analysed in detail to permit a better understanding of the economic situation. If the estimate seems to be based on weak information, compilers will try to cross-check their information. If their first estimate is confirmed, they will carefully analyse its economic interpretation. Otherwise they will have to adopt a prudent attitude to avoid misleading their users. Furthermore, it is particularly important to analyse the revisions to past estimates that compilers make when they receive new pieces of information. They have to assess the consequences of the new information, based on their understanding of the current economic situation and the effect of the new information on the linear forecast based on the last released version. This approach, which assumes a close co-operation between short-term forecasters and quarterly national accountants, may be very useful for emphasising the innovative aspect of the new accounts. By 'innovative' we mean the quality of the new information that bridges the gaps between the released figures and the medium-term path forecastable from the last available set of information.

13.24. Compilers need to have knowledge of the relative magnitude of the macroeconomics variables and of their variability. This knowledge is useful for validating the economic description of the current situation and its salient features, but also for writing the commentary that is dispatched on the day of release to inform the users.

Compilation principles

13.25. As can be seen, statistical, accounting and economic analyses are intricately mixed in quarterly national accounts compilation. Nevertheless, and even if the different types of work are done by the same team, it is crucial to separate the three aspects. Each aspect follows its own logic, but these different kinds of logic do not have similar roles in the way accounts must be compiled.

In this manner, economic logic is subordinated to statistical and accounting internal consistency, and statistical logic is subordinated to accounting principles. It is thus of importance that the economic behavioural concepts and their related analysis play only a role to test for the consistency of the economic description at the end of the process. Economic logic and description must not be used to determine the relevance of different statistics to estimate the various components of an economic equation; in other words, quarterly national accounts compilation must not rely on economic reasoning or relationships. It would be very damaging to their credibility and legitimacy if some economic theory were used to organise the use of statistical information during compilation. The basic principle is the following one: each account estimate must be based on basic statistics of exactly the same economic nature, i.e. income from income statistics for each sector, expenditures from expenditure or turnover statistics for each product and each sector, output from output statistics for each product, etc.

13.26. When the information on which the estimate of an account item relies is weak, compilers have to define a strategy. Their estimates will be built up according to the information they get. If no external information exists whose quality has already been assessed in the past, compilers will try to deliver an economic message that is not misleading. If the business cycle phase is clearly identified, a conservative estimate consistent with regularly observed economic dynamics in this phase will be proposed. There is no short-run innovative information. If the business cycle phase is not identified, a conservative estimate consistent with long-run economic dynamics will be proposed. If external information of good quality exists, it will be used to conform to what has been observed in the past.

13.27. When contradictory information exists, compilers will give greater importance to their usual statistical sources in order to be able to assess their quality when new and more detailed information becomes available one or two years later. Once the permanent or transitory poor quality of the statistical source has been established, compilers may or may not change their sources.

13.28. In brief, validation corresponds to the processes used to:

- i) cross-check the consistency of the description provided by statistics at a disaggregated level;
- ii) analyse the revisions (when they occur) of the last released figures and their consequences for the understanding of the current economic situation, and to improve the reliability of the current estimates (see Chapter 14);
- iii) ensure the consistency of the description of the overall economic situation with what has been observed in the past ;
- iv) try to capture rapidly the most important new economic phenomena.

It must rely on a set of simple steps:

- i) regularly read the economic and business press to learn about mergers, new plants, etc.;
- ii) collect information on government economic actions;
- iii) critically examine the basic statistics and regularly discuss with the producers of these;
- iv) estimate missing observations with models that have been validated through a demanding set of procedures;
- v) deal with outliers (which means collecting information on their causes);
- vi) ensure stability of seasonal adjustment treatment;
- vii) compare various statistics which describe closely related economic phenomena;
- viii) compute contributions to changes in main aggregates;
- ix) study short-term forecast exercises published by renowned organisations.

The validation process stops when all these steps have been taken and any innovative aspect of the description provided by the new released figures can be commented on, explained or discussed.

CHAPTER 13 - Annex

Statistical validation: tests

Statistical validation: tests

13.A.01. Numerous test procedures exist which might help compilers in their choice of the appropriate specification, most of them available in software packages. We propose to focus here on two basic hypotheses: residual auto-correlation and parameter constancy, in some circumstances, and refer to textbooks for details about various test procedures for different hypotheses such as heteroscedasticity, integration, co-integration, omitted variables, gaussianity, etc. Nevertheless, the time series approach provides a framework, a set of tools and statistics which allow statisticians to compute linear dynamic approximations of multivariate series of ordered observations in numerous cases without an a priori assumption about the economic structure.

Testing for auto-correlation

13.A.02. In case of a model with strictly exogenous regressors, the empirical autocorrelation coefficient of order *j* can be estimated by

$$r(j) = \frac{\sum_{t=j}^{T} \hat{u}_t \hat{u}_{t-j}}{\sum_{t=1}^{T} \hat{u}_t^2}$$

where $\hat{u}_t$ denotes the OLS residual at date *t*, and *T* the sample size. In the absence of auto-correlation up to the order *s*, the test statistic

$$T\sum_{j=1}^{s} r(j)^2$$

is asymptotically distributed as a $\chi_2(s)$. In a model with only lagged values of the dependent variables, the same test statistic is asymptotically distributed as a $\chi_2(s-\kappa)$ where *s is* $O\left(\sqrt{T}\right)^2$ and where *k* is the order of the autoregression. This statistic can be corrected for small sample size in the following way:

2 A sequence of random variables $\{X_T\}_{T=1}^{\infty}$ is said to be $O\left(\sqrt{T}\right)$ if for every $\varepsilon > 0$, there exists an $M > 0$ such that $P\left\{(X_T) > M\sqrt{T}\right\} < \varepsilon$ for all T.

$$T(T+2)\sum_{j=1}^{s}\frac{1}{T-j}r(j)^{2}.$$

Testing for parameter constancy (model without lagged dependent variables)

13.A.03. The most widespread test procedure is that proposed by Chow in 1960 (Econometrica, 28) and amounts to a splitting of the sample into two sub-samples which are assumed to satisfy the same gaussian linear regression model but with different parameter values, and to proceed to a Fisher test for their equality. When the number of regressors is larger than the number of available observations in one sub-sample, a test can be performed by considering the prediction errors in the smallest sub-sample derived in using the estimates from the linear model associated with the largest one. When these prediction errors are too large, parameter constancy is under question. This test procedure is not robust for the violation of assumptions that the error-terms are homoscedastic, not autocorrelated or normally distributed. Another way of testing for parameter constancy consists of studying the cumulative sum of the recursive residuals (Cusum test). By recursive residual, we mean the one-step forecast error derived from each sample obtained by starting from a set of the first observations whose number is equal to that of regressors plus one $(K+1)$ up to the complete sample of size and each associated estimate. Properly divided by the variance of the forecast error, this cumulative sum is at each date t asymptotically distributed as a normal variable whose variance is equal to t minus the number of regressors. The null hypothesis of parameter constancy is accepted at a 5% confidence level if the absolute value of these test statistics is for each t less than $0.948\sqrt{T-K}+1.896\frac{t-K}{\sqrt{T-K}}$ (cf. Brown, Durbin and Evans, 1975, Journal of the Royal Statistical Society). Various kinds of statistics can be computed from this statistic and the reader is referred to standard textbooks for details of these.

PART VI

CHAPTER 14

THE PROCESS OF REVISION

An important characteristic of the data currently published by NSIs is that they usually undergo a recurrent revision process before being considered definitive.

This is particularly the case for quarterly national accounts data, for which the increasing need for timely information on the state of the economy has to be balanced with the requirement for more accurate and reliable estimates.

This chapter discusses the causes of revisions the nature of the revision process on a quarterly basis and the importance of a quantitative analysis of the revision process from both a user and a producer perspective.

Revisions are classified as routine, occasional and mixed, according to the causes that generate them. This classification is considered to be an important preliminary step for the quantitative analysis of the revision process which is presented in Chapter 15.

The process of revision

Introduction

14.01. Data currently produced by NSIs are often subject to a recurrent revision process resulting in the publication of successive releases, which represent different quantitative evaluations of the same phenomenon under study. There are various reasons why the revision process is necessary. For example, revisions can be caused by improvements in the estimation techniques used by NSIs, enlargements of the information set, refinements in the system of basic statistics, changes in the accounting definitions and classifications, or by changes in the base year for constant prices evaluations.

14.02. Revisions can be considered as the final step in the process of estimation of national accounts figures. As described in other chapters of this handbook, in the process of compilation of quarterly accounts, the information coming from basic statistics (see Chapter 4) is treated according to compilation and recording rules (see Chapter 3) within the coverage and framework of the quarterly national account scheme (see Chapter 2) following a specific compilation approach (see Chapters 5 and 6). Quarterly figures are next subject to a preliminary overall qualitative control during the balancing process (see Chapter 11). The first release is then published. The compilation process is finally completed by the revision process in which new and more accurate information is used to revise figures.

14.03. Revisions are a common characteristic of national account figures. They concern both annual and quarterly accounts. However, revisions have particular significance in quarterly accounts because quarterly information is more subject to change as better and newer basic data become available. Additionally, quarterly figures are integrated by more accurate annual information when that too becomes available.

14.04. The main purpose of revisions, and of their analysis, is to identify any biases that occur in the initial estimates and then to make some allowance for them in the published figures. Any revision policy is subject to the principle that the best data available are published at each stage. Thus revisions are regarded as incidental to the quality of the estimates, not an issue in their own right. However one important feature of this approach needs to be emphasised: small revisions, which are within the error margin of the estimates, should be avoided. There is need here to deal with the issue of a revision that is small in relation to a major aggregate, but relatively large for a component. Too many revisions, which add nothing to the interpretation of the data, can be a nuisance to users.

14.05. For high frequency data, such as quarterly national accounts, it is important to consider as a possible source of revisions the increasing demand for more accurate and timely estimates. This implies that more and more preliminary quarterly figures are likely to be estimated from an incomplete set of information. A common practice is for quarterly national accounts data to be initially released on a preliminary basis to satisfy the users' need for timely information, and then to be routinely revised and improved, incorporating information not available at the time of the preliminary releases. This issue is discussed further in Chapter 15.

14.06. For quarterly national accounts, the importance of the trade-off between timeliness and accuracy is dictated by at least two considerations:

- quarterly national accounts are often based on less complete information than that used for annual estimates;
- quarterly figures provide the most comprehensive and coherent source of information about short-term national economy, and they are consequently intensively used by both private and public entities to guide their economic decisions. Fiscal and monetary policy actions are increasingly based on indications about the state of national economies provided by quarterly national account, and the information contained in the estimated quarterly data is also capable of influencing the behaviour of private investors and the movements of financial markets.

14.07. In any assessment of the revision problem, it is essential to distinguish between revision analysis and revision policy. By far the main purpose of revision analysis, as stated before, is to identify and allow for any possible bias in the figures. Revision analysis is accordingly concerned with the quality of data. Revision policy is concerned with establishing an approach, possibly a common approach, for introducing revisions.

14.08. It is necessary to recognise that differences in systems of collection and estimation imply differences in the quality (and hence scope for revision) of data at the various publication stages. Hence, revisions are not always considered from the same starting point.

14.09. There are two different, though interrelated approaches to revision analysis: user-oriented or producer-oriented. Both can contribute to a better understanding of the causes of the revisions and can suggest possible remedies for improving the data production process of NSIs.

14.10. The *user-oriented* approach is to analyse the effects that the revision process can have on users' perception of the economic conditions and on their forecasts of macroeconomic variables. This approach often concentrates on the nature of the revision in order to verify if preliminary releases satisfy certain desirable features of rational forecasts (i.e. lack of bias, efficiency and orthogonality), or if the models using provisional releases are sensitive to changes resulting from the revision of data. An important aspect for the latter is to consider the stationarity of the revisions from different releases (i.e the invariance of their statistical properties to changes in time origin) and their similarity from an econometric point of view.

14.11. The supply or *producer-oriented* approach is to consider the revision process from the viewpoint of data producers. The analysis of revisions provides NSIs with a basis both for assessing the accuracy of provisional in relation to final estimates, and for improving the methods of estimation used to compile preliminary figures. Using this approach, the analysis of the revision process cannot say anything about the reliability of the final estimates, since the lack of revisions can be considered a necessary condition, but not a sufficient condition, for their reliability. Assessment of the reliability of the final estimates additionally requires an evaluation of data sources and the estimation techniques used by NSIs. Nevertheless, the analysis of the revision process can give important indications to data producers in several circumstances. For example, the presence of a systematic bias in the preliminary figures can suggest to the statistician what adjustment may be directly made to the series. This might lead to even more radical changes, such as the collection of new/additional information and sources, or the improvement of the estimation procedures.

14.12. This chapter and the next one deal with methods for a quantitative analysis of the revision process and for an assessment of distinctive features of the process. One important and critical aspect to consider is the accurate classification of the revisions. Given the diversified nature of the revision process and the complexity of the situations involved, it is essential to be able to compare releases which result from the same classes of causes.

Chapter 15 discusses the tools which allow NSIs to compare short/medium and long-term components of the preliminary and the final releases, namely the indices of accuracy for providing a descriptive analysis of the revisions, and the econometric techniques for obtaining an insight into the revision process.

In addition, this part of the handbook broadens the scope of discussion to consider the complexity of the problems involved and the different solutions already implemented by various countries. These considerations entail the definition of some guidelines and strategies for improving the harmonisation of revision practices. The desire for a unitary and coherent scheme for the analysis of the revisions take account of the procedures currently followed by countries for the compilation and refinement of quarterly national accounts. These aspects are covered in Chapter 15, which contains suggestions for extending the harmonisation of revision practices across the EU countries and draws attention to those problems for which no solution has yet been found.

Current, occasional and mixed revisions

14.13. A useful classification of revisions distinguishes revisions into three main groups:

- current (or routine) revisions;
- occasional revisions;
- mixed revisions.

The first group contains all those revisions characterised by their high periodicity and certain release. They are often made every quarter and differ from the occasional revisions in the second group which NSIs produce at longer, and generally irregular, time intervals. Mixed revisions are those which are influenced by routine and occasional revisions working together.

Current revisions

14.14. Depending on their causes, current revisions can be of diverse nature. They can be due to the growing need for timely information discussed above, to the statistical characteristics of the estimation techniques adopted by NSIs, to changes in the base statistics used to compile quarterly figures or, more simply, to errors made by national accountants.

14.15. The main reason for current revisions to quarterly national accounts is to attempt to reconcile the timeliness and reliability of the estimates. For most countries, this trade-off often leads to *within-year revisions*, which occur when the annual value is not yet available and quarterly estimates are mainly based on the information provided by the available basic statistics. Basic statistics are often susceptible to revision, thus inducing changes in the previously released estimates.

14.16. In addition to this kind of routine revision, there is also a revision associated with the publication of the 'final' annual figure. This revision differs not only conceptually from the within year revision, but also quantitatively as it could give rise to changes to the quarters of the current year and to the whole reference period of the data.

14.17. Taking into account the annual constraint of quarterly accounts which is a prerequisite of time consistency, the magnitude of the current revision usually grows when there is a widening discrepancy between the within-year basic statistics and those used to estimate the annual figure. Chapter 10 discusses the issues involved.

14.18. In general, the within-year revision induced by the annual benchmarks may be subject to further changes, caused by the current revisions that are usually made to the annual figures. These in turn generate revisions in quarterly national accounts. This particular kind of revision can be called an " *annual benchmark*"revision.

14.19. From a theoretical point of view, the annual benchmark revisions lead to a similarity between the indirect methods for quarterly disaggregation discussed in Chapter 6 and other methods that do not use within-year information. In particular, for non-seasonally adjusted data, the indirect methods based on the techniques suggested by Bassie and by Chow and Lin, which are described in Chapter 6, do not induce revisions in the course of the year unless the quarterly indicators change. For countries where the reconciliation between annual and quarterly figures is made by the use of annual input-output tables, and for countries using various kinds of regression techniques, the raw data are generally not revised during the year unless there is a change in the indicators used or the methodologies adopted.

14.20. *Seasonal adjustment techniques* represent another cause of current revisions, both when they are applied to raw data or to quarterly raw indicators, as is the case for some EU Member States. In fact, the methods currently used by NSIs lead to revisions, which could well be consistent, when new data become available. This is true for seasonal adjustment procedures incorporating symmetric filters which, use past and future measures of the observed series. By their nature, such revisions could be seen as current revisions, in their quantitative evaluation. They will include those revisions on raw data induced, for example, by revisions of the basic statistics.

14.21. The revisions caused by a *change in the reference base year* for constant price evaluations, even if they are not always made regularly, can be conveniently classified as routine revisions. However, the revisions due to the effects of rebasing have some distinctive characteristics. First, they involve all the reference period of the constant series. Secondly, it is a common practice of NSIs to introduce the rebased series without recalculating the preceding release of data in the new base. This means that the revisions induced by rebasing are frequently superimposed on the other kinds of current revisions discussed above. A further consequence is that it is virtually impossible to compare the preliminary and the final releases of data.

Occasional revisions

14.22. Due to their frequency and certainty of release, current revisions differ from those produced by NSIs at longer and infrequent intervals, and classified above as *occasional*. A useful distinction is between:

- *occasional statistical revisions* which result from changes in surveys and/or in estimation procedures;
- *occasional conceptual revisions* which derive from changes in concepts and definitions of the aggregates and/or in the classifications used.

For example, revisions generated by the use of new quarterly statistics or indicators, those caused by a new censuses, and those caused by the adoption of different estimation methods, all belong to the former group of revisions. On the other hand, revisions originated, for example, from the adoption of a new accounting system or from the use of a new nomenclature should be classified as conceptual.

14.23. It should be noted however that this distinction cannot in practice be an exact one. Each occasional revision is unique to its historical moment and sometimes NSIs combine statistical and conceptual changes in the same revision package.

Mixed revisions

14.24. It sometimes happens that occasional revisions are superimposed upon current annual or within year revisions leading to *mixed revisions*, which are simultaneously influenced by routine, benchmark and/or occasional components.

The presence of mixed revisions hinders the possibility of making homogeneous comparisons between releases at different levels of the revision process. Consequently the possibilities of undertaking any statistical analysis are reduced.

14.25. As may appear evident, the classification of the revisions used in this chapter is based more on the causes of the revision process than on the length of the time period for which the data are revised. Some authorities (e.g. Smith, 1977) prefer, however, to put the accent on the second consideration in order to distinguish between, for example, *historical* and *unusually long* revisions, according to whether the revisions involve more than the previous three years' data or have more lasting effects. The choice of a classification for the causes of the revision process nonetheless appears to be particularly appropriate for quarterly data. As observed above for annual benchmark revisions or for the revisions caused by a change in the base year for constant price data, even routine revisions of quarterly data can induce changes over the whole reference period for which the variables are defined.

CHAPTER 15

A COMMON SCHEME OF REVISIONS

The first part of this chapter proposes a unitary and coherent scheme for the analysis of the revi sion process. A quantitative evaluation of the revisions can be done in terms of various appropriate descriptive indices and by applying the more sophisticated statistical techniques presented in Annexes A and B to this chapter. Steps to follow in conducting a quantitative assessment of the revision process are set out in the first section of the chapter.

It is stressed that both the descriptive and the statistical approaches can give indications of the size of the revisions, serving to highlight some important aspects of the revision process. These aspects include the causes of the revisions and their relative importance, their effects on the statistical characteristics of the series, and the impact the revisions have on the economic interpretation of the statistics.

A further and critical aspect considered in the first part is that the analysis of the revisions can give NSIs a basis both for assessing the accuracy of preliminary estimates and for improving the techniques adopted and/or the sources used to compile quarterly figures.

In the second part of the chapter, the revision policies actually followed in the compilation of quarterly national accounts are analysed to highlight similarities and divergences. This analysis shows that, though there are many similarities in the national systems, there is room in the future for a greater convergence of the revision practices at the European level.

A common scheme of revisions, strictly related to the publication policy, is suggested. This scheme takes into account preliminary and regular releases of quarterly data, revisions due to annual estimates and occasional revisions.

A common scheme of revisions

The analysis of revisions

15.01. Revision analysis provides a basis both for assessing the accuracy of provisional estimates compared to the final ones, and for improving the estimation methods used to compile provisional estimates by NSIs. The latter aspect is concerned mainly with the data production process and the former one has an important impact on the users of the data. However, NSIs must take both aspects into account, since an adequate and complete assessment of past revisions can identify their presence, their causes, and the way to improve future estimates. Revisions imply first of all the existence of a statistical problem in the data production process, which is closely linked to the presence of a divergence between two successive releases. There may also well be a problem about the economic significance of the data which depends on the causes of the revisions and the consequences they have on the perception of the economic picture conveyed by the statistics. It is therefore proposed that, in the analysis of the revision process, NSIs consider some simple indices measuring the accuracy of the preliminary estimates and carry out more sophisticated and formal analyses on the successive releases of the data.

15.02. This section examines a unitary and coherent reference scheme for the analysis of the revisions, gives indications for their quantitative evaluation and, where possible, provides suggestions for the possible causes and for remedies to adopt for improving the preliminary figures. The scheme can be conceptually divided into two stages:

- the first concerns the examination of data revisions, adopting a descriptive statistical approach based on the analyses of certain relevant measures;
- the second proposes a sequential procedure to determine the impact of the revision process on both short/medium and long-term components of the series.

15.03. It is not easy to give a general description of the revision analysis. In fact, the necessity to build up a unique reference scheme is in conflict with the diverse composition of the situations involved. Revision analysis should:

- refer to aggregate or disaggregate variables;
- refer to different levels of aggregation;
- apply to observations at different frequencies;
- be expressed in nominal or real terms;

- be subject to accounting, temporal, and/or spatial constraints.

Each attempt to resolve these conflicting requirements must at the same time be able to satisfy the following requirements:

a) to pay attention to the qualitative characteristics of the revisions and their relationship with accounting rules;

b) to identify appropriate summary indices of revisions as the basis for decomposition methods to establish the accuracy of the revision process and hence evaluate the convergence of provisional estimates to final values;

c) to analyse relevant aspects of the revisions connected with data evaluations on different bases (e.g. current or constant price evaluation and their deflators) and with the use of seasonal adjustment procedures (i.e. revisions of raw and seasonally adjusted series).

To serve these purposes, it is necessary to have a general scheme of analysis to follow when considering quarterly national accounts revisions.

Consider an economic aggregate and its estimate at time *t*. Suppose now that benchmark estimates are scheduled for this aggregate every *h* periods, and that current minor surveys are planned between two subsequent benchmarks. Further, suppose that *m* successive preliminary releases ${}_ip_t$ ($i=1,2,...,m$) are made before producing the final estimate r_t. After the final estimate, the information contained in the benchmark survey will again lead to a new revision of r_t. The benchmark estimate could be subsequently modified when an occasional (statistical or conceptual) revision occurs.

Table 15.1 (see end of the chapter) displays the publication schedule discussed above. It contains:

- the revisions placed on the principal diagonal and in the lower diagonals, which correspond to the releases going from the first preliminary estimate ${}_1p_t$ to the final one r_t. They represent current revisions;
- the horizontal revisions, called ${}_br_t$ which are published twice every *h* periods;
- the horizontal revisions, called ${}_sr_t$, which represent occasional revisions inducing retrospective changes for many periods back (in the table, an example is given by the revision published at *T+3*).

Furthermore, Table 1 shows some mixed revisions originating from the overlapping of current and benchmark (or occasional) revisions. This is the case of the estimates represented by ${}_sr_t$ and marked with an asterisk. Clearly, the associated revision is not homogeneous with either the previous or the following revisions.

15.04. The analysis of accuracy and reliability of the estimates relies on comparisons between the preliminary and the final release, no matter how the latter is defined. Such analysis must compare homogeneous revisions and must carefully take into account the existence of revisions that differ slightly in their nature. Consequently, comparisons that include one (or more) mixed revisions should be avoided[1]. On the contrary, feasible comparisons could be made for the diagonal estimates, such as those from ${}_1p_t$ to r_t; benchmark revisions (r, ${}_br_t$), and occasional revisions implying comparisons between ${}_sr_t$ and the last release of published data or similar.

Sometimes it is possible to eliminate at least partially the mixed component in the revision. This is the case for revisions which associate current changes with occasional (but periodic) revisions, such as those caused by a change of the base year for constant prices estimates. Patterson and Heravi (1991) suggest a procedure, based on econometric techniques, to eliminate these mixed comparisons.

15.05. The analytical operations of the analysis of revisions have different aims:

- Those carried out on current and benchmark revisions are useful in identifying possible shortcomings in the data estimation process, in evaluating their systematic aspects, and in suggesting criteria for a more efficient use of preliminary figures.
- The analyses conducted on the occasional revisions allow the data producers to appreciate the improvements obtained in the reliability and relevance of the estimates. The causes underlying occasional revisions are generally known *a priori* to national accountants, thus rendering them aware of the direction and, in some cases, of the importance and magnitude of the revision involved.

15.06. Summary statistics can be produced which make various comparisons between preliminary and final estimates. In particular, two types of errors, can be considered: errors in the levels and errors in the growth rates.

Relative errors give information on the accuracy of preliminary estimates of the levels, whereas absolute errors must be considered in order to evaluate the accuracy of preliminary growth rates. More details can be found in Annex 15.A.

15.07. To give a comprehensive assessment of the innovations introduced by the revision process, the analyses should be integrated with the use of econometric techniques. Some of these techniques are already used by many NSIs to assess the quality of national accounts data. Others developed in the econometric literature have only recently been applied to the analysis of the revision process and these are discussed in Annex A.

The policy of revision: the EU Member States policies

15.08. There are many similarities in the policies for revising quarterly accounts actually followed by EU Member States although some noticeable differences remain between the national

1 Sometimes it is possible to eliminate - at least partially - the mixed component in the revision. T his is the case for revisions which associate current changes with occasional (but periodic) revisions, such as those caused by a change of the base year for constant prices estimates. Patterson and Heravi (1991) suggest a procedure, based on econometri c techniques, to eliminate these mixed comparisons.

systems. The four characteristics common to national revision processes in the EU are broadly as follows:

- most countries impose fairly strict criteria on when and how frequently current revisions are permitted;
- data are not open for current revisions after a period varying from three to four years from their first release;
- historical revisions are generally carried out every five to ten years;
- the estimates of a macroeconomic aggregate for a particular quarter are open to current revisions each time a new quarter in the same reference year is published, and then annually for a period varying from two to four years.

15.09. Some common features of the revision policies actually followed in quarterly accounts by Member States are mentioned in § 15.10-15.13. These features relate to data which is not seasonally adjusted.

15.10. In some countries the first release is a preliminary estimate and it is obviously subject to a revision when more accurate data are available. The revision of the preliminary estimates is then made during the same quarter (this means before that the following quarterly figures are available).

15.11. The first release of the quarter is generally revised when new successive quarters are published. The revision is made either each time that a new quarter is published or only when the fourth quarter is available.

15.12. When annual data become available, a revision is usually carried out on quarterly data. Annual revisions imply a consequent effect on quarterly figures. If annual figures are revised twice a year for a first release and a second more accurate release, quarterly accounts are affected.

15.13. Annual data are generally subject to routine revisions twice a year for a period of three or four years. The same revisions are then applied to quarterly data. In some countries annual revisions are carried more often than twice a year, implying the same policy for quarterly data. After this period annual and quarterly data are considered as definitive.

15.14. When historical revisions take place, quarterly figures are obviously revised. The same is true when the reference year for constant prices is changed.

15.15. Determining a common approach to the revision process for the EU Member States appears to be an ambitious objective. Although there are many convergencies in the revision policies actually followed, significant differences remain, in both the estimation procedures adopted and the sources used to compile quarterly national accounts. Moreover, views about the trade-off between timeliness and accuracy differ from country to country and this fact alone limits the possibilities for substantial harmonisation at the European level.

15.16. In the short to medium terms, when the methodologies used and the reliability of the sources adopted are essentially fixed, an important step towards greater harmonisation would be to standardise on the publication interval for first preliminary estimates. Standardisation in this way could appropriately be followed by a reduction in the average delay for publication of quarterly figures by NSIs. At present, the maximum acceptable delay appears to be ninety days from the end of the reference quarter because this seems to permit, in most cases, a satisfactory combination of timeliness and accuracy of the preliminary figure.

15.17. Yet other ways can be followed in the direction of greater harmonisation. These might start from a general reconsideration of the pragmatic approach used by most countries to determine when and how frequently current revisions are allowed. For raw data, revisions originating from changes in the reference indicators rarely cause revisions to quarterly aggregates more than one year previously. Revisions apart from these are often generated from the enlargement of the information set that occurs when new annual figures become available. When new annual data are added, new econometric relationships are generated and most methodologies currently used by EU Member States lead to revisions for the full reference period of the data. Such revisions are all the same “artificially” limited to some quarters, determined judgementally by each country.

15.18. The practice of limiting the scope for revisions in this way may be theoretically debatable but it has a certain practical relevance. Continuous revisions to the entire system of quarterly national accounts could create practical problems for the users and undermine their confidence in the reliability of the estimates. An important aspect to consider here is the difficulty that both users and NSIs have in working with quarterly national accounts obtained as estimates from indirect methods. Such estimates are inevitably characterised by a certain degree of uncertainty, and are thereafter subject to continuous changes as a result, for example, of the enlargement of the information set available. Conceding this difficulty, it should made clear in presentation that the estimates, and their degree of uncertainty, could be subject to substantial changes. Moreover, although an artificial constraint imposed on the revision process can have practical advantages, it can also cause unwanted jumps in the estimates when revisions have to be made for reasons of consistency.

15.19. Concerning revisions to seasonally adjusted figures, the seasonal adjustment methods currently used introduce revisions as new data are added. As already pointed out, this short-coming is not overcome by the most recent methods proposed in the literature. NSIs understandably attach a great deal of importance to revisions arising from seasonal adjustment techniques. In fact, it is worth noting that these revisions are exclusively caused by the application of statistical methodologies. Preference should be given, other things being equal to those techniques that limit the revisions, both in their magnitude and in the period over which they are made. The choice of the most preferable seasonal adjustment method is a matter for empirical study.

15.20. General adoption of one particular seasonal adjustment technique would be advantageous for greater harmonisation but it would still be necessary to deal with the revisions which the chosen technique induced. In this case, the choice would be between medium-term and short-term revisions. In the medium term, the revision schedule could impose, for example, the estimation of the seasonal coefficients once a year and their maintenance for the other quarters. In the short-term, the estimates should be revised each quarter, when new observations are added. Preliminary experimentation has confirmed the expectation that the lowest frequency of revisions is obtained when the parameters remain fixed, that the re-estimation of parameters leads to increasing revisions, and that this increase is even greater if the models are re-identified every quarter. However, the choice between the two alternatives could depend on the solutions adopted for raw data: if the revision process is not subject to limits, then seasonally adjusted data could well be refined each quarter using different seasonal coefficients. Even in this case, however, there is room for pragmatic and user-oriented solutions. In fact, the choice between the two alternatives could vary according to the characteristics of the series. For example, for series characterised by a relatively stable seasonal component, the revision of the seasonal coefficients could be done once per year since the information lost would be immaterial. In this case, too, a common policy would be preferable.

15.21. Two further aspects concerning the dissemination of quarterly national accounts should be mentioned. The first is that NSIs should be sure to emphasise the revisions introduced in successive releases of the data. Users must be aware of the revision policies followed, of the revisions' causes, and of their relative magnitude and importance. Therefore, the publication of successive releases should be conveniently accompanied by a thorough explanation of the causes of the revision and by quantitative information derived from the indices of the revision process discussed in Chapter 14. The second aspect concerns the fact that users should be briefed on the information content of the data, which could well vary from quarter to quarter depending on the available sources, their degree of coverage and their reliability. For example, the information content of a preliminary estimate of GDP will usually be lower than the corresponding fully-based figure published some weeks later, because it may well be based on an incomplete set of information and on statistical extrapolations, thus rendering successive revisions unavoidable.

A common scheme of policy of revision: a suggestion

15.22. The aim of the analyses presented in the previous paragraphs is to improve the quality of the estimates of quarterly figures. It was stressed in Chapter 14 that the amount of revisions is strictly related to revision policy and that revisions are part of the production process. It follows that revisions are a function of the basic information collection system and of the estimation process adopted.

A scheme of revision is then a part of the production process that brings about the improvement derived from new information available. It is clear, as stressed above, that too many revisions, which add nothing to interpretation of the data, should be avoided since they can be a nuisance to users. Additionally, revisions should not be pursued for their own sake. A balanced view needs to be taken of revisions as a means of making normal and periodic improvements to the data.

15.23. Since revisions are a part of the production process they are strictly related to the publication policy and they directly influence it. It was recommended in Chapter 12 that the following releases should be published each quarter:

- Preliminary estimates of the main aggregates (flash estimates) of the quarterly accounts;
- Detailed estimates of quarterly accounts.

Two estimates of the year are then produced: the former when the fourth quarter is available and the latter when annual information is consolidated. A first preliminary estimate of the annual data can also be produced at the same time that the flash estimate of the fourth quarter as a sort of annual flash estimate.

15.24. The suggested revision policy follows the recommended publication policy:

- concerning non-seasonally adjusted data, each time that a new quarter is published a revision is carried out on previous quarters;
- each annual revision generates a consequent quarterly revision;
- routine revisions made to change the reference base year for constant prices imply consequent quarterly revisions;
- historical revisions involve quarterly figures.

15.25. From a theoretical point of view, the impact of such revisions applies to the entire quarterly series. From a practical point of view the impact is usually restricted to the quarters of the last three or four years. The recommendation concerning routine revisions is therefore to revise quarterly figures for the latest four years and consider quarterly data for earlier years as definitive.

15.26. Seasonally adjusted quarterly figures have to be revised each time that a new quarterly figure is estimated because the seasonal adjustment procedure generates the revision. For practical purposes, the same limitations considered for raw data can be applied to seasonally adjusted data: only quarterly figures for the last four years should be revised. The same principles as in the case of raw data can also be applied for historical and routine rebasing revisions.

Table 15.1: Reference scheme for the successive revisions of an aggregate*

Dissemination period	Reference period																			
	t - 2h + 1	**.**	**.**	**t - h**	**t - h + 1**	**.**	**t - m**	**.**	**.**	**t - 1**	**t**	**t + 1**	**.**	**.**	**T - m**	**.**	**.**	**T - 1**	**T**	**T + 1**
t - 2h + 2	${}_1p_{t-2h+1}$																			
.	${}_2p_{t-2h+1}$	.																		
.	.	.	.																	
.	.	.	.	${}_1p_{t-h}$																
t - 2h + m + 2	${}_mp_{t-2h+1}$	.	.	${}_2p_{t-h}$	${}_1p_{t-h+1}$															
t - 2h + m +3	r_{t-2h+1}	.	.	.	${}_2p_{t-h+1}$	.														
.	.	.	.	.	.	.	${}_1p_{t-m}$													
.			.	${}_mp_{t-h}$	.	.	${}_2p_{t-m}$	${}_1p.$												
.				r_{t-h}	${}_mp_{t-h+1}$	.	.	${}_2p.$	${}_1p.$											
.					r_{t-h+1}	.	.	.	${}_2p.$	${}_1p_{t-1}$										
.	${}_br_{t-2h+1}$			${}_br_{t-h}$	.	.	${}_mp_{t-m}$	.	.	${}_2p_{t-1}$	${}_1p_t$									
t + 2							r_{t-m}	${}_mp.$	.	.	${}_2p_t$	${}_1p_{t+1}$								
.								$r.$	${}_mp.$	.	.	${}_2p_{t+1}$	.							
.									$r.$	${}_mp_{t-1}$	.	.	.	.						
.										r_{t-1}	${}_mp_t$	.	.	.	${}_1p_{r-m}$					
t - m + 2											r_t	${}_mp_{t+1}$	.	.	${}_2p_{r-m}$	${}_1p.$				
t - m + 3												r_{t+1}	.	.	.	${}_2p.$	${}_1p.$			
.					${}_br_{t-h+1}$		${}_br_{t-m}$	.	.	${}_br_{t-1}$	${}_br_t$		.	.	.	.	${}_2p.$	${}_1p_{r-1}$		
.														.	${}_mp_{r-m}$	.	.	${}_2p_{r-1}$	${}_1p_r$	
T + 2															r_{t-m}	${}_mp.$	.	.	${}_2p_r$	${}_1p_{r+1}$
T + 3	${}_sr_{t-2h+1}$	.	.	${}_sr_{t-h}$	${}_sr_{t-h+1}$	.	${}_sr_{t-m}$	.	.	${}_sr_{t-1}$	${}_sr_t$	${}_sr_{t+1}$	.	.	${}_sr_{t-m}$	r^*	${}_mp^*.$	.	.	${}_2p^*_{r+1}$

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CHAPTER 15 - Annex A

A COMMON SCHEME OF ANALYSIS OF REVISIONS

A common scheme of analysis of revisions

15.A.01. In this annex, a common scheme of analysis of the revisions is presented according to the principles and the notation of Chapter 15.

To simplify the presentation of this type of analysis, consider a single vector ***p*** of provisional estimates and the corresponding vector ***r*** containing the final release. We can produce summary statistics making various comparisons between preliminary and final estimates. In particular, we consider two types of errors, namely:

- *errors in the levels* ;
- *errors in the growth rates* .

Following Biggeri and Trivellato (1991), relative errors give information on the accuracy of preliminary estimates of the levels, whereas absolute errors must be considered in order to evaluate the accuracy of preliminary growth rates.

Now let v_t and e_t indicate respectively the absolute and relative error at time t of the preliminary estimate with respect to the final one, that is:

$$v_t = p_t - r_t, \quad e_t = \frac{p_t - r_t}{r_t}.$$

From a statistical point of view, v_t and e_t are supposed to be stationary processes. Otherwise the traditional statistics would converge in law to distributions that are not so informative. In particular, this implies that if the variables are integrated they must be co-integrated too.

15.A.02. In order to analyse the preliminary estimate of the levels, consider the following indices:

a) mean relative error, $\bar{e}$;
b) mean absolute relative error, $\overline{e'}$;
c) standard deviation of the relative error, s_e;
d) square root of the mean quadratic relative error, d_e;
e) bias component of the mean quadratic relative error, U_e^b.

15.A.03. In turn, the following indices can be used to evaluate the accuracy of preliminary growth rates:

1a. mean error, $\bar{v}$;
2a. mean absolute error, $\overline{v'}$;

3a. standard deviation of the absolute error, s_v;
4a. square root of the mean quadratic error, d_v;
5a. bias component of the mean quadratic error, U_v^M;

The above indices are calculated in the following way:

$$\bar{v} = \frac{1}{n}\sum_{t=1}^{n} v_t, \qquad \bar{e} = \frac{1}{n}\sum_{t=1}^{n} e_t,$$

$$\bar{v}' = \frac{1}{n}\sum_{t=1}^{n} |v_t|, \qquad \bar{e}' = \frac{1}{n}\sum_{t=1}^{n} |e_t|,$$

$$s_v = \sqrt{\frac{1}{n}\sum_{t=1}^{n}\left(v_t - \bar{v}\right)^2}, \qquad s_e = \sqrt{\frac{1}{n}\sum_{t=1}^{n}\left(e_t - \bar{e}\right)^2},$$

$$d_v = \sqrt{\frac{1}{n}\sum_{t=1}^{n} v_t^2}, \qquad d_e = \sqrt{\frac{1}{n}\sum_{t=1}^{n} e_t^2},$$

$$U_v^M = \frac{\left(\bar{p} - \bar{r}\right)^2}{d_v^2}, \qquad U_e^M = \frac{\left[\left(\frac{\bar{p}}{\bar{r}}\right) - 1\right]^2}{d_e^2},$$

15.A.04. Clearly, $\bar{v}$ and $\bar{e}$ are not measures of provisional estimates. However, together with the information given by $\bar{v}'$ and $\bar{e}'$, they make it possible to evaluate if, and eventually to what extent, the errors are always (or almost always) of the same sign, thus imposing corrections on the preliminary estimates.

15.A.05. The analysis of the errors in growth rates could also be conducted in the following way. Two different preliminary estimates of the final growth rate could be considered thus:

$$\dot{r} = \frac{(r_t - r_{t-1})}{r_{t-1}}$$

that is

$$p(0)_t = \frac{(p_t - r_{t-1})}{r_{t-1}}$$

and

$$\dot{p}(d)_t = \frac{(p_t - p_{t-1})}{p_{t-1}}.$$

The first is the *horizontal* estimate, which considers data published at the same time but not homogeneous in the revision process; the second one, which is called *diagonal*, compares homogeneous data without considering all the information available at the time the final estimate is released. Consequently, we could define two different absolute errors, namely $w(0)_t = p(0)_t - r_t$ (the horizontal error) and $w(d)_t = \dot{p}(d)_t - \dot{r}_t$ (the diagonal error). It should be noted that the relationships between the errors in the levels and the errors in the growth rates are given by

$$w(0)_t = (r_t + 1)e_t$$

and

$$w(d)_t = (r_t + 1)\left[\frac{e_t + 1}{(e_{t-1} + 1)} - 1\right].$$

These equations imply that, if the relative errors in the levels are biased, w $(0)_t$ is also biased in the same direction, whilst $w(d)_t$ is zero.

15.A.06. The choice between the analyses conducted on absolute or relative errors in judging the accuracy of the level estimates could be made by considering the equation $p_t = \alpha + \beta r_t + \varepsilon_t$, from which is obtained

$$v_t = \alpha + (\beta - 1)r_t + \varepsilon_t, e_t = (\beta - 1) + \alpha\frac{1}{r_t} + \frac{\varepsilon_t}{r_t}.$$

These expressions clearly show that one could select the appropriate indices by testing the homoscedasticity of ε_t against the alternative of homoscedasticity of ε_t / r_t .

Patterson and Heravi (1992) have correctly pointed out that the growth rates should be calculated on the same release of data in order to isolate the factors influencing the revision process. Otherwise, in the case of a horizontal estimate, the numerator of the above expressions could be considered as the sum of a *pure difference effect* and of a *revision effect*. This is caused by the mixture between the definition of release and that of version.

15.A.07. For the decomposition of the indices, it is appropriate to consider the relative decomposition

$$1 = U_v^M + U_t^R + U_V^D$$

where

$$u_V^M = \frac{(\bar{p} - \bar{r})^2}{d_V^2}, U_V^R = \frac{(s_r - p\ s_p)^2}{d_V^2}, U_V^M = \frac{(1 - \hat{\rho}^2)s_p^2}{nd_V^2}$$

represent the regression and the residual components of the mean quadratic error.

If the analysis is conducted on the relative errors, reference is made to the decomposition $= U_e^b + U_e^c$ where

$$U_e^b = \frac{\left[\overline{\left(\frac{p}{r}\right)} - 1\right]^2}{d_e^2}, U_e^c = \frac{\sum\left[\left(\frac{p_t}{r_t}\right) - \overline{\left(\frac{p}{r}\right)}\right]^2}{d_e^2}.$$

15.A.08. Consider now the convergence of the successive preliminary estimates to the final release and suppose, for the sake of simplicity, that there are three estimates, i.e. $_1p$, $_2p$ and r. The mean quadratic error of $_1p$ with respect to *r can be decomposed* in two steps, that is

$$_1p \rightarrow {_2p},\ {_2p} \rightarrow r$$

Thence

$$_1v = {_1p} - {_2p},\ {_2v} = {_2p} - r$$

and

$$_3v = {_1p} - r.$$

Let d^2_{1v}, d^2_{2v}, and d^2_{3v} denote the quadratic mean error respectively of $_1v$, $_2v$ and $_3v$ so that

$$d^2_{3v} = d^2_{1v} + d^2_{2v} + \frac{2}{n}\sum_1 v_{2t} v_t$$

from which is derived the decomposition

$$1 = D_I + D_{II} + D_{I,II}$$

where the first two components are the ratios of d^2_{3v} due to the quadratic mean error respectively of the first and the second revision, while $D_{I,II}$ represents the correlation effect between $_1v$ and $_2v$.

The decomposition is somewhat problematic considering the relative errors, but useful information could be obtained from the values of and from results of the comparisons ($_1$p, $_2$p), ($_2$p,r) a*nd* ($_1p$, r).

15.A.09. To give an adequate and exhaustive assessment of the innovations introduced by the revision process, the analyses discussed above should be integrated with the use of econometric techniques. Whereas some of these techniques are currently used by many NSIs to assess the quality of national accounts data, others discussed below have been recently developed in the econometric literature for the study of common components in time series; only recently have they been applied to the analysis of the revision process. In this respect, the important aspects to consider are the lack of bias and the efficiency of the preliminary releases with respect to the final ones. In fact, preliminary releases of data can be viewed as forecasts of the final releases, conditional on the available information at the time the forecast is made. It follows that the tests usually applied to verify the rationality of forecasts in the sense of Muth’s (1961) rational expectations framework should be used to assess the accuracy of provisional estimates.

15.A.10. Here we refer to four types of such tests, namely:

- tests for lack of bias;
- serial correlation;
- efficiency;
- orthogonality.

Their interpretation is straightforward.

15.A.11. An attractive feature of preliminary releases is that the associated revisions are unaffected by systematic biases. The notion of lack of bias requires that, on average, projections are equivalent to out-turns; in technical terms, the expected mean revision should not be statistically different from zero. On the other hand, the efficiency of a preliminary estimate requires the associated revision to be uncorrelated with the information available at the time that the preliminary estimate is made and that past errors do not affect future errors. Holden and Peel

(1990) and Barrionuevo (1993) have suggested the following procedure in testing for lack of bias and efficiency. The test for lack of bias is carried out by running an OLS regression of the revision on a constant term. Under the null hypothesis of no bias, the estimate should not be statistically different from zero. If the null is rejected, the revision errors could be systematically reduced by adjusting the preliminary figures by the estimated value of the constant term. A test for efficiency requires testing whether both the following conditions are satisfied:

a) in an OLS regression of the revision on the preliminary estimate, the associated coefficient is zero (the so-called β test);

b) in an OLS regression of the current revision on that of the previous period, the coefficient is zero (the so-called ρ test).

When the null is accepted, the preliminary estimate is considered to be an efficient forecast of the final release; otherwise, if either β or ρ are significantly different from zero, the forecast is shown to be inefficient. This implies that the variance of the revision could be reduced, and consequently the provisional estimates improved. In fact, three cases can be considered:

a) past errors are repeated in the present ;

b) the preliminary estimates could be improved upon by modifying the forecasting model $(\beta \neq 0 \cap \rho = 0)$;

c) the inefficiency could be reduced either without repeating past errors or by changing the forecasting model $(\beta \neq 0 \cap \rho \neq 0)$.

15.A.12. The tests described above are particular cases of the orthogonality test. The orthogonality condition requires that the revision, i.e. the forecast error, be unpredictable using the information Ω_t available at the time the final release is produced. The rationale of this definition consists in considering the final estimate as fully (and efficiently) incorporating all the information contained in the matrix Ω_t available at the time the forecast is made. In fact, if some of the elements of Ω_t are statistically significant, it turns out that some systematic factors have been erroneously omitted from the data production process. It follows that the variance of the associated revision could be reduced by considering the information content of the past history. To implement the orthogonality test, one needs to consider the possible components of the information set Ω_t. As it happens, for lack of bias and efficiency tests, candidate variables could be represented by the constant term and the revision lagged once. However, other aspects are likely to be of importance here, namely:

- the history of revisions and past values of the same release;
- the rate of inflation, which could influence the estimates of constant prices figures (for example, downward revisions when the rate of inflation is rising rapidly);
- the stage of the business cycle at the time the initial estimate is released (for example, upward revisions during the expansion of the economic cycle);
- seasonal effects in the revision process (for example, revisions systematically higher/lower in a quarter than in others even though seasonally adjusted data are considered)[2].

2 For further details on this topics see Kenny (1987), Patterson and Heravi (1991), York (1994) and P isani and Savio (1994)

The statistical significance, the magnitude and the sign of the coefficients associated with each of the above variables can give important indications to data producers on the possibilities for improving the estimates by incorporating the previously neglected variables.

15.A.13. Another desirable property for the revision process is the similarity of releases from the viewpoint of co-integration analysis. Such an analysis is found to be particularly relevant both for the activity of the official statiµstical agencies and for the users of data[3]. In fact, if the hypothesis of co-integration between, say, a preliminary release and the final one were rejected, this would imply that the forecast error, that is the current revision, is indistinguishable from a non-stationary process. If this is the case, an *I(1)* variable (i.e. integrated with order one), or combination of variables, would have been omitted between the preliminary and the final estimate: this in turn would imply that the data production process could be improved by finding the variables omitted when passing from one release of the data to another. For example, this omission could well be due to the presence of measurement errors in the preliminary estimates, or to their accumulation over time. These errors could in turn arise if the early estimates are based on unrepresentative data and/or incomplete sampling: this would render the final release of data particularly unreliable, thus leading to a general reconsideration of the quality of the base statistics used. Further, if this is the case, the preliminary estimates and subsequent revisions will generally tend to be negatively correlated with each other and it should be possible to improve the preliminary figures by considering this negative correlation.

In technical terms, consider the following relationship

$$u_t = r_t - \alpha p_t$$

and suppose that both p_t and r_t are *I(1).* The preliminary and the final release are said to be cointegrated if there exists a vector α such that u_t is *I(0).*

15.A.14. There is a close relationship between the notion of co-integration and the tests discussed above. In fact, for u_t to be stationary, α could be other than unity. Thus, p_t could well be a biased and inefficient predictor of r_t, but the appropriate scaled difference could be stationary. If u_t is *I(1),* then there is no equilibrium relationship between the preliminary and the final vintage and the use of p_t to forecast r_t is statistically incorrect.

15.A.15. Summing up, the presence of non-co-integration between a preliminary and a final estimate has three important implications:

a) The tests for lack of bias and efficiency discussed above hypothesise that the regression's residuals are stationary, whereas a finding of non-co-integration refutes this.

b) Non-co-integration implies that the preliminary release cannot be considered as an efficient forecast of the final estimate since a non-stationary variable would have been omitted passing from the initial to the final figure.

3 The appendix to this chapter contains some technical details on the concepts of integration, co-int egration and common cycle analysis discussed below.

c) The substitution of a preliminary release for the final one could have negative consequences for empirical studies as it could generate non-stationary residuals in the econometric analyses and render the results unreliable.

From the above discussion, it should be possible to define co-integration between the preliminary and the final series as a necessary, but not a sufficient condition for the lack of bias and the efficiency of the revision process.

15.A.16. Though co-integration is an important aspect of the revision process to be verified, it pertains to long-term characteristics of the series. A further aspect to consider is the comparison of releases from the point of view of their cyclical components. In fact, even if a preliminary and the final release are co-integrated, their cyclical behaviour could well be characterised by different turning points or by different amplitudes and phases. For example, this omission could well be due to measurement errors, or to a cumulation of them over time. This would render the final release of data particularly unreliable, thus inducing a general reconsideration of the quality of the base statistics used, or even the methodologies adopted in the estimation process.

15.A.17. Whereas co-integration is an indicator of co-movements among non-stationary variables, the existence of a serial correlation common feature (SCCF) implies co-movements in the stationary components of the series. Therefore, SCCF is closely analogous to co-integration, except that it concerns the stationary components of the series rather than the non-stationary components. While co-integration implies common trends, SCCF implies common stationary cycles and relates to short or medium term swings of the series. If the growth rates of the preliminary and the final releases are characterised by a (statistically) similar correlation structure, they will be said to share common cycles[4]. In other terms, t p_t and r_t have a common idiosyncratic cycle if

$$\beta' \Delta(p_t r_t) = \varepsilon_t$$

Where ε_t indicates a white noise disturbance.

Therefore, SCCF not only implies a similar correlation structure between the initial and the final release, but it also requires the existence of a linear combination of their growth rates that represents and eliminates all the serial correlation with the past[5].

15.A.18. For the discussion above, it is possible to define a sequential strategy going from the less to the most restrictive hypothesis concerning the characteristics of the revision process. This strategy could be summarised as follows:

a) verify the null of non-co-integration between the preliminary and the final release. If the null is rejected, go to the next step;

b) verify the null of no SCCF subject to the results obtained in the previous step (see Annex 15.B). If the null is rejected, go to the next step;

4 A more formal definition of SCCF is given in the appendix 15.B.

5 In spite of integration and co-integration tests, those for SCCF have standard distributions becaus e they apply to the stationary components of the series.

c) verify the null of lack of bias. If the null is accepted, go to the next step;

d) verify the null of efficiency. If the null is accepted, go to the next step;

e) verify the null of orthogonality.

It should be noticed that one must not necessarily conclude, if the preceding properties were not fulfilled, that there is some flaw in the data production process and that the revision analysis has revealed that flaw. Consider, for example, a macroeconomics aggregate which is constantly revised upwards by historical revision. The final release could well be co-integrated with the preliminary one, but the preliminary series would still be an unbiased (and inefficient) predictor of the final release. A clear distinction is needed in these situations between occasional and current revisions.

Methodological appendix

15.B.01. This appendix briefly reviews some statistical and econometric aspects of the common trends-common cycles analysis used in Chapter 15 of this handbook[6].

6 Further details on this topic can be found in Engle and Granger (1987), Johansen (1988), Engle and Kozicki (1993), Vahid and Engle (1993), Engle and Issler (1995).

CHAPTER 15 - Annex B

METHODOLOGICAL APPENDIX

Assume y_t is integrated with order one, that is *I(1),* and let it represent the two-vector series of the final and preliminary quarterly estimates at time t [7].

Now, suppose y_t has the following finite p-order vector autoregressive representation in first differences:

$$\Delta y_t = \mu + A^*(L)\Delta y_{t-1} - A(1)y_{t-1} + \varepsilon_t, \quad t = 1, 2, \ldots, T.$$

Where ε_t is a ($T\, x\, 1$) vector of white noise disturbances,

$$A(1) = \sum_{j=0}^{p} A_j L^j$$

and

$A_0 = I$ with the A_j's (TxT) matrices

and

$$A_i^* = -\sum_{j=i+1}^{p} A_j, \forall i = 1, 2, \ldots, p-1$$

If rank $A(1) = r$ ($\neq 0$) the elements of y_t are said to be co-integrated (Engle and Granger 1987; this implies that a common trends representation exists (Stock and Watson, 1988)[8].

Rewriting $A(1) = A\beta'$, where α and β (the co-integrating vector) are ($2\, x\, r$) matrices, we obtain from equation (1) the reduced form error correction model:

$$\Delta y_t = \mu + A^*(L)\Delta y_{t-1} - \alpha z_{t-1} + \varepsilon_t, \quad z_{t-1} = \beta' y_{t-1}. \tag{B.1}$$

If the series are co-integrated, the trend component can be reduced to linear combinations of r random walks. A similar reduction applies if Δy_t has a *serial correlation common feature*, that is if it has common cycles [9].

15.B.02. A series is said to have a cycle if its first difference displays persistence. This is an example of *feature*, as defined by Engle and Kozicki (1993). Such a feature is said to be common if there exists a linear combination of the growth rates of y_t which has no cycle. Thus, a

7 A series with no deterministic component is said to be *integrated of order d* if it has a stationary, invertible ARIMA representation after differencing d times. In particular, if a series $x_t \sim I(1)$ with $x_0 = 0$, then:(a) the variance of x_t goes to infinity as t goes to infinity; (b) an innovation has a permanent effect on the values of x_t ; (c) the spectrum of x_t has an approximate shape given by $f(w) \sim Aw^{-2d}$ for small w so that $f(w) \to \infty$; (d) the expected time between crossing of $x=0$ is infinite; (e) the theoretical autocorrelation $r_k \to 1$ $\forall$k as $t \to \infty$ *(Engle and Granger, 1987).*

8 The components of the vector y_t are said to be *cointegrated of order (d,b)* if:(a) all components of y_t are I(d); (b) there exists a vector a ¹ 0, called the cointegrating vector, such that $z_t = a' x_t \sim I\ (d\text{-}b)$ with $b>0$ (Engle and Granger, 1987).

9 Formally, the elements of Δy_t have a *serial correlation common feature* if there exists a linear combination of them which is an innovation with respect to the information available at time t. Such a linear combination is called a *cofeature combination* and the vector which represents it is called the *cofeature vector* (Vahid and Engle, 1993).

business cycle which is a component of the preliminary and the final releases will be common if its amplitude is different but its phase is the same across different releases.

Given equation (B.1), the persistence of Δy_t is captured by

$$(\Delta y_{t-1}, \Delta y_{t-2}, \ldots, \Delta y_{t-p}, \alpha z_{t-1})'.$$

Now, let γ_s (s=1,2,...,k) with $k \leq (2-r)$ indicate the co-feature vector, that is the linear combination of growth rates that eliminates all the serial correlation with the past.

The existence of a serial correlation common cycle implies that $\gamma_s' A(1) = 0$ and that $\gamma_s' A_i^* = 0 \quad \forall s, i$. In this case the two variables will have their cyclical behaviour governed by (2-*s*) common cycles.

If the data are characterised by a form of serial correlation common feature, then $\gamma_s' \Delta y_t = \gamma_s' \varepsilon_t$.

15.B.03. Two implications of this result should be stressed. Firstly, $\gamma_s' y_t$ is a random walk and the vector that removes all the serial correlation of Δy_t also removes the cyclical component of y_t. Secondly, γ_s' must be linearly independent from the co-integration space so that the number of the co-feature vectors can be at most *2-r.* When this maximum is achieved, a special trend-cycle decomposition is possible and the results obtained make the comparison between permanent and transitory components of preliminary and final releases easy to implement.

In fact, suppose that *N=r+s* and consider the matrix $A = (\gamma' \alpha')$.

Since the co-integrating and co-feature spaces are linearly independent, *A* is a full rank matrix and hence it will have an inverse. Now consider the following partition of A^{-1} conformable to $A^- = (\gamma^- \ \alpha^-)$ and apply the trend-cycle decomposition:

$$y_t = A^- A\, y_t = \gamma^- (\gamma' y_t) + \alpha^- (\alpha' y_t) = Y_T^P Y_T^C$$

This equation represents a common trend-common cycle decomposition. In fact, the first term of the equation contains only trends, as $\alpha' y_t$ is a random walk, and henceforth has no cycle. The second term contains only cycles, as $\alpha' y_t$ is *I(0)* and is serially correlated.

Notice that the elements of the first term are linear combinations of the error correction terms, which should be considered cyclical generators; this result emphasises their role in macro-econometrics. A similar role is played by the trend generators, which are linear combinations of the co-feature vectors.

15.B.04. Let us now go back to the estimation of the dimension of the co-integration and co-feature spaces; in the application of the techniques described above to the analysis of the revision process one can follow these steps:

- Analysis of the degree of integration of the preliminary and final vintages using, for example, standard ADF tests (see Dickey and Fuller ,1979, 1981).
- Co-integration analysis between the preliminary and the final vintages of data using either the procedure suggested by Engle and Granger (1987) or the maximum likelihood co-integration analysis proposed by Johansen (1988).
- If the series appear to be co-integrated, a canonical correlation analysis among Δy_t and the right-hand side variables in the vector ECM model should be performed.
- Apply a test for significance of the smallests canonical correlations given by

$$C\,(p,s) = -\,(T-p-1)\,\sum_{i=1}^{s}\ln\left(1-p_i^2\right)$$

where the p_i are the smallest squared canonical correlations among the variables. Under the null that the dimension of the co-feature space is at least *s* (or that there are at most *2-s* common cycles) this statistics has a standard χ^2 distribution.

PART VII

CHAPTER 16

FLASH ESTIMATES: METHODOLOGICAL ASPECTS

This chapter first defines flash estimates and then describes the methodological work which is currently being undertaken by Eurostat on flash estimates of main quarterly aggregates. Some guidelines are offered to help Member States that want to start compiling these kinds of flash estimates. Revisions and other topics of special interest are discussed later in the chapter.

Flash estimates: methodological aspects

Introduction, definition and overview

16.01. Some indicators of the economic activity are rapidly available, such as production indices, prices, non-EU foreign trade and business surveys. However, these indicators do not have the homogeneity and consistency of a system of accounts (see Chapter 4). On the other hand, the first estimates of quarterly accounts are often only released after considerable delay which makes them unsuitable for some of the needs they are supposed to satisfy, e.g. business cycle analysis and the evaluation of economic and monetary policy measures. It therefore seems important to provide for a reliable and rapid system of preliminary estimates for the main quarterly accounts aggregates, so as to have an early and consistent view of developments in the economy.

16.02. This system of preliminary estimates has been given the name “flash estimates”.

Definition:

A flash estimate is defined as the earliest picture of the economy according to national accounts concepts, which is produced and published as soon as possible after the end of the quarter, using a more incomplete set of information than the set used for traditional quarterly accounts.
Because this preliminary estimate is based on incomplete information, the compilers must use *ad hoc* statistical procedures for reducing the margin of error associated with it. The actual level of disaggregation is left open and output, expenditure and income aggregates may all be estimated to some extent.

16.03. It may be useful to clarify the existing differences between flash estimates and any other type of earlier estimates. In particular flash estimates differ from leading indicators in the sense that flash estimates give a coherent picture of the whole economy for a past period of time under the constraint that certain accounting relations are adhered to. By contrast leading indicators anticipate the future trend of some relevant economic variables, often for only part of economy. The leading indicators do not respect accounting relations even if they can be conceptually related to some quarterly national account variables (e.g. gross domestic product). Leading indicators are one area of forecasting, which we distinguish from flash estimates by the fact that forecasts are made using no information from the reference period.

16.04. It is also important to underline that many real-time estimates of relevant variables produced by the Central Banks or by the Economic ministries are directly derived from the existing econometric models. In consequence the estimates are model-dependent since the hypotheses made about the behaviour of the economic agents can influence the resulting estimates.

16.05. The accuracy of the flash estimates must be the first priority, in order to reduce the risk of publishing misleading data which may lead to unsuitable reactions from economic agents.

16.06. The first step in the implementation of a flash estimate system is to determine which aggregates will be included. Because not all basic data are available, the system should be more aggregated that used for the normal compilation of quarterly accounts. The choice of the level of aggregation for the flash estimates is typically determined by a compromise between the need of users for the maximum amount of information and the more prudent attitude of the producers. The series included in the system of flash estimates should be modelled to obtain preliminary predictions for the current period. More accurate predictions could be achieved, where the information is available, by using related indicators. Since production statistics are, in many cases, available earlier than other statistics (e.g. expenditure data), the estimation of GDP from the output side is more easily computed.

16.07. The objective of flash estimates is to produce a coherent (in the national accounts sense) system of estimates for the main aggregates. For this reason the estimation of the GDP from only one approach does not seem to be completely satisfactory. However the next stage is represented by one additional estimation of GDP. In general, the second estimate of GDP is obtained from the expenditure approach. There is usually more information available for expenditure aggregates than for income aggregates and, in addition, some of the expenditure variables seem to be more important for the purposes of short-term analysis. The last stage consists in balancing the GDP figures arising from the different approaches. The balancing procedures reflect those discussed in Chapter 11. The result of this stage is a unique estimate of GDP. This single estimate should be more reliable than the unbalanced ones.

16.08. A system to produce flash estimates should be based on a robust statistical method. The typical features of flash estimates should be examined, in particular the importance of the revisions to the flash estimates has to be studied. Revisions to flash estimates can typically be relatively large, even compared with those made to the first estimates of quarterly national accounts. For revisions, there is a choice between timeliness and accuracy. It is important to bear in mind that the estimates of original series and seasonally adjusted series might be of different quality and one should be especially careful with the latest seasonally adjusted figures, which could be subject to the greatest revisions.

Methodology of flash estimates

16.09. An efficient way of estimating the main aggregates should take into account the infra-annual information coming from different sources, finding the best way to incorporate it into the accounting framework. In this way the need for timely information can be reconciled with the rigour of a consistent information system. One should be aware that the flash estimates are not just an earlier release of the quarterly accounts, but are really a different “product”. The difference between the normal estimation of quarterly accounts and the flash estimates consists essentially in the statistical method used. This method must be able to provide good estimates when the base information is scarce. Qualitative data can be widely used, together with some sophisticated time series techniques, to provide earlier estimates of quarterly account aggregates. Clearly the level of disaggregation is normally different from the level used in later estimates of quarterly national accounts.

16.10. The first step in the process of producing flash estimates is to determine which aggregates can reasonably be estimated as flash estimates. This process has to be evaluated country by country, since the time delays in the acquisition of information after the end of the reference quarter may be quite different. Given the need for strict timeliness, it is a common practice to limit the number of aggregates to a minimum set of relevant variables. On the other hand the indicators which are available influence the aggregates which can reasonably be compiled, especially if the underlying process cannot be properly predicted by a statistical model. The best case is if indicators related to output, expenditure and income aggregates can be found. But, in many cases, it might be difficult to find data on income aggregates and the information on income aggregates is not so often required for short-term analyses. In view of this it might be reasonable to concentrate the flash estimate exercise on output and expenditure aggregates, at least in the first stage.

16.11. The second step is the identification and the estimation of a set of univariate models, one for each aggregate. These univariate models should be used as a reference for evaluating the efficiency of the following steps during the establishment of the flash estimates procedure and then at regular intervals thereafter.

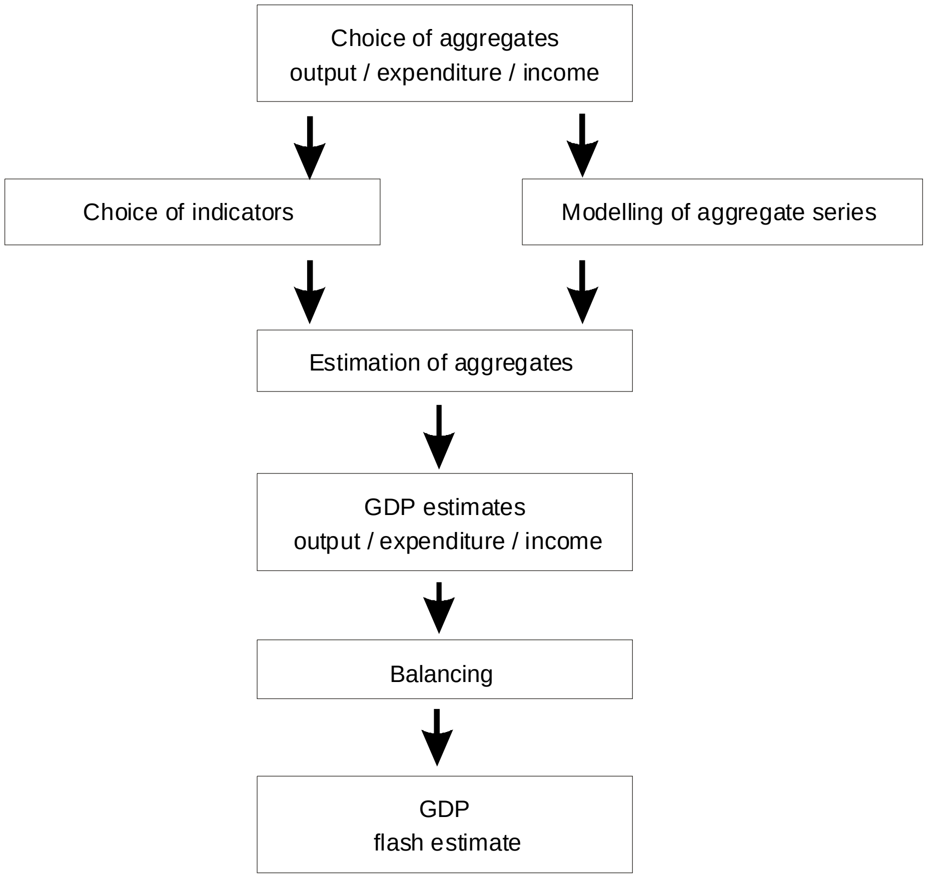
16.12. However, it is useful to try to get more information on series which are not covered by the time of compilation. So, the next possible step in the procedure is the selection of indicators from those available which have the following features:

- stable relationship with the quarterly aggregate to be estimated;
- early availability so as to make the estimation possible within the scheduled period.

16.13. The third step is to find all the statistical information needed for each aggregate. This set of information can contain both monthly and quarterly series. It is important to verify if all the period of interest is covered or if there is only part of the information for some indicators (e.g. only two months of the quarter). If this is the case, the methods described below can be used.

16.14. If there is additional information (e.g. qualitative surveys) that can be helpful in estimating the unavailable data, a statistical model must be identified and estimated for this purpose. Before this can be undertaken the qualitative surveys to be used have to be quantified. The different approaches for this quantification are not described here but the main approaches used are based on a simple difference between positive and negative answers or on a probabilistic model which assigns values to answers taking the forms “more”, “less” or “same” (see Chapter 4, § 4.29). After this operation the relations between the incomplete series of

Figure 16.1: The procedure of flash estimates in principle



indicators and the qualitative data can be tested. If the relations are statistically significant it is possible to use a time series model to forecast the unavailable information.

16.15. By contrast, if we do not have additional information to use, an univariate model must be fitted and used for estimating the unavailable observations. In this case it is clear that the reliability of this indicator is quite low. For this reason the compilers should proceed with prudence in this area. Personal input by the statistician can play an important role in improving the reliability of these indicators.

16.16. When the information set is complete, it is possible to use this for producing flash estimates of the quarterly accounts aggregates. This estimate can be obtained in two very different ways: by extrapolating the past values of the aggregates using the indicators, and by using the indicators in a time disaggregation procedure as described in Chapter 6.

16.17. In *the extrapolation approach* the relationship between the growth of an indicator and the aggregate we want to estimate has to be identified and estimated. This information can then be included in a multivariate model to obtain more accurate estimates of the aggregates for the current period. The estimating performance is essential because in most cases, where there is about a one month time lag, missing data (i.e. basic data for aggregates) have to be predicted for the end of quarter.

16.18. In *the time disaggregation approach* the levels of the indicators are used in the context of a procedure which is similar to the standard procedures used in many countries (France, Italy etc.). One of the variants of the Chow-Lin method is recommended. If there are no indicators for some aggregates it is possible to use a method without indicators such as the Stram and Wei method (see Chapter 6). This approach leads to revisions in the aggregates when there are revisions to the indicators.

16.19. The estimates produced by the techniques described above represent a set of preliminary estimates of the aggregates. This set is typically unbalanced and consequently it cannot be considered as a set of quarterly account estimates.

16.20. The last, but very important, stage is to adjust the various GDP figures estimated from the different approaches to have a unique value for GDP. This balancing process is discussed in more detail in Chapter 11 and it seems reasonable to use similar balancing procedures to those used for later estimates of quarterly accounts. Since the flash estimates are produced at a very aggregated level, a simple balancing procedure may be used such as a multivariate adjustment method (e.g. Denton, Rossi etc.; see Chapters 6 and 11).

Work done in Eurostat

16.21. In consideration of the increasing importance and demand for a rapid picture of the European economy, Eurostat has launched a project aiming to produce a system of flash estimates of GDP and its main components for the EU as a whole. Eurostat plans to publish EU figures within 40-45 days of the end of the quarter. This delay may be revised according to the empirical results of this project. The rapid nature of estimation means that all the basic statistics needed to compile quarterly national accounts are not available, so some estimates have to be made by Eurostat for unavailable or incomplete basic information. However, Eurostat does not make any surveys for collecting basic data for quarterly national accounts purposes and depends upon statistics compiled by national statistical institutes.

16.22. The methodology used is essentially the same as that described above. The first stage is the identification of the key aggregates to be estimated taking into account the problem of lack of information. An univariate ARIMA model of the selected aggregates is estimated and used as a benchmark. Then the available basic statistics are analysed to verify their adequacy for estimating the aggregates. If the basic statistics are incomplete, a forecasting procedure for the last observation is made using, where available, qualitative surveys. The extrapolation procedure then gives the first estimates for all the aggregates. The last stage consists in the balancing procedure to obtain a unique estimate for GDP.

16.23. The typical indicators used in this procedure are derived from short-term statistics. Consequently there is more information available from the output side than from the expenditure side. It is clear that there are some exceptions on the output side there is an important lack of information concerning some types of services whereas the data from the balance of payments represent a good source of information for the expenditure side. The balancing procedure must take into account the reliability of the different estimates of GDP.

16.24. It may be important to underline that the flash estimates are only really useful if they are as accurate as possible (of minimum variance) and unbiased. In order to achieve these objectives there is need to work in a fully robust statistical framework. For this reason many studies have been made to improve the performance of the time series models used in this field. Even if there are no definitive results, it seems that some recent developments of time-series theory using non-linear models are especially appropriate in this case. This is especially true of neural networks which provide a family of non-liner models that are very flexible and have the ability to learn from past errors.

Revisions and other problems

16.25. One typical feature of short-term statistics is the need for revisions of the earlier published figures. These revisions are discussed in more detail in Section 5 but it is worth noting that revisions are more likely to be made to flash estimates than with 'traditional', later, estimates of quarterly accounts. However, the users of flash estimates are expecting to get an unbiased picture of the overall economy with a short time lag. They will inevitably compare the flash estimates to the first releases of 'traditional' quarterly accounts, not the later revisions of data.

16.26. Another problem is the choice between timeliness and accuracy. If a short time lag is preferred it means that flash estimates are compiled with less basic information available. Therefore more estimation is needed for data not yet covered. This means that revisions are likely to be larger than if compilation were to be based on more complete information. The compilation of flash estimates puts more weight on timeliness which means that larger revisions should be tolerated. For this reason the publication policy must be thought through carefully, i.e. to give users the right picture about the information contained in the published figures.

16.27. These revisions could either originate from revised basic statistics, or from the estimation of unavailable data. It is useful to keep track of these revisions in order to see if there is a need to correct any bias in flash estimates and whether these corrections should be made to data coming from basic statistics or to the estimation process for missing data. In addition to this, analyses of revisions could also give valuable information to help the balancing process. Revisions to quarterly national accounts are dealt in more detailed level in Chapters 14 and 15 and these practices can be utilised in flash estimates too. The experience obtained from compiling flash estimates and from comparisons with the subsequent estimates can be used to improve the reliability of the flash estimates over time.

16.28. Production of flash estimates is also complicated by issues related to seasonality. Even if good estimates can be obtained of 'raw' (non-seasonally adjusted) data, this does not necessarily imply that the quality of seasonally adjusted estimates is equally as good. This is a rather important point, given that one is mainly interested in the flash estimation of seasonally adjusted figures. Where the extent of the revisions is likely to influence the estimation of seasonally adjusted series, in so far as it relies on the past history of the aggregate, it might be sensible to recommend the use of unadjusted data when compiling the flash estimates. One should be careful here to make it clear, when publishing the data, that there might be large revisions in the seasonally adjusted figures for the latest quarter under compilation.

CHAPTER 17

TOWARDS MONTHLY ESTIMATION OF THE MAIN AGGREGATES OF NATIONAL ACCOUNTS

This chapter argues that the compilation of monthly estimates of main aggregates is quite similar to the compilation of quarterly flash estimates. Two main procedures used in compiling monthly indicators for the main aggregates are described. The first method is to use a regression between the desired aggregate and a suitable indicator to extrapolate the aggregate series. The second method is to use a related leading indicator series regressed on the required aggregate. The chapter concludes that especially in the case of monthly estimated aggregates, it is important to consider the way the results are published.

Towards monthly estimation

Introduction

17.01. For some purposes even flash estimates of quarterly national accounts are not timely enough, and there is substantial demand from users for producing the most essential aggregates on a monthly basis. The compilation methods used for monthly accounts are commonly similar to those used for indirectly compiling quarterly accounts. At present only Finland of the Member States publishes a monthly GDP estimate (see Lääkäri, 1994).There have been academic studies into the methods used for monthly estimation of the main aggregates; for example on data for the United Kingdom (Salazar, Smith, Weale, Wright, 1994) and Italy (Barcellan, Bruno, Mazzi, 1996). This chapter deals briefly with monthly estimation of the main aggregates of national accounts and some problems and questions related to it.

How to proceed

17.02. As mentioned above the compilation of monthly estimates of main aggregates is quite similar to the compilation of quarterly flash estimates, though clearly it is necessary to consider the data available on a monthly frequency before proceeding. The recent Eurostat initiatives for short-term indicators will hopefully lead to an increase in the available data and its quality, even if some important series (e.g. production indices, overseas trade) are already available. A sensible way to proceed towards monthly estimates is to take advantage of the compilation of flash estimates of quarterly national accounts and especially the knowledge gained from the estimation of unavailable data and its relation to the available leading indicators. In general monthly estimation will probably use indirect methods, owing to the lack of direct data sources. The compilation of monthly estimates need not be very time-consuming, since a quite standardised estimation can be used with parameters updated only once a year, but clearly it is better to have a dynamic model with parameters updated more regularly (see Chapter 6 for more details).

17.03. There are two possible ways of compiling monthly aggregates. The first method is to use a monthly regression between the desired aggregate and a suitable monthly indicator, thereby extrapolating the aggregate series. This approach will usually take more time to complete because it is necessary to wait for measurement of the indicator and to make the resulting monthly series coherent with the quarterly data. The second method is to use a related indicator series regressed quarterly on the required aggregate and then applying the parameters to monthly data, where the results can be released earlier (they are already coherent with quarterly data) but at the cost of accuracy. If the latter approach is used then the results can be integrated into the quarterly flash estimates. In the same way as for compilation of quarterly flash estimates, the monthly estimates from different approaches should be combined, by weighting in proportion to their share of GDP, and balanced to produce a single value for GDP; however it is likely that only one approach will be used on a monthly basis.

17.04. Finally, consideration should be given to the seasonal adjustment and working/trading-day adjustments to be applied to the monthly series. Monthly series are generally more variable and seasonal than their quarterly equivalents. The techniques for seasonal adjustment are discussed above in Part IV, and the monthly data can be adjusted in the same way. Given the variability in the data, it can be useful to concentrate on the cycle-trend series of the aggregate. The treatment of strike and working/trading-day adjustments are also important for monthly data, and in fact most monthly indicators are available in an adjusted and unadjusted form (see Chapters 8 and 9) the use of adjusted base statistics can remove the need for adjusting the resulting aggregates.

The borderline between prediction and flash estimate

17.05. The two methods described in § 17.03 lead to a further difficulty, to distinguish between a monthly forecast and a monthly flash estimate. The monthly forecast will be made without the benefit of indicator data from the month in question, and in many Member States is the responsibility of the economics or finance ministries. The National Statistical Institutes will need to consider its policy in this area.

Publication

17.06. Particularly in the case of monthly estimated aggregates, it is important to consider the way the results are published. Given the needs of typical users of monthly aggregates, such as dealers in money markets, it is important to have an explicit publishing policy with fixed release dates, allowing access to information at the same time for all interested parties. An essential question is whether to publish levels, or changes, or both. In general it is better to publish only changes because revision in levels are generally larger than revision of changes and also because the main interest is usually in changes of short-term macro economic statistics.

17.07. Thought should also be given to the form in which the figures are published, i.e. exact figures or rounded ones, graphics only or tables, etc. It would be good to consider thoroughly what weight should be put on raw and seasonally adjusted series or cycle trend series, and how to present them. More details should also be given about any working/trading days or other adjustments made to the data.

PART VIII

CHAPTER 18

QUARTERLY FINANCIAL ACCOUNTS

The development of financial activity, in a context of globalisation, has considerably reinforced the argument of its complete coverage. The need of quarterly financial accounts may be seen as not so imperative, whereas financial accounts would concern preferentially for structural studies. An annual basis seems sufficient. Nevertheless, one can consider the coverage of these statistics as not enough comprehensive, notably because of cross-border operations engaged directly by economic agents without domestic financial institutions.

The Council Regulation dated 25 June 1996 makes no provision for compiling quarterly financial accounts. So, quarterly financial accounts could only be implemented on a totally voluntary basis.

This chapter deals with the question of the features of quarterly financial accounts, examines the problem of sources of information and of methods, treats the problems of consolidation, timeliness, seasonal adjustment and publishing.

Quarterly financial accounts

Need for quarterly financial accounts

18.01. The first question to consider is the need for producing financial accounts. The development of financial activity, in a context of globalisation, has considerably reinforced the argument for its complete coverage. One can observe a kind of autonomy of financial flows and possibly strong effects on the expenditure behaviour of economic agents through variables, such as interest or exchange rates. The following points present arguments in favour of a quarterly compilation in the light of the original and illuminating contribution that financial accounts can provide.

18.02. It is often argued that within the financial accounts, the *money and banking statistics*, centred on the Monetary Financial Institutions (MFIs), represent the main pillar of financial accounts. MFIs have a crucial contribution to creation and movement of financial assets in the economy. The need for full quarterly financial accounts is in this view not a compelling one and quarterly financial accounts would preferably be used for structural studies. An annual basis would seem sufficient for these purposes. Nevertheless, the coverage of money and banking statistics is not sufficiently comprehensive, especially concerning cross-border operations conducted directly by economic agents without the involvement of domestic financial institutions. Moreover, although available on a monthly basis, the money and banking statistics mainly aim to measure monetary aggregates and some information on financial accounts required under the ESA 1995 Regulation may be missing.

18.03. In addition, it must be stressed that the financial accounts methodology incorporates a double consistency check. That is really a fundamental contribution to analysis. On one hand, financial accounts are linked to non financial transactions. “Net borrowing/net lending” is in principle a balancing item both in the capital account and in the financial accounts. On the other hand, except for “monetary gold and SDRs”[1] (AF1), any financial asset held by one unit is balanced by a liability incurred by another unit (including units in the same institutional sector where accounts are not consolidated). In these conditions, financial accounts allow deeper analysis of financial behaviour and of the effects of change in some variables. Moreover, the possibility of having two measures of the same transaction helps to improve the quality of the accounts.

1 SDRs: special drawing rights

18.04. Request for quarterly financial accounts typically originates within national central banks from research departments, responsible for the analysis of the effects of the monetary policy. The larger the analytical framework, the better the analysis. In particular, it is then possible to track the arbitrage between many market financial instruments. At the level to be assigned in future to the European Central Bank (ECB), the usefulness of quarterly financial accounts for monitoring the new single monetary policy has clearly been stated by the Monetary, Economic and Statistics Department in the European Monetary Institute (EMI). The demand for this kind of information comes also from other users, notably in public or private organisations specialising in economic analysis and forecast. For instance, financial accounts would be very useful for ascertaining the effects of a “policy mix”, as when the effects of fiscal policy measures on financial behaviour are ascertained from monetary trends. Regular publication of reliable quarterly financial accounts would no doubt also stimulate interest from a much wider public in the press, the business community and academic institutions.

Voluntary basis

18.05. The Council Regulation on ESA 1995 dated 25 June 1996 makes no stipulation for compiling quarterly financial accounts. Thus, quarterly financial accounts could only be implemented on an entirely voluntary basis. Indeed the legal requirements at European level for quarterly non-financial accounts are limited to some specific aggregates and variables. This presumably explains the considerable variations both in current practice and in future intentions of Member States concerning the compilation of quarterly financial accounts. Only a few countries already produce quarterly financial accounts or will start doing so in the near future. Nevertheless, the evident usefulness of such accounts and the pressure to harmonise statistics, at least at the European Monetary Union (EMU) level, is likely to lead to an increase in activity by Member States. In these circumstances, it could be appropriate to recommend the general implementation of quarterly financial accounts, along the lines set out in this chapter. Implementation would proceed using a progressive and evolutionary approach. Improvements would be introduced step by step, following the use of better sources or estimates. During a transitional period features relating to coverage, quality, reliability, consistency of quarterly accounts could thus deviate from standards. This kind of flexibility would be acceptable under the condition that the accuracy of the results is fundamentally ensured. Otherwise, the use of quarterly financial accounts would be very limited, particularly in comparison with the wide dissemination and impact of monetary statistics. It is therefore advisable that the time-scale for achieving the objective and the length of the transition period should be specified by an agreement between Eurostat and the Member States.

Main features of quarterly financial accounts

18.06. Considering all the arguments, a simplification of the format used for quarterly financial accounts compared to the format used for annual financial accounts cannot really be recommended. On the contrary, it is firmly recommended to use the same format annually and quarterly both for sectors and for financial instruments. It would be inefficient and unhelpful to compile two sets of data for financial accounts, annually and quarterly, based on quite different or even incompatible conceptual frameworks. The effort needed for implementing the quarterly accounts will of course be greater with this requirement but it will also be more worthwhile compared to any alternative. Users could find the level of detail in simplified quarterly accounts inadequate for their purposes. It is also borne out by national experience in some countries that simplification does not necessarily make the accounts any easier to compile and it may indeed create new difficulties.

18.07. Methodological deviations may for a time be unavoidable in the quarterly financial accounts, particularly if the appropriate sources are lacking (see below). If this is the case, it will be essential to construct the accounts in such a way that relations can easily be established regarding their components. For instance, a simplification of the sector classification could entail grouping some sub-sectors without changing the criterion used for including units. Mixing two or more out of the six “first level” sectors defined in ESA 1995 is not recommended. While there may be a case for putting households and Non-Profit Institutions Serving Households (NPISHs) together, households and non-financial corporations should remain separate and distinct sectors by reason of their different financial behaviours. Moreover, identification of certain sub-sectors, as for MFIs, Insurance and Central Government is practically obligatory because their financial behaviours can show significant short-term fluctuations. Concerning financial transactions, the seven main categories identified in ESA 1995 preferably should not be grouped for quarterly accounts although it is possible that within each category the detail of instruments could be less developed than for annual accounts. Again this kind of simplification should not be set as a general principle and it should not happen too frequently. In addition, the different borderline cases raised by the classification should be strictly treated in an identical manner in quarterly and annual financial accounts.

18.08. One new fundamental feature of ESA 1995, as well as of SNA 1993, is the requirement for the provision of a complete set of data including flows and stocks, with flows split into transactions and other flows. Transactions are defined as “the interactions between institutional units, or between them and the rest of the world, by mutual agreement reference”. Other flows cover changes in the balance sheets that are not the result of transactions, namely the “other change in volume of assets” and those found in the “revaluation account” recording nominal holding gains and losses. The first type of flow is rather limited in the case of financial assets and liabilities. To the contrary, the second type of flow is significant, given the huge development of marketable financial instruments which are sometimes very frequently traded on organised or non-organised markets. It is therefore difficult to envisage any implementation in accordance with ESA 1995 without the provision of a complete set of data, at least at a final stage. This amounts to an integral requirement in ESA 1995 that cannot be dropped. Indeed, the meaning and the methodological consistency of financial accounts depend very much on this comprehensive approach.

18.09. Another fundamental requirement of ESA 1995, that cannot be ignored, is the *accrual basis* for recording interest payments. The latter are to be “recorded as accruing continuously over time to the creditor on the amount of principal outstanding”. It is difficult to think that this principle would not apply to the quarterly financial accounts. Leaving aside any consistency problem with annual accounts, it is clear that accounts compiled on any other basis (for instance, the recorded occurrences of interest payments) would have almost no meaning or, at least, could not be integrated in the conceptual framework of ESA 1995.

18.10. The view expressed in § 18.09 might be judged as an ideal that would be difficult to meet in practice. It does, however, reflect the compilation conditions encountered in many cases by national compilers. The transactions concerned are often derived in practice from the change in balance sheets where, as for financial institutions, these data are easily available. In this case, it is essential to be in a position to identify clearly and reliably the other flows in order to measure the transactions. Other changes in volume and nominal holding gains, which are fundamentally different in nature, also have to be identified. At the first stage, however, the full detail on nominal gains could be foregone if it proved too difficult to provide.

18.11. The proposal made above has the crucial advantage of permitting time consistency between quarterly and annual financial accounts. The cumulation of four quarterly financial accounts compiled during a year could, with the necessary adjustments, yield a first provisional version, of annual financial accounts. It is clear that a high level of consistency on quarterly and annual bases could enable compilation of annual provisional data more quickly. This would certainly be advantageous for the dissemination of financial accounts and the interest of the public in them would increase. The experience of some countries already compiling quarterly financial accounts indicates that the proposal is the best single solution to adopt.

18.12. Close attention should be paid to the question of revisions. Where annual data provides better information for recording some financial transactions, only a provisional annual account may be consistent with the previous quarterly accounts. This can happen when the necessary sources are available only on an annual basis and the quarterly accounts cannot be corrected. The semi-final and final annual financial accounts would then differ from the summed four quarterly accounts. This situation would apply more particularly during the first stage of the implementation of quarterly financial accounts and national compilers would presumably work over time towards the objective of revising quarterly accounts as fully as possible. Meanwhile, quarterly financial accounts would essentially be used for short-term analysis rather than for monitoring structural changes and the effects of this lack of consistency might be quite small. Users should nonetheless be advised that these effects might be present.

Sources and methods

18.13. Although much of the data required are available on a quarterly basis, in some cases, as indicated above, the sources of information may be available only on an annual basis. For instance, resources may not be adequate for carrying out special-purpose surveys of households more frequently than annually. Balance sheets are generally drawn up only once a year for non-financial corporations. Other difficulties arise also for insurance corporations and pension funds. More often, a quarterly coverage of all the units included in the General Government sector is not possible and data may only be readily available for central government. It is apparent that in many countries the sources of information used for the detail in annual accounts would only be available in part for compiling financial accounts.

18.14. As stated earlier, a simplified scheme for quarterly accounts is only admissible under the condition that the general consistency of both sector and instrument classification is preserved. If, for instance, quarterly information were limited to units in central government, this would not alone be a sufficient basis for compiling complete accounts of the General Government sector. Accordingly, estimates should be made for the data associated with the other units included in general government. Similarly, it would be incorrect to exclude from quarterly financial accounts a significant component of a main category of instrument. Components of crucial importance in this regard are as follows:

- financial derivatives within “securities other than shares”;
- mutual funds shares within “shares and other equity”;
- unquoted shares and other equity also within “shares and other equity”;
- “net equity of households” within “Insurance technical reserves”.

On the other hand, some distinctions are probably of secondary importance. Examples here include items in the breakdown of “currency and deposits”, for “loans” (by maturity), “securities other than shares excluding financial derivatives” (by maturity) and “other accounts”. In other words, any lack of information should not lead to a significant shift in the methodology used for quarterly accounts that would create large discrepancies with the annual accounts.

18.15. The general conclusion to this point is that national compilers would be well advised to try to get as much reliable information as possible rather than to produce quarterly financial accounts which are less than complete. Several different general approaches are worth consideration. A first general approach is to give attention to the sources. An annual source could be turned into a quarterly one where the burden on the reporting agents is not thought to be too heavy. Data available in the accounting system of the reporting agents is thus mobilised and reshaped. Secondly, new sources could be used even if they do not meet all the ESA 1995 requirements. This involves making adjustments on the basis of a comparison between the annual and the quarterly data. Information from commercial suppliers or from other parts of the statistical system could be used in some cases, notably when the collection and treatment of other sources would otherwise be onerous. For instance, the recording of accrued interest in the quarterly accounts could be based on macro-economic data rather than micro-economic information.

18.16. Another general approach utilises substitution methods. First, compilers could introduce estimates, based for instance on econometric models measuring the links between some financial transactions and various variables. They could also use grossing up methods from limited samples. However, the feasibility of doing things in this way is not at all certain and compilers should be careful in using such methods if there is a possibility of getting unreliable results. Secondly, in some cases a parametrical approach can be recommended, namely to apply ratios calculated on an annual basis in the quarterly accounts. This approach can for instance meet the need to distinguish holders of some instruments from among several different categories of agents. Obviously, it should be applied only when movements in the instruments are not volatile. As financial behaviour becomes more and more sensitive to market variables, the use of such an approach could in fact be rather limited. Another example concerns the calculation of accrued interest that could, for practical reasons, be done on various bases such as simplified methods, proxy variables, and information available from the market on a global basis. There is the proviso here that comparison of the outcome with the annual results should not involve any significant adjustments. In any case, compilers will have to check the degree of reliability of the alternative approaches available to them. A good general guideline is to accept only small deviations that do not alter the message of the quarterly data.

Other issues

18.17. In ESA 1995 two requirements exist side by side. These requirements relate respectively to consolidated and unconsolidated accounts. The difference between the two types of accounts is caused by the netting-off of the transactions which units in the same sector make with each other. Both kinds of accounts are relevant for analytical purposes. However, the consolidation for some sectors like General Government and Non Financial Corporations raises some specific difficulties, particularly where alternative sources or estimates have to be used. As consolidation is only feasible if it can cover all sectors, priority in practice has to be given to implementation of non-consolidated accounts.

18.18. Information given by the quarterly financial accounts will really be useful only if it is made available within a “reasonable” interval following its reference period. Experience shows that some quarterly information is often available just after the reference quarter. Due to the demands of the compilation process and to the need for doing the necessary checks, a reasonable interval for quarterly accounts could be fixed at a maximum of four months. A provisional version of annual financial accounts could thus be available four months after the end of the reference year, whereas more definitive but not necessarily final data could be produced after a nine-month interval as the ESA 1995 regulation requires.

18.19. The publishing policies of Member States for quarterly accounts may vary considerably because of their different views about reliability and quality. Nevertheless, reliability and quality should be progressively improved, given the objective of achieving time consistency between quarterly and annual accounts. It therefore seems right to publish these data, excepting any secondary breakdowns containing discrepancies that it would be inappropriate to reveal. Grouping some items of the classification together is possibly the best solution when, as in this case, a high degree of quality has not been achieved. At the European level, the Commission and the Central Bank would primarily use these quarterly data for their own analysis purposes. Publication of the data could as a normal practice be restricted to a high level of aggregation. Publication of data at lower levels of aggregation would only take place with the agreement of the Member States in order to be consistent with national practices on this issue.

18.20. However, the aggregation of data raises specific problems such as the feasibility of the breakdown of the Rest of the World sector in ESA 1995 into the three sub-sectors of "European Monetary Union Members", other "European Union Members" and other countries. If all the EU members were in a position to provide reliable quarterly financial accounts, the aggregation could be built up directly by adding all the accounts, using only total data for the Rest of the World. As this will evidently not be the case in practice, it is recommended split the Rest of the World down into the three sub-sectors. If some countries were not in a position to do this on the basis of the data available to them, the ratios of the three sub-sectors to the Rest of the World totals observed for other countries which have provided full information could be used as initial proxies under certain conditions.

18.21. Where data are compiled at sub-annual frequencies, seasonal adjustment is necessary to improve the analysis. Regular movements, if any, in the evolution of financial transactions and stocks, could be misleading. However, evidence for the existence of a seasonal component can only be found by applying specific methods on rather long time series, a minimum of nine or ten years for quarterly data. Otherwise the effectiveness of the statistical tests is likely to be reduced, particularly for checking whether the seasonality is stable. The problem is that some countries will not be in a position to provide back-data because they are not yet compiling quarterly financial accounts. Moreover, other Member States could encounter difficulties in adapting older time-series to new ESA 1995 requirements, especially concerning accrued interest. During the first stage of the new regime, seasonal adjustment is therefore unlikely to feature. It must further be stressed that seasonal adjustment, when in due course applied, should be computed at an aggregate level as it would not be relevant to sum up the adjusted domestic figures.

Operational conclusions

18.22. The discussion in this chapter of issues arising from the recommended compilation of quarterly financial accounts points towards conclusions and recommendations for further action as follows:

- The views expressed in favour of a comprehensive approach to the production of quarterly financial accounts have some endorsement from the experience of the countries that already compile such accounts. There is accordingly a case for producing general guidelines on how to expand provision of such data at the European level.
- Approaches could usefully be made to the Member States which are not yet producing quarterly financial accounts in order to agree on a common "action programme". The question arises as to whether completion of such a programme should be determined as a medium-term objective or as the subject of work during a transitional period.

ANNEX

ANNEX

QUARTERLY NATIONAL ACCOUNTS QUESTIONNAIRE

Quarterly national account questionnaire

Summary

A.01. Annex B of ESA Regulation specifies the list of variables that must be compiled in order to obtain a complete set of national accounts according to ESA 1995 principles. The annex contains the information that is necessary to compile a minimal set of consistent quarterly accounts. In order to improve quarterly accounts and going towards a more complete and detailed picture of the economy, the minimal set of quarterly aggregates required by the Annex B of ESA Regulation is enlarged according to the framework stated in Chapter 2 of this handbook. In this annex, the requirements of Annex B of ESA Regulation are illustrated and the proposal coming from Chapter 2 are integrated. These proposals mainly correspond to the more detailed industries breakdown (with respect to the breakdown present in Annex B) and the new sectors breakdown presented in Chapter 2.

A.02. The Annex B of ESA Regulation explicitly asks for a questionnaire whose aim is to collect, in a harmonised form, the information related to national accounts in the Member States. The questionnaire covers both annual and quarterly accounts. It is structured as a set of tables which collect the minimum set of aggregates.

The Annex B of the ESA 1995 regulation explicitly asks the variables included in the compulsory tables on a quarterly base. This is the starting point of the compilation of the quarterly accounts according to ESA 1995. Besides this, a set of voluntary tables is add on a quarterly base in order to give a more complete picture of the short-term economic situation.

The questionnaire, for our purposes, is then made by 12 compulsory tables and 10 voluntary tables. The voluntary tables are based on the simplified scheme of the accounts, introduced in Chapter 2.

A.03. This annex is devoted to the analysis and presentation of the contents of both the compulsory and voluntary tables. Most tables display several dimensions concerning current and constant prices in raw, seasonally-adjusted, and cycle-trend design. This annex is also a part of the standard international (Eurostat/OECD/UN) questionnaire.

Eurostat's Proposed Quarterly National Accounts Questionnaire Tables

A.04. Structure of the questionnaire

The quarterly questionnaire concerning national accounts, is composed of 22 tables. 12 tables (0101-0112) are the compulsory Eurostat questionnaire tables arising from Annex B of the ESA 1995 Council regulation (EC 2223/96). They contain sometimes splits on a voluntary basis. In addition, Eurostat proposes 10 tables (0113-0122) on a voluntary basis:

Table 0101	Gross value added at basic prices and gross domestic product at market prices
Table 0102	GDP identity from the expenditure side
Table 0103	GDP identity from the income side
Table 0104	Final consumption
Table 0105	Gross capital formation
Table 0106	Exports and imports of goods (f.o.b.) and services
Table 0107	Disposable income
Table 0108	Saving and net lending/borrowing
Table 0109	Real disposable income
Table 0110	Population and employment
Table 0111	Employment in persons and full time equivalents by industry
Table 0112	Compensation of employees by industry
Table 0113	Gross value added in A17 breakdown (table 0101 extended)
Table 0114	Employment by industry in A17 breakdown (table 0111 extended)
Table 0115	Compensation of employees by industry in A17 breakdown (table 0112 extended)
Table 0116	Actual individual final consumption of households by purpose (according to the COICOP classification)
Table 0117	Final Consumption of households by durability of goods
Table 0118	Gross operating surplus by industry in A17 breakdown
Table 0119	Simplified non financial accounts by institutional sector
Table 0120	Exports of goods (f.o.b.) and services by Member States of the EU / third countriesTRP7
Table 0121	Imports of goods (f.o.b.) and services by Member States of the EU / third countries TRP7

Table 0122	Financial accounts by sector (consolidated)
Table 0123	Financial accounts by sector (non-consolidated)
Table 0124	Revaluation account abstract (consolidated)
Table 0125	Revaluation account abstract (non-consolidated)
Table 0126	Balance sheets for financial assets and liabilities (consolidated)
Table 0127	Balance sheets for financial assets and liabilities (non-consolidated)

A.05. The following paragraphs briefly discuss and describe the questionnaire tables. The results should be transmitted in raw, seasonally-adjusted, and cycle-trend form. Only total population is required in 'raw' unadjusted form.

In order to conceal the requirements of consistency and the problems of compilation that the countries may face with, especially in the first phase of the implementation of ESA 1995, in some tables appear the column "Discrepancy". It is assumed that some discrepancies can occur: for example, between the different estimates derived from the approaches to the compilation of GDP and between the net lending and net borrowing in capital and the financial account (when the quarterly figures are compiled). Discrepancies in other places have to be considered not advisable. Member States are invited to discuss with Eurostat any other specific discrepancy.

A.06. **Table 0101.** Shows gross value added at basic prices and gross domestic product at market prices. Gross value added is the result of output valued at basic prices less intermediate consumption valued at purchasers' prices (see ESA 1995, § 9.23; SNA 1993, § 6.37). Gross domestic product at market prices is the final result of the production activity of resident producer units. Here gross domestic product at market prices is the sum of gross value added plus taxes and less subsidies on products (see ESA 1995, § 8.89; SNA 1993, § 6.237). The table has the following elementary columns: gross value added at basic prices for six industries, FISIM, taxes less subsidies on products. A column statistical discrepancy is included, where countries report the discrepancy between the GDP in column 13 and the GDP finally published.

A.07. **Table 0102.** Gives a breakdown of the expenditure measure of GDP into the following components: GDP, final consumption expenditure, gross capital formation, exports and imports. There is room to report the statistical discrepancy between the GDP in column 3 and the GDP finally published.

A.08. **Table 0103**. Displays the GDP identity from the income side with the columns gross domestic product, compensation of employees, gross operating surplus and mixed income, taxes on production and imports less subsidies. A column statistical discrepancy should report the discrepancy between the GDP in column 3 and the GDP finally published.

A.09. **Table 0104**. Sets out final consumption expenditure, which consists of expenditure incurred by resident institutional units on goods or services that are used for the direct satisfaction of individual needs or wants or the collective needs of members of the community. The following aggregates are included: final consumption expenditure of households, final consumption expenditure of NPISH's, individual final consumption expenditure of general government, collective final consumption expenditure of general government, actual individual consumption, each at current and at constant purchaser's prices.

A.10. **Table 0105**. Contains gross capital formation (see SNA 1993, § 10.32) broken down into the PI6 classification. The columns are: gross fixed capital formation by six products at current purchasers' prices, changes in inventories at current purchasers' prices, acquisitions less disposals of valuables at current purchasers' prices, gross fixed capital formation by six products at constant purchasers' prices, changes in inventories at constant purchasers' prices, acquisitions less disposals of valuables at constant purchasers' prices.

A.11. **Table 0106.** Exports and imports of goods (f.o.b.) and services are broken down in exports of goods and services, imports of goods and services. The separation of goods and services is on a voluntary basis.

A.12. **Table 0107.** Disposable income at current prices requires: gross domestic product, primary incomes receivable from the rest of the world, primary incomes payable to the rest of the world, gross national income at market prices, consumption of fixed capital, net national income at market prices, current transfers receivable from the rest of the world, current transfers payable to the rest of the world, net national disposable income, each item at current prices.

A.13. **Table 0108.** Saving and Net lending/borrowing at current prices: net national disposable income, final consumption expenditures; saving, net; capital transfers receivable from the rest of the world; capital transfers payable to the rest of the world; gross capital formation; consumption of fixed capital; net lending/net borrowing, each item at current prices.

A.14**.** **Table 0109.** Real disposable income: gross domestic product at constant prices; trading gain or loss; real gross domestic income; real primary incomes receivable from the rest of the world; real primary incomes payable to the rest of the world; real gross national income at market prices; real current transfers receivable from the rest or the world; real current transfers payable to the rest of the world; real gross national disposable income; consumption of fixed capital at constant prices; real net national income at market prices; real net national disposable income.

A.15**.** **Table 0110.** Population and employment: presents total population, economically active population, unemployed persons, and employment with a split between employees and self-employed. Total employment equals the sum of employees and self-employed. The results should be given in thousand/million persons and full time equivalent.

A.16. **Table 0111.** Shows employment by industry (employees and self-employed) in A6 classification. The results should be given in thousand/million persons and full time equivalent.

A.17. **Table 0112**. Displays compensation of employees by industry and gross wages and salaries by industry in A6 classification.

A.18**.** **Table 0113**. Shows as a partial disaggregation of table 0101 gross value added in A17 breakdown at basic prices.

A.19. **Table 0114**. Shows employment by industry in A17 breakdown (extending table 0111).

A.20. **Table 0115.** Displays the disaggregation of table 0112. It shows compensation of employees by industry in A17 breakdown.

A.21. **Table 0116.** Final consumption expenditure of households by Purpose (according to the COICOP classification, version 1.10.96) shows 12 purposes.

A.22. **Table 0117.** Exhibits final consumption of households by durability. It displays the four columns final consumption of households, durable goods, non-durable goods and services. The position 'Non-Durable Goods' includes the current consumption of 'Clothing and Footwear'.

A.23. **Table 0118.** Shows gross operating surplus by industry in A17 breakdown.

A.24. **Table 0119.** Simplified Non Financial Accounts by Institutional Sector displays a scheme with the uses and resources of the sectors total economy, corporations, general government, and households and NPISH for the variables: operating surplus, capital consumption, net property income, taxes on production and imports less subsidies, current transfers, net national disposable income, adjustment for the change in net equity of households in pension funds reserves, final consumption expenditure, net saving, capital transfers, gross capital formation, gross fixed capital formation, changes in inventories, acquisitions less disposals of valuables, consumption of fixed capital, net lending/net borrowing.

A.25. **Table 0120.** Shows exports of goods (f.o.b.) and services by Members States of the EU / third countries.

A.26. **Table 0121.** Shows imports of goods (c.i.f.) and services by Members States of the EU / third countries.

A.27. **Tables 0122-0123.** Financial accounts by sector (transactions) shows the financial accounts scheme of the total economy, of corporations, of general government, and of households and NPISH with the following items: monetary gold and sdrs; currency and deposits; securities other than shares; loans; shares and other equity; insurance technical reserves; other accounts receivable.

A.28. **Table 0124.** Revaluation account shows a voluntary financial scheme.

A.29. **Table 0126.** Balance sheets for financial assets and liabilities shows a voluntary financial scheme.

List of abbreviations

Units

NAC	national currency
PER	persons
HRS	hours
FTE	Full time equivalent
JOB	Jobs

Quantity of units

TSD	thousand
MIO	million
MRD	billion

Payable/Receivable

PAY	payable
REC	receivable

Gross/net

G	gross
N	net

Employment

POP	Total population
ETO	Total employment
EEM	Employees
ESE	Self-employed
EHW	Hours worked
EUN	Unemployed Persons

Code for industries

AYA+AYB	Agriculture, hunting and forestry; fishing
AYC_AYE	Industry, including energy
AYF	Construction
AYG_AYI	Wholesale, retail trade; repair of motor vehicles and household goods, hotels and restaurants

Transport and communication

AYJ+AYK	Financial, real-estate, renting and business activities
AYL_AYP	Other service activities

AYA	Agriculture, hunting and forestry
AYB	Fishing
AYC	Mining and quarrying
AYD	Manufacturing
AYE	Electricity, gas and water supply
AYF	Construction
AYG	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods
AYH	Hotels and restaurants
AYI	Transport, storage and communication
AYJ	Financial intermediation
AYK	Real estate, renting and business activities
AYL	Public administration and defence; compulsory social security
AYM	Education
AYN	Health and social work
AYO	Other community, social and personal service activities
AYP	Private households with employed persons

Prices

CUP	current prices
COPYY	constant prices
CIF	cost, insurance and freight
FOB	free on board

Classification of individual consumption by purpose (COICOP)

CP010	Food and non-alcoholic beverages
CP020	Alcoholic beverages, tobacco and narcotics
CP030	Clothing and footwear
CP040	Housing, water, electricity, gas and other fuels
CP050	Furnishings, household equipment and routine maintenance of the house
CP060	Health
CP070	Transport
CP080	Communications
CP090	Recreation and culture
CP100	Education
CP110	Restaurants and hotels
CP120	Miscellaneous goods and services

Concepts

DC	domestic concept
NC	national concept

Code for transactions

TRB1	Value added at basic prices

TRB1*	Domestic product at market prices
TRB2	Operating surplus
TRB3	Mixed income
TRB5	Balance of primary income
TRB5*	National income
TRB6	Disposable income
TRB8	Saving
TRB9	Net lending/net borrowing
TRP1	Output
TRP11	Market output
TRP12	Output for own final use
TRP13	Other non-market output
TRP2	Intermediate consumption
TRP3	Final consumption expenditure
TRP31	Individual consumption expenditure
TRP32	Collective consumption expenditure
TRP4	Actual final consumption
TRP41	Actual individual consumption
TRP5	Gross capital formation
TRP51	Gross fixed capital formation
TRP52	Changes in inventories
TRP53	Acquisitions less disposals of valuables
TRP6	Exports of goods and services
TRP61	Exports of goods
TRP62	Exports of services
TRP7	Imports of goods and services
TRP71	Imports of goods
TRP72	Imports of services
TRD1	Compensation of employees
TRD11	Wages and salaries
TRD12	Employers' social contributions
TRD2	Taxes on production and imports
TRD21	Taxes on products
TRD211	Value added type taxes (VAT)
TRD212	Taxes and duties on imports excluding VAT
TRD214	Taxes on products, except VAT and import taxes
TRD29	Other taxes on production
TRD3	Subsidies
TRD31	Subsidies on products
TRD39	Other subsidies on production
TRD21-TRD31	Taxes less subsidies on products
TRD29-TRD39	Other taxes on production paid minus other subsidies on production received
TRD4	Property income
TRD41	Interest
TRD42	Distributed income of corporations

TRD43	Reinvested earnings on direct foreign investment
TRD44	Property income attributed to insurance policy holders
TRD45	Rents
TRD5	Current taxes on income, wealth, etc.
TRD51	Taxes on income
TRD59	Other current taxes
TRD61	Social contributions
TRD62	Social benefits other than social transfers in kind
TRD7	Other current transfers
TRD8	Adjustment for the change in net equity of households in pension funds
TRD9	Capital transfers

Adjustment

N	raw
S	seasonally-adjusted
C	cycle-trend

Code for sectors

SES1	Total economy
SES11	Non-financial corporations
SES12	Financial corporations
SES13	General government
SES14	Households
SES15	Non-profit institutions serving households

Questionnaire “ESA 1995"

Table 0101

01 Main aggregates

country:
currency: MIO NAC
prices: CUP and COPYY

Table 0101: Gross value added at basic prices and gross domestic product at market prices

Quarter/year	Time-code	Industries (combination of letters of NACE Rev. 1)						Total A6	FISIM	Gross value added, exclud. FISIM	Taxes less subsidies on products	Gross Domestic Product	Statistical discrepancy[(1)]
Code of transaction		TRB1G	TRB1G	TRB1G	TRB1G	TRB1G	TRB1G	TRB1G	TRP119	TRB1G-TRP119	TRD21-TRD31	TRB1*G	DOTRB1*G
Code of industries		AYA+AYB	AYC_AYE	AYF	AYG_AYI	AYJ+AYK	AYL_AYP	TA6					
1	2	3	4	5	6	7	8	9=3+...+8	10	11=9-10	12	13=11+12+14	14
first quarter	1995Q1												
second quarter	1995Q2												
third quarter	1995Q3												
fourth quarter	1995Q4												
year 1995	1995												

(1) Please report the discrepancy between the GDP in column 13 and the GDP finally published

Questionnaire “ESA 1995"

Table 0102

01 Main aggregates

country:
currency: MIO NAC
prices: CUP and COPYY

Table 0102: GDP identity from the expenditure side

Quarter/year	Time-code	Gross Domestic Product	Final consumption expenditure	Gross capital formation	Exports	Imports	Statistical discrepancy (1)
Code of transaction		TRB1*G	TRP3	TRP5	TRP6	TRP7	DETRB1*G
1	2	3=4+5+6-7+8	4	5	6	7	8
first quarter	1995Q1						
second quarter	1995Q2						
third quarter	1995Q3						
fourth quarter	1995Q4						
year 1995	1995						

(1) Please report the discrepancy between the GDP in column 3 and the GDP finally published.

Questionnaire “ESA 1995"

Table 0103

01 Main aggregates

country:
currency: MIO NAC
prices: CUP and COPYY

Table 0103: GDP identify from the income side

Quarter/year	Time-code	Gross domestic product	Compensation of employees	Gross operating surplus and gross mixed income	Taxes less subsidies on production and imports	Statistical discrepancy(1)
Code of transaction		TRB1*G	TRD1	TRB2G+TRB3G	TRD2-TRD3	DITRB1*G
1	2	3 = 4+5+6+7	4	5	6	7
first quarter	1995Q1					
second quarter	1995Q2					
third quarter	1995Q3					
fourth quarter	1995Q4					
year 1995	1995					

(1) Please report the discrepancy between the GDP in column 3 and the GDP finally published

Questionnaire “ESA 1995"

Table 0104

01 Main aggregates

country:
currency: MIO NAC
prices: CUP and COPYY

Table 0104: Final consumption

Quarter/year	Time-code	Final consumption expenditure						Actual individual consumption (1)
		Total	of households (2)	of NPISH's	of general government			
					Total	Individual (1)	Collective (1)	
Code of sector		SES13_SES15	SES14	SES15	SES13	SES13	SES13	SES13_SES15
Code of transaction		TRP3	TRP31	TRP31	TRP3	TRP31	TRP32	TRP41
1	2	3=4+5+6	4	5	6 =7+8	7	8	9 = 4+5+7
first quarter	1995Q1							
second quarter	1995Q2							
third quarter	1995Q3							
fourth quarter	1995Q4							
year 1995	1995							

(1) on a voluntary basis for the quarterly exercise.
(2) final consumption expenditure of households including final consumption expenditure of resident households in the rest of the world and excluding final consumption expenditure of non-resident households on the economic territory.

Questionnaire "ESA 1995"

Table 0105

01 Main aggregates

country:
currency: MIO NAC
prices: CUP and COPYY

Table 0105: Gross capital formation

Quarter/year	Time-code	Gross capital formation TRP5										
		Total economy	Gross fixed capital formation TRP51							Changes in inventories and acquisition less disp. of valuables	Changes in inventories	Acquisition less disp. of valuables
			Gross fixed capital formation by product						Total PI6			
Code of transaction		TRP5	TRP51	TRP51	TRP51	TRP51	TRP51	TRP51	TRP51	TRP52+TRP53	TRP52	TRP53
Code of product		...	PI61	PI62	PI63	PI64	PI65	PI66	TPI6	...	...	...
1	2	3 = 10+11	4	5	6	7	8	9	10=4+...+9	11=12+13	12	13
first quarter	1995Q1											
second quarter	1995Q2											
third quarter	1995Q3											
fourth quarter	1995Q4											
year 1995	1995											

Questionnaire “ESA 1995"

Table 0106

01 Main aggregates

country:
currency: MIO NAC
prices: CUP and COPYY

Table 0106: Exports and imports of goods (f.o.b.) and services

Quarter/year	Time-code	Exports of goods and services TRP6 (2)			Imports of goods and services TRP7 (3)			External balance of goods and services (1)
		Total	Goods (1)	Services (1)	Total	Goods (1)	Services (1)	Total
Code of transaction		TRP6	TRP61	TRP62	TRP7	TRP71	TRP72	TRB11
1	2	3=4+5	4	5	6=7+8	7	8	9 =3-6
first quarter	1995Q1							
second quarter	1995Q2							
third quarter	1995Q3							
fourth quarter	1995Q4							
year 1995	1995							

(1) on a voluntary basis.
(2) Exports including final consumption expenditure of non-residents households on the economic terretory.
(3) Imports including final consumption expenditure of non-residents households on the economic terretory.

Questionnaire “ESA1995"

Table 0107

01 Main aggregates

country:
currency: MIO NAC
prices: CUP and COPYY

Table 0107: Disposable income

Quarter/year	Time-code	Gross Domestic Product	Primary incomes receivable from the rest of the world	Primary incomes payable to the rest of the world	Gross national income at market prices	Consumption of fixed capital	Net national income at market prices	Current transfers receivable from the rest of the world	Current transfers payable to the rest of the world	Net national disposable income
Code of transaction		TRB1*G	TRD1_TRD4	TRD1_TRD4	TRB5*G	TRK1	TRB5*N	TRD5_TRD7	TRD5_TRD7	TRB6N
Code of product		SES1	FRSES2	TOSES2	SES1	SES1	FRSES2	FRSES2	TOSES2	SES1
1	2	3	4	5	6 = 3+4-5	7	8 =6-7	9	10	11 = 8+9-10
first quarter	1995Q1									
second quarter	1995Q2									
third quarter	1995Q3									
fourth quarter	1995Q4									
year 1995	1995									

Questionnaire “ESA 1995"

Table 0108

01 Main aggregates **country:**
currency: MIO NAC
prices: CUP and COPYY

Table 0108: Saving and net lending/borrowing

Quarter/year	Time-code	Net national disposable income	Final consumption expenditure	Adjustment for the change in net equity of households in pension funds reserves	Saving net	Capital transfers receivable fron the rest of the world	Capital transfers payable to the rest of the world	Gross capital formation	acq. less disp. of non-financial non-produced assets	Consump-tion of fixed capital	Net/lending/net borrowing
Code of transaction		TRB6N	TRP3	TRD8	TRB8N	TRD9	TRD9	TRP5	TRK2	TRK1	TRB9
Code of sector		SES1	SES1	SES1	SES1	FRSES2	TOSES2	SES1	SES1	SES1	SES1
1	2	3	4	5	6=3-4	7	8	9	10	11	12=6+7-8-9-10+11
first quarter	1995Q1										
second quarter	1995Q2										
third quarter	1995Q3										
fourth quarter	1995Q4										
year 1995	1995										

Questionnaire “ESA 1995" | Table 0109

01 Main aggregates **country:**
currency: MIO NAC

Table 0109: Real disposable income

Quarter/year	Time-code	Gross Domestic Product at constant prices	Trading gain or loss [1]	Real gross domestic income	Real primary incomes receivable from the rest of the world [2]	Real primary incomes payable to the rest of the world [2]	Real gross national income at market prices	Real current transfers receivable from the rest of the world [2]	Real current transfers payable to the rest of the world [2]	Real gross national disposable income	Consumption of fixed capital at constant prices	Real net national income at market prices	Real net national disposable income
Code of transaction		TRB1*G	TRTGL	TRGDI	TRD1_TRD	TRD1_TRD	TRB5*G	TRD5_TRD7	TRD5_TRD7	TRB6G	TRK1	TRB5*N	TRB6N
Code of sector		SES1	SES1	SES1	FRSES2	TOSES2	SES1	FRSES2	TOSES2	SES1	SES1	SES1	SES1
Code f prices		COPPY		RTYY	RTYY	RTYY	RTYY	RTYY	RTYY	RTYY	COPYY	RTYY	RTYY
1	2	3	4	5=3+4	6	7	8=5+6-7	9	10	11=8+9-10	12	13=8-12	14 = 11-12
first quarter	1995Q1												
second quarter	1995Q2												
third quarter	1995Q3												
fourth quarter	1995Q4												
year 1995	1995												

(1) T = (X-M)/P - (X/Px - M/Pm) The choice of the deflator for the current trade balance (P) is left to the NSO. If there is uncertainty, the average of the import (Pm) and export (Px) price indices should be used.
(2) deflator: index of Gross domestic final expenditure (final consumption expenditure of households plus NPISH and general government plus gross capital formation)

Questionnaire “ESA 1995"

Table 0110

01 Main aggregates **country:** **unit:** TSD PER
concept: NC

Table 0110: Population and employment

Quarter/year	Time-code	Total population	Economically active population (1)	Unemployed persons	Employment		
					Total	Employees (2)	Self-employed (3)
Code of transaction		POP	PEA	EUN	ETO	EEM	ESE
1	2	3	4=5+6	5	6 = 7+8	7	8
first quarter	1995Q1						
second quarter	1995Q2						
third quarter	1995Q3						
fourth quarter	1995Q4						
year 1995	1995						

(1) on a voluntary basis.
(2) residents employed by resident and non-resident producer units.
(3) residents self-employed by resident and non-resident producer units.

Questionnaire "ESA 1995"

Table 0111

01 Main aggregates

country:
concept: NC
units: TSD PER and TSD FTE (1)

Table 0111: Employment in persons and full time equivalents by industry

Quarter/year	Time-code	Total employment ETO (2)						
		Total A6	Total employment by industry					
Code of industries		TA6	AYA+AYB	AYC_AYE	AYF	AYG_AYI	AYJ+AYK	AYL_AYP
1	2	3 =4+...+9	4	5	6	7	8	9
first quarter	1995Q1							
second quarter	1995Q2							
third quarter	1995Q3							
fourth quarter	1995Q4							
year 1995	1995							

Quarter/year	Time-code	Employees EEM (2)						
		Total A6	Employees by industry					
Code of industries		TA6	AYA+AYB	AYC_AYE	AYF	AYG_AYI	AYJ+AYK	AYL_AYP
1	2	10=11+...+16	11	12	13	14	15	16
first quarter	1995Q1							
second quarter	1995Q2							
third quarter	1995Q3							
fourth quarter	1995Q4							
year 1995	1995							

Quarter/year	Time-code	Self-employed ESE (3)						
		Total A6	Self-employed by industry					
Code of industries		TA6	AYA+AYB	AYC_AYE	AYF	AYG_AYI	AYJ+AYK	AYL_AYP
1	2	17=18+...+23	18	19	20	21	22	23
first quarter	1995Q1							
second quarter	1995Q2							
third quarter	1995Q3							
fourth quarter	1995Q4							
year 1995	1995							

(1) on a voluntary basis.
(2) residents employed by resident and non-resident producer units.
(3) residents self-employed by resident and non-resident producer units.

Questionnaire “ESA 1995"

Table 0112

01 Main aggregates	**country:**		**prices:**	CUP
	units:	MIO NAC	**concept:**	DC

Table 0112: Compensation of employees by industry

Quarter/year	Time-code	Compensation of employees by industry [1]													
		Total							Of which wages and salaries						
Code of transaction		TRD1							TD11						
		Total A6	Compensation of employees by industry						Total A6	Wages and salaries by industry					
Code of industries		TA6	AYA+AYB	AYC_AYE	AYF	AYG_AYI	AYJ+AYK	AYL_AYP	TA6	AYA+AYB	AYC_AYE	AYF	AYG_AYI	AYJ+AYK	AYL_AYP
1	2	3=4+...+9	4	5	6	7	8	9	10=11+...+16	11	12	13	14	15	16
first quarter	1995Q1														
second quarter	1995Q2														
third quarter	1995Q3														
fourth quarter	1995Q4														
year 1995	1995														

(1) compensation of employees of residents and non-residents employed by resident producer units.

Questionnaire “ESA 1995"

Table 0113

01 Main aggregates **country:** **prices:** CUP and COPYY

units: MIO NAC **adjustment:** N, S and C

Table 0113: Gross value added in A17 breakdown (1) (2)

Quarter/year	Time-code	Gross value added of industries in A17 breakdown																Total A17	FISIM	Gross value added, excluding FISIM	Taxes less subsidies on prod-ucts	Gross Domestic Product	Statistical discrep-ancy (2)
Code of transaction		TRB1G																	TRP119	TRB1G-TRP119	RD21-TRD3	TRB1*G	DOTRB1*G
Code of industries		AYA	AYB	AYC	AYD	AYE	AYF	AYG	AYH	AYI	AYJ	AYK	AYL	AYM	AYN	AYO	AYP	TA17					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19=3+...+18	20	21=19-20	22	23=21+22+24	24
first quarter	1995Q1																						
second quarter	1995Q2																						
third quarter	1995Q3																						
fourth quarter	1995Q4																						
year 1995	1995																						

(1) on a voluntary basis.

(2) please report the discrepancy between the GDP in column 23 and the GDP finally published.

Questionnaire "ESA 1995"

Table 0114

01 Main aggregates **country:** **adjustment**: N, S and C

concept: DC

unit: TSD PER, TSD FTE, TSD JOB and TSD HRS

Table 0114: Employment by industry in A17 breakdown (1)

Quarter/year	Time-code	Total employment in A 17 breakdown																Total A 17
Code		ETO (2)																
Code of industries		AYA	AYB	AYC	AYD	AYE	AYF	AYG	AYH	AYI	AYJ	AYK	AYL	AYM	AYN	AYO	AYP	TA17
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
first quarter	1995Q1																	
second quarter	1995Q2																	
third quarter	1995Q3																	
fourth quarter	1995Q4																	
year 1995	1995																	

Quarter/year	Time-code	Total employment in A 17 breakdown																Total A 17
Code		EMM (2)																
Code of industries		AYA	AYB	AYC	AYD	AYE	AYF	AYG	AYH	AYI	AYJ	AYK	AYL	AYM	AYN	AYO	AYP	TA17
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
first quarter	1995Q1																	
second quarter	1995Q2																	
third quarter	1995Q3																	
fourth quarter	1995Q4																	
year 1995	1995																	

Quarter/year	Time-code	Total employment in A 17 breakdown																Total A 17
Code		ESE (2)																
Code of industries		AYA	AYB	AYC	AYD	AYE	AYF	AYG	AYH	AYI	AYJ	AYK	AYL	AYM	AYN	AYO	AYP	TA17
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
first quarter	1995Q1																	
second quarter	1995Q2																	
third quarter	1995Q3																	
fourth quarter	1995Q4																	
year 1995	1995																	

(1) on a voluntary basis.
(2) residents employed by resident and non-resident producer units.
(3) resident self-employed in resident and non-resident producer units.

Questionnaire “ESA 1995"

Table 0115

01 Main aggregates

country:
currency: MIO NAC
prices: CUP
adjustment: N, S and C
concept: DC

Table 0115: Compensation of employees by industry in A 17 breakdown (1) (2)

Quarter/year	Time-code	Compensation of employees by industry in A 17 breakdown															Total A 17
Code of transaction		TRD1															
Code of industries		AYA	AYB	AYC	AYD	AYE	AYF	AYG	AYH	AYI	AYJ	AYK	AYL	AYM	AYN	AYO	AYP	TA17
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
first quarter	1995Q1																	
second quarter	1995Q2																	
third quarter	1995Q3																	
fourth quarter	1995Q4																	
year 1995	1995																	

Quarter/year	Time-code	Gross wages and salaries by industry in A 17 breakdown																Total A 17
Code of transaction		TRD11																
Code of industries		AYA	AYB	AYC	AYD	AYE	AYF	AYG	AYH	AYI	AYJ	AYK	AYL	AYM	AYN	AYO	AYP	TA17
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
first quarter	1995Q1																	
second quarter	1995Q2																	
third quarter	1995Q3																	
fourth quarter	1995Q4																	
year 1995	1995																	

(1) on a voluntary basis.
(2) compensation of employees of residents and non-residents employed by resident producer units.

Questionnaire "ESA 1995" | Table 0116

01 Main aggregates

country:
currency: MIO NAC
prices: CUP and COPYY

adjustment: N, S and C
sector: SES14

Table 0116: Final consumption expenditure of households by purpose (COICOP) (1)

Quarter/year	Time-code	TRP31, DC (2)													TRP33 (4)	TRP34 (5)	TRP31, NC (3)
Code of transaction		TRP31	TRP31	TRP31	TRP31	TRP31	TRP31	TRP31	TRP31	TRP31	TRP31	TRP31	TRP31	TRP31			
COICOP code		CP010	CP020	CP030	CP040	CP050	CP060	CP070	CP080	CP090	CP100	CP110	CP120	TCP			
Code of concept		DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15=3+...+14	16	17	18=15+16-17
first quarter	1995Q1																
second quarter	1995Q2																
third quarter	1995Q3																
fourth quarter	1995Q4																
year 1995	1995																

(1) on a voluntary basis.
(2) final consumption expenditure of resident and non-resident households on the economic territory.
(3) final consumption expenditure of resident households on the economic territory and abroad.
(4) final consumption expenditure of resident households in the rest of the world.
(5) final consumption expenditure of non-resident households on the economic terretory.

Questionnaire “ESA 1995"

Table 0117

01 Main aggregates

country:
currency: MIO NAC
prices: CUP and COPYY
adjustment: N, S and C
sector: SES14

Table 0117: Final consumption of households by durability of goods [1]

Quarter/year	Time-code	Final consumption of households	Durable goods	Non-durable goods	Services
Code of transaction		TRP31	TRP311	TRP312	TRP313
1	2	3 =4+5+6	4	5	6
first quarter	1995Q1				
second quarter	1995Q2				
third quarter	1995Q3				
fourth quarter	1995Q4				
year 1995	1995				

(1) on a voluntary basis.

Questionnaire "ESA 1995"

Table 0118

01 Main aggregates

country :
currency : MIO NAC
prices: CUP

adjustment: N, S and C

Table 0118: Gross operating surplus by industry in A 17 breakdown [(1)]

Quarter/year	Time-code	Gross operating surplus and gross mixed income by industry																Total A17
Code of transaction		TRB2G + TRB3G																
Code of industries		AYA	AYB	AYC	AYD	AYE	AYF	AYG	AYH	AYI	AYJ	AYK	AYL	AYM	AYN	AYO	AYP	TA17
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19=3+...+18
first quarter	1995Q1																	
second quarter	1995Q2																	
third quarter	1995Q3																	
fourth quarter	1995Q4																	
year 1995	1995																	

(1) on a voluntary basis.

Questionnaire “ESA 1995”

Table 0119

Table 0119: Simplified non-financial accounts by institutional sector (1)

country:		**adjustment**:	N,S and C
currency:	MIO NAC	**period**:	1995Q1
prices:	CUP and COPYY		

Transaction \ Sector		Corporations	General government	Households and NPISHs	Total economy
		SES11+SES12	SES13	SES14+SES15	SES1
Generation of income account					
TRB1G	Value added, gross				
TRD1PAY	Compensation of employees, paid				
TRD2PAY	Taxes on production and imports, paid				
TRD29PAY	Other taxes on production and imports, paid				
TRD3REC	Subsidies, received				
TRD39REC	Other subsidies on production, received				
TRB2G+TRB3G	Operating surplus and mixed income, gross				
TRB3G	Mixed income, gross				
Distribution of income account					
TRD1REC	Compensation of employees, received				
TRD2REC	Taxes on production and imports, received				
TRD3PAY	Subsidies, paid				
TRD4PAY	Property income, paid				
TRD4REC	Property income, received				
TRD5PAY	Current taxes on income, wealth etc., paid				
TRD5REC	Current taxes on income, wealth etc., received				
TRD61PAY + TRD62PAY	Social contributions and social benefits, other than social transfers in kind, paid				
TRD61REC + TRD62REC	Social contributions and social benefits, other than social transfers in kind, received				
TRD7PAY	Other current transfers, paid				
TRD7REC	Other current transfers, received				
TRB6N	Net national disposable income				

Transaction	Sector	Corporations	General government	Households and NPISHs	Total economy
		SES11+SES12	SES13	SES14+SES15	SES1
Use of disposable income					
TRD8PAY	Adjustment for the change in net equity of households in pension funds reserves, paid				
TRD8REC	Adjustment for the change in net equity of households in pension funds reserves, received				
TRP3	Final consumption expenditure				
TRB8N	Saving, net				
Capital account					
TRD9PAY	Capital transfers, paid				
TRD9REC	Capital transfers, received				
TRP5	Gross capital formation				
TRP51	Gross fixed capital formation				
TRP52	Changes in inventories				
TRP53	Acquisitions less disposals of valuables				
TRK1	Consumption of fixed capital				
TRK2	Acquisitions less disposals of non-finantial non-produced assets				
TRB9	Net lending / net borrowing				

(1) on voluntary basis.

Questionnaire “ESA 1995"

Table 0120

01 Main aggregates **country:** **prices:** CUP and COPYY

units : MIO NAC

Table 0120: Exports of goods (f.o.b.) and services by Member States of the EU / third countries TRP6 [(1)]

Quarter/year	Time-code	Exports of goods (f.o.b.) and services by Member States of the EU / third countries (code of transaction TRP6)					
		Member States of the EU and institutions of the EU					to third countries and international organisa-tions
		Total	EU countries			Institutions of the EU	
			Member States of the EU	Members of the Monetary Union	Non-members of the Monetary Union		
Code of sector		SES21	SES211	SES2111	SES2112	SES212	SES22
1	2	3=4+5+6-7	4	5	6	7	8
first quarter	1995Q1						
second quarter	1995Q2						
third quarter	1995Q3						
fourth quarter	1995Q4						
year 1995	1995						

(1) on a voluntary basis

Questionnaire “ESA 1995"

Table 0121

01 Main aggregates

country:
units : MIO NAC
prices: CUP and COPYY

Table 0121: Imports of goods (c.i.f.) and services by Member States of the EU / third countries TRP7 (1)

Quarter/year	Time-code	Imports of goods (f.o.b.) and services by Member States of the EU / third countries (code of transaction TRP7)					
		Member States of the EU and institutions of the EU					from third countries and international organisations
		Total	EU countries			Institutions of the EU	
			Member States of the EU	Members of the Monetary Union	Non-members of the Monetary Union		
Code of sector		SES21	SES211	SES2111	SES2112	SES212	SES22
1	2	3=4+5+6-7	4	5	6	7	8
first quarter	1995Q1						
second quarter	1995Q2						
third quarter	1995Q3						
fourth quarter	1995Q4						
year 1995	1995						

(1) on a voluntary basis

Questionnaire “ESA 1995”

Table 0122

Table 0122: Financial accounts by sector (transactions)[1]

Consolidated CO **country:** **year:** N,S and C

currency: MIO NAC

Sectors and sub-sectors / Changes in financial assets	Code of transactions	Total economy [1]	Non-financial corporations	Financial corporations: Total	Financial corporations: Central Bank [1]	Financial corporations: Other monetary financial institutions [1]	Financial corporations: Other financial intermediaries	Financial corporations: Financial auxiliaries	Financial corporations: Insurance corporations and pension funds	General government: Total	General government: Central and state government	General government: Local government	General government: Social security funds	Households and non-profit institutions saving households	Rest of the world: Total	Rest of the world: European Union [1]	Rest of the world: Others [1]
Code of sectors		SES1	SES11	SES 12	SES1 21	SES122	SES12 3	SES1 24	SES125	SES 13	SES1311 +SES131 2	SES13 13	SES13 14	SES14 + SES15	SES 2	SES21	SES22
<u>Net acquisition of financial assets</u>	TRFAS																
Monetary gold and SDRs	TRF1AS																
Currency and deposits	TRF2AS																
Currency [1]	TRF21AS																
Transferable deposits [1]	TRF22AS																
Other deposits [1]	TRF29AS																
Securities other than shares	TRF3AS																
Securities other than shares, excluding financial derivatives	TRF33AS																
Short-term [1]	TRF331AS																
Long-term [1]	TRF332AS																
Financial derivatives [1]	TRF34AS																
Loans	TRF4AS																
Short-term [1]	TRF41AS																
Long-term [1]	TRF42AS																
Shares and other equity	TRF5AS																
Shares and other equity, excluding mutual funds shares	TRF51AS																
Quoted shares [1]	TRF511AS																
Unquoted shares [1]	TRF512AS																
Other equity [1]	TRF513AS																
Mutual funds shares [1]	TRF52AS																
Insurance technical reserves	TRF6AS																
Net equity of households in life insurance reserves and in pension funds reserves	TRF61AS																
Net equity of households in life insurance reserves	TRF611AS																
Net equity of households in pension funds reserves	TRF612AS																
Prepayments of insurance premiums and reserves for outstanding claims	TRF62AS																
Other accounts receivable	TRF7AS																
Trade credits and advances [1]	TRF71AS																
Other [1]	TRF79AS																

(1) on a voluntary basis

Table 0122: Financial accounts by sector (transactions)

Consolidated CO **country:** **year:** N,S and C

currency: MIO NAC

Sectors and sub-sectors / Changes in financial liabilities	Code of transactions	Total economy (1)	Non-financial corporations	Financial corporations: Total	Central Bank (1)	Other monetary financial institutions (1)	Other financial intermediaries	Financial auxiliaries	Insurance corporations and pension funds	General government: Total	Central and state government	Local government	Social security funds	Households and non-profit institutions saving households	Rest of the world: Total	European Union (1)	Others (1)
Code of sectors		SES1	SES11	SES12	SES121	SES122	SES123	SES124	SES125	SES13	SES1311+ SES1312	SES1313	SES1314	SES14 + SES15	SES2	SES21	SES22
Net incurrence of liabilities	TRFLI																
Monetary gold and SDRs	TRF1LI																
Currency and deposits	TRF2LI																
Currency (1)	TRF21LI																
Transferable deposits (1)	TRF22LI																
Other deposits (1)	TRF29LI																
Securities other than shares	TRF3LI																
Securities other than shares, excluding financial derivatives	TRF33LI																
Short-term (1)	TRF331LI																
Long-term (1)	TRF332LI																
Financial derivatives (1)	TRF34LI																
Loans	TRF4LI																
Short-term (1)	TRF41LI																
Long-term (1)	TRF42LI																
Shares and other equity	TRF5LI																
Shares and other equity, excluding mutual funds shares	TRF51LI																
Quoted shares (1)	TRF511LI																
Unquoted shares (1)	TRF512LI																
Other equity (1)	TRF513LI																
Mutual funds shares (1)	TRF52LI																
Insurance technical reserves	TRF6LI																
Net equity of households in life insurance reserves and in pension funds reserves	TRF61LI																
Net equity of households in life insurance reserves	TRF611LI																
Net equity of households in pension funds reserves	TRF612LI																
Prepayments of insurance premiums and reserves for outstanding claims	TRF62LI																
Other accounts receivable	TRF7LI																
Trade credits and advances (1)	TRF71LI																
Other (1)	TRF79LI																
Statistical adjustment	TRADJ																
Net lending (+) / net borrowing (-)	TRB9F																

(1) on a voluntary basis

Questionnaire “ESA 1995”

Table 0123

Table 0123: Financial accounts by sector (transactions)

Non-consolidated NCO **country:** **year:** N,S and C

currency: MIO NAC

Sectors and sub-sectors / Changes in financial assets	Code of transac-tions	Total economy (1)	Non-financial corpora-tions	Financial corporations: Total	Financial corporations: Central Bank (1)	Financial corporations: Other mone-tary financial institu-tions (1)	Financial corporations: Other finan-cial interm e-diares	Financial corporations: Finan-cial auxilia-ries	Financial corporations: Insurance corpora-tions and pension funds	General government: Total	General government: Central and state govern-ment	General government: Local govern-ment	General government: Social security funds	House-holds and non-profit institutions saving households	Rest of the world: Total	Rest of the world: European Union (1)	Rest of the world: Others (1)
Code of sectors		SES1	SES11	SES 12	SES1 21	SES122	SES12 3	SES1 24	SES125	SES 13	SES1311 +SES131 2	SES13 13	SES13 14	SES14 + SES15	SES 2	SES21	SES22
Net acquisition of financial assets	TRFAS																
Monetary gold and SDRs	TRF1AS																
Currency and deposits	TRF2AS																
Currency (1)	TRF21AS																
Transferable deposits (1)	TRF22AS																
Other deposits (1)	TRF29AS																
Securities other than shares	TRF3AS																
Securities other than shares, excluding financial derivatives	TRF33AS																
Short-term (1)	TRF331AS																
Long-term (1)	TRF332AS																
Financial derivatives (1)	TRF34AS																
Loans	TRF4AS																
Short-term (1)	TRF41AS																
Long-term (1)	TRF42AS																
Shares and other equity	TRF5AS																
Shares and other equity, excluding mutual funds shares	TRF51AS																
Quoted shares (1)	TRF511AS																
Unquoted shares (1)	TRF512AS																
Other equity (1)	TRF513AS																
Mutual funds shares (1)	TRF52AS																
Insurance technical reserves	TRF6AS																
Net equity of households in life insurance reserves and in pension funds reserves	TRF61AS																
Net equity of households in life insurance reserves	TRF611AS																
Net equity of households in pension funds reserves	TRF612AS																
Prepayments of insurance premiums and reserves for outstanding claims	TRF62AS																
Other accounts receivable	TRF7AS																
Trade credits and advances (1)	TRF71AS																
Other (1)	TRF79AS																

(1) on a voluntary basis

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Table 0123: Financial accounts by sector (transactions)

Non-consolidated NCO **country:** **year:** N,S and C

currency: MIO NAC

Sectors and sub-sectors / Changes in financial liabilities	Code of transactions	Total economy (1)	Non-financial corporations	Financial corporations: Total	Financial corporations: Central Bank (1)	Financial corporations: Other monetary financial institutions (1)	Financial corporations: Other financial intermediaries	Financial corporations: Financial auxiliaries	Financial corporations: Insurance corporations and pension funds	General government: Total	General government: Central and state government	General government: Local government	General government: Social security funds	Households and non-profit institutions saving households	Rest of the world: Total	Rest of the world: European Union (1)	Rest of the world: Others (1)
Code of sectors		SES1	SES11	SES12	SES121	SES122	SES123	SES124	SES125	SES13	SES1311+ SES1312	SES1313	SES1314	SES14 + SES15	SES2	SES21	SES22
Net incurrence of liabilities	TRFLI																
Monetary gold and SDRs	TRF1LI																
Currency and deposits	TRF2LI																
Currency (1)	TRF21LI																
Transferable deposits (1)	TRF22LI																
Other deposits (1)	TRF29LI																
Securities other than shares	TRF3LI																
Securities other than shares, excluding financial derivatives	TRF33LI																
Short-term (1)	TRF331LI																
Long-term (1)	TRF332LI																
Financial derivatives (1)	TRF34LI																
Loans	TRF4LI																
Short-term (1)	TRF41LI																
Long-term (1)	TRF42LI																
Shares and other equity	TRF5LI																
Shares and other equity, excluding mutual funds shares	TRF51LI																
Quoted shares (1)	TRF511LI																
Unquoted shares (1)	TRF512LI																
Other equity (1)	TRF513LI																
Mutual funds shares (1)	TRF52LI																
Insurance technical reserves	TRF6LI																
Net equity of households in life insurance reserves and in pension funds reserves	TRF61LI																
Net equity of households in life insurance reserves	TRF611LI																
Net equity of households in pension funds reserves	TRF612LI																
Prepayments of insurance premiums and reserves for outstanding claims	TRF62LI																
Other accounts receivable	TRF7LI																
Trade credits and advances (1)	TRF71LI																
Other (1)	TRF79LI																
Statistical adjustment	TRADJ																
Net lending (+) / net borrowing (-)	TRB9F																

(1) on a voluntary basis

Questionnaire “ESA 1995”

Table 0124

Table 0124: Revaluation account abstract [(1)]

Consolidated CO **country:** **year:** N,S and C

currency: MIO NAC

Sectors and sub-sectors / Changes in financial assets	Code of other flows	Total economy	Non-financial corporations	Financial corporations						General government				Households and non-profit institutions saving households	Rest of the world		
				Total	Central Bank	Other monetary financial institutions	Other financial intermediaries	Financial auxiliaries	Insurance corporations and pension funds	Total	Central and state government	Local government	Social security funds		Total	European Union	Others
Code of sectors		SES1	SES11	SES12	SES121	SES122	SES123	SES124	SES125	SES13	SES1311 +SES1312	SES1313	SES1314	SES14 + SES15	SES2	SES21	SES22
Currency and deposits	OFAF2K11AS																
Unrealised holding gains/losses	OFAF2K117AS																
- change in exchange rate	OFAF2K1171AS																
Realised holding gains/losses	OFAF2K119AS																
- change in exchange rate	OFAF2K1191AS																
Securities other than shares	OFAF3K11AS																
Unrealised holding gains/losses	OFAF3K117AS																
- change in exchange rate	OFAF3K1171AS																
- change in market valuation	OFAF3K1172AS																
Realised holding gains/losses	OFAF3K119AS																
- change in exchange rate	OFAF3K1191AS																
- change in market valuation	OFAF3K1192AS																
Loans	OFAF4K11AS																
Unrealised holding gains/losses	OFAF4K117AS																
- change in exchange rate	OFAF4K1171AS																
- change in market valuation	OFAF4K1172AS																
Realised holding gains/losses	OFAF4K119AS																
- change in exchange rate	OFAF4K1191AS																
- change in market valuation	OFAF4K1192AS																
Shares and other equity	OFAF5K11AS																
Unrealised holding gains/losses	OFAF5K117AS																
- change in exchange rate	OFAF5K1171AS																
- change in market valuation	OFAF5K1172AS																
Realised holding gains/losses	OFAF5K119AS																
- change in exchange rate	OFAF5K1191AS																
- change in market valuation	OFAF5K1192AS																

(1) on a voluntary basis

Table 0124: Revaluation account abstract [(1)]

Consolidated CO **country:** **year:** N,S and C

currency: MIO NAC

Sectors and sub-sectors / Changes in financial liabilities	Code of other flows	Total economy	Non-financial corpora-tions	Financial corporations: Total	Financial corporations: Central Bank	Financial corporations: Other monetary financial institu-tions	Financial corporations: Other financial interme-diares	Financial corporations: Finan-cial auxilia-ries	Financial corporations: Insurance corpora-tions and pension funds	General government: Total	General government: Central and state government	General government: Local govern-ment	General government: Social security funds	Households and non-profit insti-tutions saving households	Rest of the world: Total	Rest of the world: European Union	Rest of the world: Others
Code of sectors		SES1	SES11	SES12	SES121	SES122	SES123	SES124	SES125	SES13	SES1311+ SES1312	SES1313	SES1314	SES14 + SES15	SES2	SES21	SES22
Currency and deposits	OFAF2K11LI																
Unrealised holding gains/losses	OFAF2K117LI																
- change in exchange rate	OFAF2K1171LI																
Realised holding gains/losses	OFAF2K119LI																
- change in exchange rate	OFAF2K1191LI																
Securities other than shares	OFAF3K11LI																
Unrealised holding gains/losses	OFAF3K117LI																
- change in exchange rate	OFAF3K1171LI																
- change in market valuation	OFAF3K1172LI																
Realised holding gains/losses	OFAF3K119LI																
- change in exchange rate	OFAF3K1191LI																
- change in market valuation	OFAF3K1192LI																
Loans	OFAF4K11LI																
Unrealised holding gains/losses	OFAF4K117LI																
- change in exchange rate	OFAF4K1171LI																
- change in market valuation	OFAF4K1172LI																
Realised holding gains/losses	OFAF4K119LI																
- change in exchange rate	OFAF4K1191LI																
- change in market valuation	OFAF4K1192LI																
Shares and other equity	OFAF5K11LI																
Unrealised holding gains/losses	OFAF5K117LI																
- change in exchange rate	OFAF5K1171LI																
- change in market valuation	OFAF5K1172LI																
Realised holding gains/losses	OFAF5K119LI																
- change in exchange rate	OFAF5K1191LI																
- change in market valuation	OFAF5K1192LI																

(1) on a voluntary basis

Questionnaire “ESA 1995”

Table 0125

Table 0125: Revaluation account abstract [(1)]

Non-consolidated NCO **country:** **year:** N,S and C

currency: MIO NAC

Sectors and sub-sectors / Changes in financial assets	Code of other flows	Total economy	Non-financial corporations	Financial corporations						General government				Households and non-profit institutions saving households	Rest of the world		
				Total	Central Bank	Other monetary financial institutions	Other financial intermediaries	Financial auxiliaries	Insurance corporations and pension funds	Total	Central and state government	Local government	Social security funds		Total	European Union	Others
Code of sectors		SES1	SES11	SES 12	SES1 21	SES122	SES12 3	SES1 24	SES125	SES 13	SES1311 +SES131 2	SES13 13	SES13 14	SES14 + SES15	SES 2	SES21	SES22
Currency and deposits	OFAF2K11AS																
Unrealised holding gains/losses	OFAF2K117AS																
- change in exchange rate	OFAF2K1171AS																
Realised holding gains/losses	OFAF2K119AS																
- change in exchange rate	OFAF2K1191AS																
Securities other than shares	OFAF3K11AS																
Unrealised holding gains/losses	OFAF3K117AS																
- change in exchange rate	OFAF3K1171AS																
- change in market valuation	OFAF3K1172AS																
Realised holding gains/losses	OFAF3K119AS																
- change in exchange rate	OFAF3K1191AS																
- change in market valuation	OFAF3K1192AS																
Loans	OFAF4K11AS																
Unrealised holding gains/losses	OFAF4K117AS																
- change in exchange rate	OFAF4K1171AS																
- change in market valuation	OFAF4K1172AS																
Realised holding gains/losses	OFAF4K119AS																
- change in exchange rate	OFAF4K1191AS																
- change in market valuation	OFAF4K1192AS																
Shares and other equity	OFAF5K11AS																
Unrealised holding gains/losses	OFAF5K117AS																
- change in exchange rate	OFAF5K1171AS																
- change in market valuation	OFAF5K1172AS																
Realised holding gains/losses	OFAF5K119AS																
- change in exchange rate	OFAF5K1191AS																
- change in market valuation	OFAF5K1192AS																

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Table 0125: Revaluation account abstract [1]

Non-consolidated NCO **country:** **year:** N,S and C

currency: MIO NAC

Sectors and sub-sectors / Changes in financial liabilities	Code of other flows	Total economy	Non-financial corporations	Financial corporations						General government				Households and non-profit institutions saving households	Rest of the world		
				Total	Central Bank	Other monetary financial institutions	Other financial intermediaries	Financial auxiliaries	Insurance corporations and pension funds	Total	Central and state government	Local government	Social security funds		Total	European Union	Others
Code of sectors		SES1	SES11	SES12	SES121	SES122	SES123	SES124	SES125	SES13	SES1311+ SES1312	SES1313	SES1314	SES14 + SES15	SES2	SES21	SES22
Currency and deposits	OFAF2K11LI																
Unrealised holding gains/losses	OFAF2K117LI																
- change in exchange rate	OFAF2K1171LI																
Realised holding gains/losses	OFAF2K119LI																
- change in exchange rate	OFAF2K1191LI																
Securities other than shares	OFAF3K11LI																
Unrealised holding gains/losses	OFAF3K117LI																
- change in exchange rate	OFAF3K1171LI																
- change in market valuation	OFAF3K1172LI																
Realised holding gains/losses	OFAF3K119LI																
- change in exchange rate	OFAF3K1191LI																
- change in market valuation	OFAF3K1192LI																
Loans	OFAF4K11LI																
Unrealised holding gains/losses	OFAF4K117LI																
- change in exchange rate	OFAF4K1171LI																
- change in market valuation	OFAF4K1172LI																
Realised holding gains/losses	OFAF4K119LI																
- change in exchange rate	OFAF4K1191LI																
- change in market valuation	OFAF4K1192LI																
Shares and other equity	OFAF5K11LI																
Unrealised holding gains/losses	OFAF5K117LI																
- change in exchange rate	OFAF5K1171LI																
- change in market valuation	OFAF5K1172LI																
Realised holding gains/losses	OFAF5K119LI																
- change in exchange rate	OFAF5K1191LI																
- change in market valuation	OFAF5K1192LI																

(1) on a voluntary basis

Questionnaire “ESA 1995”

Table 0126

Table 0126: Balance sheets for financial assets and liabilitie (1)

Consolidated CO **country:** **year:** N,S and C

currency: MIO NAC

Sectors and sub-sectors / Financial assets	Code of transactions	Total economy (1)	Non-financial corpora-tions	Financial corporations						General government				House-holds and non-profit institutions saving house-holds	Rest of the world		
				Total	Centra l Bank (1)	Other mone-tary financial institu-tions (1)	Other finan-cial interm e-diares	Finan-cial auxilia-ries	Insurance corpora-tions and pension funds	Total	Central and state govern-ment	Local govern-ment	Social security funds		Total	European Union (1)	Other s (1)
Code of sectors		SES1	SES11	SES 12	SES1 21	SES122	SES12 3	SES1 24	SES125	SES 13	SES1311 +SES131 2	SES13 13	SES13 14	SES14 + SES15	SES 2	SES21	SES22
<u>Net acquisition of financial assets</u>	STAFAS																
Monetary gold and SDRs	STAF1AS																
Currency and deposits	STAF2AS																
Currency (1)	STAF21AS																
Transferable deposits (1)	STAF22AS																
Other deposits (1)	STAF29AS																
Securities other than shares	STAF3AS																
Securities other than shares, excluding financial derivatives	STAF33AS																
Short-term (1)	STAF331AS																
Long-term (1)	STAF332AS																
Financial derivatives (1)	STAF34AS																
Loans	STAF4AS																
Short-term (1)	STAF41AS																
Long-term (1)	STAF42AS																
Shares and other equity	STAF5AS																
Shares and other equity, excluding mutual funds shares	STAF51AS																
Quoted shares (1)	STAF511AS																
Unquoted shares (1)	STAF512AS																
Other equity (1)	STAF513AS																
Mutual funds shares (1)	STAF52AS																
Insurance technical reserves	STAF6AS																
Net equity of households in life insurance reserves and in pension funds reserves	STAF61AS																
Net equity of households in life insurance reserves	STAF611AS																
Net equity of households in pension funds reserves	STAF612AS																
Prepayments of insurance premiums and reserves for outstanding claims	STAF62AS																
Other accounts receivable	STAF7AS																
Trade credits and advances (1)	STAF71AS																
Other (1)	STAF79AS																

(1) on a voluntary basis

Table 0126: Balance sheets for financial assets and liabilities (1)

Consolidated CO **country:** **year:** N,S and C

currency: MIO NAC

Sectors and sub-sectors / Financial liabilities	Code of transactions	Total economy (1)	Non-financial corpora-tions	Financial corporations						General government				House-holds and non-profit institutions saving house-holds	Rest of the world		
				Total	Central Bank (1)	Other monetary financial institu-tions (1)	Other financial interme-diares	Finan-cial auxilia-ries	Insurance corpora-tions and pension funds	Total	Central and state government	Local govern-ment	Social security funds		Total	European Union (1)	Others (1)
Code of sectors		SES1	SES11	SES12	SES121	SES122	SES123	SES124	SES125	SES13	SES1311+ SES1312	SES1313	SES1314	SES14 + SES15	SES2	SES21	SES22
Net incurrence of liabilities	STAFLI																
Monetary gold and SDRs	STAF1LI																
Currency and deposits	STAF2LI																
Currency (1)	STAF21LI																
Transferable deposits (1)	STAF22LI																
Other deposits (1)	STAF29LI																
Securities other than shares	STAF3LI																
Securities other than shares, excluding financial derivatives	STAF33LI																
Short-term (1)	STAF331LI																
Long-term (1)	STAF332LI																
Financial derivatives (1)	STAF34LI																
Loans	STAF4LI																
Short-term (1)	STAF41LI																
Long-term (1)	STAF42LI																
Shares and other equity	STAF5LI																
Shares and other equity, excluding mutual funds shares	STAF51LI																
Quoted shares (1)	STAF511LI																
Unquoted shares (1)	STAF512LI																
Other equity (1)	STAF513LI																
Mutual funds shares (1)	STAF52LI																
Insurance technical reserves	STAF6LI																
Net equity of households in life insurance reserves and in pension funds reserves	STAF61LI																
Net equity of households in life insurance reserves	STAF611LI																
Net equity of households in pension funds reserves	STAF612LI																
Prepayments of insurance premiums and reserves for outstanding claims	STAF62LI																
Other accounts receivable	STAF7LI																
Trade credits and advances (1)	STAF71LI																
Other (1)	STAF79LI																
Net financial assets	STB9F																

(1) on a voluntary basis

Questionnaire "ESA 1995"

Table 0127

Table 0127: Balance sheets for financial assets and liabilities [1]

Non-consolidated NCO **country:** **year:** N,S and C

currency: MIO NAC

Sectors and sub-sectors / Financial assets	Code of transactions	Total economy [1]	Non-financial corpora-tions	Financial corporations						General government				House-holds and non-profit institutions saving house-holds	Rest of the world		
				Total	Central Bank [1]	Other mone-tary financial institu-tions [1]	Other finan-cial interm e-diares	Finan-cial auxilia-ries	Insurance corpora-tions and pension funds	Total	Central and state govern-ment	Local govern-ment	Social security funds		Total	European Union [1]	Others [1]
Code of sectors		SES1	SES11	SES 12	SES1 21	SES122	SES12 3	SES1 24	SES125	SES 13	SES1311 +SES131 2	SES13 13	SES13 14	SES14 + SES15	SES 2	SES21	SES22
Net acquisition of financial assets	STAFAS																
Monetary gold and SDRs	STAF1AS																
Currency and deposits	STAF2AS																
Currency [1]	STAF21AS																
Transferable deposits [1]	STAF22AS																
Other deposits [1]	STAF29AS																
Securities other than shares	STAF3AS																
Securities other than shares, excluding financial derivatives	STAF33AS																
Short-term [1]	STAF331AS																
Long-term [1]	STAF332AS																
Financial derivatives [1]	STAF34AS																
Loans	STAF4AS																
Short-term [1]	STAF41AS																
Long-term [1]	STAF42AS																
Shares and other equity	STAF5AS																
Shares and other equity, excluding mutual funds shares	STAF51AS																
Quoted shares [1]	STAF511AS																
Unquoted shares [1]	STAF512AS																
Other equity [1]	STAF513AS																
Mutual funds shares [1]	STAF52AS																
Insurance technical reserves	STAF6AS																
Net equity of households in life insurance reserves and in pension funds reserves	STAF61AS																
Net equity of households in life insurance reserves	STAF611AS																
Net equity of households in pension funds reserves	STAF612AS																
Prepayments of insurance premiums and reserves for outstanding claims	STAF62AS																
Other accounts receivable	STAF7AS																
Trade credits and advances [1]	STAF71AS																
Other [1]	STAF79AS																

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Table 0127: Balance sheets for financial assets and liabilities [(1)]

Non-consolidated NCO **country:** **year:** N,S and C

currency: MIO NAC

Sectors and sub-sectors / Financial liabilities	Code of transactions	Total economy (1)	Non-financial corpora-tions	Financial corporations						General government				House-holds and non-profit institutions saving house-holds	Rest of the world		
				Total	Central Bank (1)	Other monetary financial institu-tions (1)	Other financial interme-diares	Finan-cial auxilia-ries	Insurance corpora-tions and pension funds	Total	Central and state government	Local govern-ment	Social security funds		Total	European Union (1)	Others (1)
Code of sectors		SES1	SES11	SES12	SES121	SES122	SES123	SES124	SES125	SES13	SES1311+ SES1312	SES1313	SES1314	SES14 + SES15	SES2	SES21	SES22
Net incurrence of liabilities	STAFLI																
Monetary gold and SDRs	STAF1LI																
Currency and deposits	STAF2LI																
Currency (1)	STAF21LI																
Transferable deposits (1)	STAF22LI																
Other deposits (1)	STAF29LI																
Securities other than shares	STAF3LI																
Securities other than shares, excluding financial derivatives	STAF33LI																
Short-term (1)	STAF331LI																
Long-term (1)	STAF332LI																
Financial derivatives (1)	STAF34LI																
Loans	STAF4LI																
Short-term (1)	STAF41LI																
Long-term (1)	STAF42LI																
Shares and other equity	STAF5LI																
Shares and other equity, excluding mutual funds shares	STAF51LI																
Quoted shares (1)	STAF511LI																
Unquoted shares (1)	STAF512LI																
Other equity (1)	STAF513LI																
Mutual funds shares (1)	STAF52LI																
Insurance technical reserves	STAF6LI																
Net equity of households in life insurance reserves and in pension funds reserves	STAF61LI																
Net equity of households in life insurance reserves	STAF611LI																
Net equity of households in pension funds reserves	STAF612LI																
Prepayments of insurance premiums and reserves for outstanding claims	STAF62LI																
Other accounts receivable	STAF7LI																
Trade credits and advances (1)	STAF71LI																
Other (1)	STAF79LI																
Net financial assets	STB9F																

(1) on a voluntary basis

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