United Nations
Economic Commission for Africa

# Operational Guide on How to Do GDP Rebasing

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# Chapter 1: Introduction

## 1.1 Background

National account aggregates, such as the gross domestic product (GDP) are normally compiled in the first instance at current or nominal prices, using the data available from different sources, such as censuses and surveys, administrative sources, producers' associations and other *ad hoc* sources and studies. This is because in most cases, the data available on values provided in the source data are at the prices prevailing in the current year or the reference year used for collecting the data.

Current price accounts can be considered as the aggregation, within an accounting framework, of transactions that took place and can be evidenced[1]. These data are useful in their own right in planning and policy making, monitoring the economy, and in international comparisons. However, current price data are not suitable for analysing the year to year changes in real terms, as they include the price element. High growth in the estimates of GDP at current prices could be due to rise in prices rather than due to increase in production, especially among the developing countries. For estimating growth of economy in real terms, it is necessary to also compile estimates of GDP at constant prices, along with those at current prices. This is achieved by removing the price element in the current price data, which includes two components, quantities or volumes and prices. Constant price data also depends upon the prices of a reference year, which could be the base year of national accounts or the previous year. The constant price data describes the economic situation of a particular year in the prices of another year, which is normally the base year of national accounts.

For a better understanding of the economy and its monitoring, it is necessary to decompose the values at current prices in terms of prices and volumes. High economic growth does not necessarily mean that the economy has grown in real terms, but could be due to price rise. Therefore, for measuring changes in the values of flows of goods and services, the current price values need to be split into their price and volume components, one reflecting solely the changes in the prices of the goods and services concerned and the other the changes in their volumes (relating to quantity, quality and compositional changes). The aim is to analyse which changes in aggregates are solely due to price movements, and which to all other changes or volume changes. This is also referred to as "constant price" measurement, implying the analysis of economic transactions valued at certain fixed prices. The prices prevailing in the base year of national accounts series are normally used to measure national accounts aggregates at constant prices or in volume terms[2].

Most developing countries use a single base year[3] for a national accounts time series for estimating aggregates at constant prices, as opposed to previous year prices. The advantage of using a single base year for constant price estimates is that it is relatively easy to compile the data and simple for users to understand. On the other hand, there are two major disadvantages

[1] *Handbook on Price and Volume Measures in national Accounts*. Luxembourg: Office for Official Publications of the European Communities, 2001. Chapter 1.3

[2] For a fixed base year, the term constant prices is appropriate, but when current price estimates of each year are deflated by a price index with a different base year, the terms used are "chain volume series", or "chain volume measure" (Para 15.98 2008 SNA)

[3] Base year is the year whose current price values are used to weight the price and volume measures derived at the elementary level of aggregation, in subsequent years in the same national accounts series.

in using a single base year. Firstly, if the base year is old or the relative prices of commodities change rapidly (economies with high inflation or rise or fall in prices of certain products, for example, crude petroleum) after the base year, the constant price estimates may give inaccurate growth rates for these years. This is because the prices prevailing in the base year of different products produced in the economy are used to value the quantities produced in the current year and the relative prices of commodities may have changed significantly in the recent years (for example, prices of crude petroleum or minerals may have fallen significantly while those of food products would have risen, between the two years of comparison). Secondly, growth rates would change when the base year is revised due to changes in the weights derived from the prices of new base year. Changes in growth rates and/or estimates of past period following the revision of base year (especially after a long gap from the old base year) is not understood by the users and normally draws criticism from them. Therefore, periodic revision (say, once in 5 years) of base years is important.

In order to overcome the problems associated with fixed base year, SNA recommends using the previous year prices or a system of chain linking for volume measures. Chain linking means linking year 1 to year 2 with year 1 weights then linking year 2 to year 3 with year 2 weights and computing the implicit change from year 1 to year 3 as the product of these two links rather than using year 1 weights for year 3. The main disadvantage of this method is the loss of additivity between the aggregates and its components, which may not be easily understood by the users. Users need to be informed carefully about the method and the reasons for loss of additivity in this method. While the theoretical advantages of this approach are clear, it may not always be possible to follow this advice directly, usually because the detailed information needed for current weights may not be available[4]. In such a case, the use of single base years will have to be continued, but it should be ensured by the countries that the base years are revised every 5 years. Efforts should, however, continued to be made by countries to use previous year prices for constant price measurement, because of its many advantages, especially in avoiding major changes in growth rates following revision of base years; and the use of updated weights.

### 1.2 Aggregation of quantities *versus* volumes

The value of a transaction for a single homogeneous product equals price multiplied by quantity. While values are additive, quantities of different products or even those of the same product with different qualities, characteristics and specifications (for example, computers or even seemingly homogeneous products like potatoes), are not additive. Firstly, the products can be dissimilar or unrelated and secondly, products with same generic name too may change in quality and characteristics over time and may also be available in different grades or specifications or at different prices in different markets at the same time[5]. Quantities are additive only for a single homogeneous product. For aggregating quantities of different products, weights based on their prices (either in the base year or the reference year or the current year depending upon the nature of compilation) are applied. However, in the national accounts, production is expressed in values in terms of a common unit of currency, so that they are invariant to the choice of quantity unit and are additive across different products.

Though it is appropriate to use the term '*quantity*' for a single homogeneous product, for aggregate products (which is essentially the focus of compiling national accounts), the term

[4] *The 2008 SNA – compilation in brief.* World Bank Group. 2014. Chapter 9.9

[5] Please see System of National Accounts 2008 handbook, chapters 15.64 to 15.75 for discussion on causes of price variation

'*volume'* is used instead of quantity in the SNA. The 2008 SNA mentions "*The quantities compared over time must be those for homogeneous items and the resulting quantity changes for different goods and services must be weighted by their economic importance, as measured by their relative values in one or other, or both, periods. For this reason, volume is a more correct and appropriate term than quantity in order to emphasize that quantities must be adjusted to reflect changes in quality.*[6]

### 1.3 Methods to derive volume measures

Broadly, the volume measures can be obtained through three methods, namely:

1) deflation, in which the current-price values of transactions are divided by an appropriate price index;
2) volume extrapolation, in which base year values are extrapolated by the appropriate quantity indicator; and
3) quantity revaluation, in which the current year quantities are multiplied by base year prices.

Among these three methods, deflation is preferred because prices usually show less variation than quantities, sampling errors associated with price indices tend to be smaller, and price indices can capture quality changes better than quantity revaluation and volume extrapolation methods[7].

There are four major types of price indices available to derive volume measures in the national accounts: consumer price indices (CPIs), producer price indices (PPIs), export price indices (XPIs) and import price indices (MPIs). CPIs are measures of purchasers' prices and PPIs are measures of basic prices. XPIs are measures of FOB prices; MPIs may measure FOB or CIF prices.

The EU handbook describes possible methods that can be used for the estimation of prices and volumes and classifies them into three groups:

A methods: most appropriate methods;
B methods: those methods which can be used in case an A method cannot be applied; and
C methods: those methods which shall not be used.

The handbook suggests that for each approach, there is a variety of different indicators that can be chosen. To assess the appropriateness of an indicator the following general criteria were suggested:

- completeness of the coverage of the product heading by the indicator. For example, whether the indicator covers all of the products under the heading or just a selection of them, such as only those products sold to households;
- valuation basis of the indicator. For e.g. market output, this should be basic prices, rather than, for example, purchasers' prices or input costs, whilst for e.g. final consumption expenditure it should be purchasers' prices;

[6] *System of National Accounts 2008*. S.L.: Commission of the European Communities, 2009 Chapter 15.13
[7] See section 2.3 of EU Handbook for more detailed discussion on why deflation with a price index is preferred

- indicator should take quality changes into account, recording them within the volume estimates;
- conceptual consistency between the indicator and the national accounts concepts.

Indicators satisfying all four criteria generally will constitute A methods. If one or more criteria are not satisfied, the methods will become B methods or C methods according to how far away the method is from an A method.

### 1.4 Use of SUTs framework

SNA recommends compilation of GDP estimates using the framework of supply and use tables (SUTs), both at current and constant prices. The framework is based on the two following identities and is especially useful while rebasing GDP estimates:

| Products | | |
|---|---|---|
| Domestic production+ imports + trade margins + separately invoiced transport costs + taxes less subsidies on products | = | Intermediate consumption + final consumption + gross fixed capital formation + change in inventories + acquisition less disposals of valuables + exports |
| Industries | | |
| Output | = | intermediate consumption + gross value added (or total inputs) |

The advantage of compiling price and volume measures through SUTs, is that it provides consistency and coherence to a set of independent measures (components of production, income, and expenditure aggregates), whose estimation is more difficult in volume terms than at current prices, as they are not based on direct evidence. This framework also ensures that the flows covered in the two tables are broken into their price and volume components in a consistent and systematic manner.

### 1.5 Reference documents

The following documents from international agencies can provide guidance on rebasing and compilation of volume estimates in national accounts:

1) *The 2008 SNA* (Chapter 15 – Price and volume measures) European Commission, IMF, OECD, UN, World Bank, 2009;
2) *Handbook on price and volume measures in national accounts*- Eurostat, Office for Official Publications of the European Communities, Luxembourg 2016;
3) *National Accounts: A practical introduction*, Studies in Methods, Serie F, No.85, UN 2003; chapter XV: Price and volume measurement;
4) *ESA 2010*, Chapter 10 – Price and Volume Measures - Regulation (EU) No 549/2013 of the European Parliament and of the Council of 21 May 2013 on the European system of national and regional accounts in the European Union;
5) *The 2008 SNA - compilation in brief, World Bank, 2014*
6) *Towards Measuring the Volume Output of Education and Health Services, O*ECD, 2010
7) *Manual on measuring Research and Development in ESA 2010,* Eurostat, Office for Official Publications of the European Communities, Luxembourg 2014

## 1.6 Purpose of the guidebook

Updating the base year of national accounts at periodic time intervals is important for proper monitoring of the economy. It also ensures that the data captures appropriately the structural changes that would have taken place in the economy in the recent years.

In addition to adopting the prices of a new base year for calculating constant price national accounts, the base year revision exercise provides an opportunity for countries to incorporate recent data available from long term surveys and censuses, update the technical coefficients in areas where data are not available regularly, implement latest compilation guidelines and standards of the international agencies, and to address the data requirements of domestic and international users.

Among African countries, many have not updated their base years of national accounts for a long time, while others update them regularly. This may have resulted in lack of comparability of growth rates of gross domestic product (GDP) at constant prices across the economies. Reasons for countries not being able to update the base year to a more recent year could be many, for example, lack of surveys and censuses and other administrative data, staff resources, and the capacity constraints to compile data according to latest international compilation guidelines such as the System of National Accounts, 2008 (2008 SNA).

Therefore, the immediate task for many countries in Africa is to update their old base-year for compiling GDP estimates at constant prices to a more recent year, such as from the base-year of 2005 or before to a more recent year, say, 2015 or 2016. Accordingly, countries need to collect good datasets for rebasing the national accounts (for instance, from the old base-year 2005 or before to the new base-year 2015 or 2016 to be released in 2018); as well as to carry out the so-called “back-casting” exercise for the whole historical series of GDP at constant price (for example, from 1960 to the new base-year).

The main objective of this guidebook is to provide guidance to African countries in updating the base years used for measuring GDP at constant prices, based on 2008 SNA recommendations and African country best practices. Besides providing the 2008 SNA guidelines and useful practical instructions, the guidebook also includes the best practices followed by some African countries in rebasing the GDP estimates. It is hoped that the guidebook helps countries in Africa on how to carry out the tasks and activities relating to rebasing GDP estimates and to achieve their objectives in an effective and efficient way.

## 1.7 Structure of the guidebook

The guidebook is organized into five chapters. Chapter 2 deals with the main topic of the guidebook, namely, rebasing the GDP. The chapter discusses the purpose, methods and procedures involved in the base year revision exercise. The chapter also suggests a sequence of steps that could be undertaken by countries for this purpose.

Chapter 3 introduces the topic of price and volume measurement in the national accounts, which is an important aspect in rebasing the GDP and in the compilation of annual and quarterly national accounts at constant prices. Manuals on methods to compile volume measures are available from some of the international agencies. Text for this chapter has mainly been drawn from these manuals and keeping in view the African country practices followed in the compilation of national accounts. The chapter discusses the best methods and

alternative methods involved in preparing volume estimates of GDP by transaction categories and by industries.

Chapter 4 deals with the methods to link the past national accounts series with the new base year of GDP and also presents the topic of annual rebasing (chain-linking)

Chapter 5 discusses the importance of documenting and disseminating the data sources and methods used in rebasing. Documentation is necessary for informing the users of the changes and revisions made in the national accounts and ensures transparency of data produced. The chapter also provides a sample FAQs that could be prepared and released along with the dissemination of rebased GDP estimates.

Chapter 6 incorporates the best practices followed by the African countries on the above four topics. Text for this chapter has been contributed by the data compiling agencies in African countries.

### 1.8 Target users of the guidebook

The Guidebook is mainly meant for the compilers of national accounts statistics in the African developing economies. Other users of national accounts statistics may also find the guidebook useful in understanding the data sources and methods used and the compilation issues involved in producing these data.

# Chapter 2: Rebasing of GDP

*This chapter presents the purpose, methods and procedures involved in the base year revision exercise. The chapter also suggests a sequence of steps that could be undertaken by countries for this purpose*.

## 2.1 Rebasing and its aim

The economies of the countries are in a dynamic process. They grow, they shrink, they add new sectors, new products and new technologies, or others disappear; or the household consumer behaviour changes over time. Having as main aim the presentation of the evolution of the economy, the national accounts take into consideration these changes and adapted and adjusted the compilation process according to new economic, social and/or political conditions existing in a country and new international requirements in the field of statistics.

As the structure of an economy evolves and as more or better data become available, revisions are needed in its compilation procedures to realign the national accounts with economic reality. In the process of compiling national accounts three important revisions can be made: routine revisions, benchmark revisions and methodological revisions.

- Routine revisions (or current revisions) encompass all changes in national accounts estimates for a particular period from the first to the final estimate. These revisions are in principle based on the availability of new information from data sources used to achieve full comparability in volume and prices changes with the previous year and for all indicators.
- Benchmark revisions (or major regular revisions) are revisions of data sources or methods used for estimation of national accounts indicators. These can affect GDP and can cause discontinuity in time series. It is recommended that, as standard practice, benchmark revisions be carried out every five years.
- Methodological revisions (or major occasional revisions) are normally due to changes in principles of national accounting.

The benchmark year refers to the year in which an economy`s transactions such as production—including input costs—, consumption, capital formation, international trade, and taxes are comprehensively measured and accurately reflect the structure of the economy (in current price GDP).

Likely the most significant element of national accounts revisions is the updating of the benchmark year although other reasons for major revisions exist, for example changes in statistical methods and changes in concepts, definitions, and classifications, and availability of new data from censuses and long term surveys. Updating the benchmark year generally improves the quality of national accounts estimates because of the incorporation of newly available and revised data sources, enhanced coverage as well as improved estimation methods. GDP is compiled based on the information and data sources available at a given period and thus benchmark revisions would require, for example, comprehensive household budget surveys, recent population censuses, business structural surveys or censuses, elaboration of the Supply and Uses tables (SUTs) and up to date business registers. Compiling

these statistics (including data collection and processing) is costly from financial and human resources angle and may take several months.

The base year refers to the year of the weights that are used to measure GDP at constant prices. Benchmark and base years do not necessarily coincide. When a country adopts the chain-linking approach, the base year is updated annually.

The change of the base year consists of two steps:

- Rebasing, i.e. the update of the weights used for the calculation of indices from base year
- Re-referencing (or rescaling) of the indices to the new reference period.

Both steps can be done at the same time, but also, independently from each other.

**Rebasing of GDP** means replacing the old base year used for the compilation of constant price estimates with a new one, more recent.

In principle, a change of base year in the national accounts implies:

- changing the price and quantity base for the individual price and quantity relatives, and
- updating the weights used in aggregating the individual quantity relatives into sub-indices and to aggregate these sub-indices into more aggregated indices
- performing the aggregation from this detailed compilation level to obtain the national accounts aggregates.

It should be stressed the fact that re- basing Paasche price indices do not involve any change in the weights (being a weighted harmonic average of price relatives, where the weights are the shares in the ***current period***); only a change in the base period for the price relatives is required. However, in practice, it is not possible to construct a set of Paasche price indices and Laspeyres volume indices from observed micro data, and aggregated using appropriated current (for the price indices) and bases period (for the volume indices) weights. In this situation, an approximate Paasche price indices and approximate Laspeyres volume indices for the estimation of the macroeconomic aggregates are constructed, by making the compilations at the most possible detailed level, and performing the aggregation from this detailed level to the main national accounts indicators.

Usually, the rebasing is carried out in conjunction with the incorporation of data from a new benchmark year.

The change of the base year and the rebasing of GDP series is desirable for several reasons, as mentioned earlier, including for capturing the structural changes in the economy and thus for reaching near to truth. An important question is how often the base period should be changed. It is desirable to change base periods frequently, especially in times of large changes in relative prices and rapid economic development. The UN Statistical Commission (UNSC) recommends that countries rebase every 5 years, although some countries do at intervals of less than 5 years

The base year provides the reference point to which future values of the GDP are compared.

## 2.2 Periodic and annual rebasing

The update of the base year (rebasing) can be realised periodically or annually (annual chain-linking).

*Periodic rebasing* is done, as is recommended, once in five years (some countries do this at ten year intervals), when the prices of the base year are applied from *new base year onwards*. Volume measures of GDP *before new base year* are calculated using price structure of previous base years. The joint volume measures of GDP at new and previous base years, means that they are expressed in terms of the prices of a specific year (i.e., reference year) is known as linking (see chapter 4). Linking is done by extrapolating backward separately the volume measures of GDP and its components at the most detailed level possible at the reference year using the real growth rates of GDP and its components which are calculated using the previous base years.

Reference year (assigned index value of 100) is usually the same as new base year in practice, so that the GDP volume measures for recent years are close to corresponding current-price measures.

The volume measurement of GDP is realised based on several methods (see chapter 1). The periodical rebasing is carried out taking into account the estimation methods of GDP growth rate, and consists of the following actions:

- *volume measures of transactions obtained by deflation*: the reference year of deflator is changed at most detailed level possible to new base year and the current-price values are deflated using the new deflators. Alternatively, the most detailed current-price value of transaction at new base year are extrapolated using the real growth rates of previous base year.
- *volume measures of transactions obtained by quantity revaluation*: in this case, the prices for revaluation are replaced with those for new base year.
- *volume measures of transactions obtained by volume extrapolation*: the year from which level is being extrapolated to new base year should be changed.

*Annual rebasing* (annual chain-linking) means to update the base year (weights) every year. The 2008 SNA recommends this procedure. It has been shown on theoretical grounds that long time series of volume and price indices are best derived by being chained. When volume estimates are rebased, say every five or ten years, then it is typically the case that the growth rates are revised. If price and volume relativities have been changing rapidly, then the changes in the growth rates can be dramatic. Such is usually the case for any aggregate in which computers have a significant share. With annual chaining history is only "rewritten" a little each year, not in one large jump every five or ten years. Annual chaining not only measures changes better, it is likely to increase confidence in the resulting national accounts volume indices.

The steps for annual chaining, as for periodical rebasing of GDP, take into account the methods used for the volume measurement:

- *volume measures of transactions obtained by deflation*: the reference year of deflators change annually. Alternatively, the extrapolated most detailed current-price values of transactions are at detailed level extrapolated using corresponding deflated value.

- *volume measures of transactions obtained by quantity revaluation*: the prices for revaluation are changed annually.
- *volume measures of transactions obtained by volume extrapolation*: the year from which level is being extrapolated is changed annually.

Linking of GDP time series is done by extrapolating forward and backward separately the volume measures of GDP and its components at the reference year using the real growth rates of GDP and its components which are calculated using the unchained volume indexes. More information is presented in chapter 4.

## 2.3 GDP rebasing activities

Changing the base year is like trying to rewrite history, as rates of growth in volume and prices change. A base year of very far-away past will show unrealistically higher rates of changes for the recent years. Sometimes, it is possible that the fixed weights from an old base year may show increase in real GDP annual growth rates for the recent years; while on the contrary, a more recent base year may underestimate the rates of changes in the past years.

The main objectives of the rebasing are:

- implementation of the 2008 SNA
- adopt new classifications (as example, ISIC Rev.4)
- change the base year
- update the production structure;
- update the structural changes in relative prices of various products;
- incorporate product changes due to developments and innovations; and
- update consumption patterns, utilization and acquisition of capital goods

Since, rebasing impacts the levels in macroeconomic indicators level and, thereby, the analysis of economic development, the rebasing procedure involves a consultative and participatory process that includes various data producers, data suppliers and data users.

The responsible institution for changing the base year is the institution in charge with the compilation of GDP; usually, the statistical institute. The process is based on several datasets provided by different Ministries, Departments and other source agencies. In addition, stakeholder workshops should be organised to elicit information and also validate the output of the rebasing exercise.

The preparatory work for the rebasing exercise commences much in advance before the actual release of rebased estimates. The duration of this period depends on the human and financial capacity of the statistical institute and the objectives of the new base year.

The main activities of the rebasing process are:

- A1: Aims and objectives
- A2: Collection of data
- A3: Rebasing
- A4: Dissemination

### 2.3.1 A1: Aims and objectives

There are three major methodological pillars, which are used to enhance the national accounts compilation framework and are, therefore, part of rebasing exercise. They refer to (a) adoption of 2008 System of National Accounts (the 2008 SNA version), (b) adoption of latest international classifications, and (c) use of much accurate and recent source data. These would allow to provide a more comprehensive picture of the economic development. Based on this framework, the first stage of the rebasing activity entails the definition of the aims and objectives. The decision about which objectives a country wants to achieve should be based on an in-depth analysis of the current situation:

- the country's statistical capacity for providing the data sources
- availability of data sources and the possibility to carry out new surveys or to use new data sources
- the human resources (number and level of knowledge) capable to carry out the process
- the cooperation with other administrative institutions in order to access the available data
- needs of national and international users for national accounts indicators.

The analysis of the current situation will enable the definition of the objectives of the change of the base year and the rebasing of GDP, which can be, for example, either or all of the following:

- in the new base year only the reference period for the individual price and volume indices are changed
- implementation only of newly available data, or some changes in the compilation methods used for national accounts estimates
- the base year incorporates major methodological improvements, introduces new classifications and improved data sources.

The objectives presented are in order of increasing complexity: the first requires the least amount of data, incorporating a small number of identities. The more complex the objectives become, the more data are required to compile them. But, complex objectives give a realistic description of the socio-economic structure and development of a country, and they are more suitable for improvement of national accounts and for policy and analytical purposes.

### 2.3.2 A2: Collection of data

Rebasing of GDP, especially when it corresponds to the elaboration of a new benchmark, is a demanding task that requires important and constant resources. The objectives, established based on the institutional conditions of human and financial capacity, should be followed by concrete actions in order to obtain the necessary data for rebasing. The collection of data has two main activities:

a. *Organization of the data collection, which consists of:*
   - analysis of the available data and methods used for the compilation of GDP. In this phase, the available administrative and statistical sources are assessed in order to identify if they answer to the objectives established.
   - formulate a concrete data collection strategy to fill the gaps. It, as results of the objectives established, could include the improvement of current surveys with additional information, carried out new surveys or the use of additional administrative sources.

*b. Collection of data, refer to:*

- Improved data from current surveys
- carrying out the new statistical surveys decided
- collection of additional administrative data.

This represents an important activity and depends on the capacity of the statistical office and its relations with other institutions: data may be collected by a different department, such as a department of the statistical institute that is entrusted with the responsibility of conducting surveys (or if resources allow for a special department) or by national accountants themselves (it being for them an additional task to their usual workload). Special formal relations based on agreements, protocols or memorandums with administrative institutions ensure access to their data.

In the process of data collection, it is important to have a permanent contact with the main stakeholders, to organise meetings and explain the reasons and benefits of rebasing GDP and their implications on economic analysis.

### 2.3.3 A3. Rebasing

This phase is dedicated to the elaboration of the estimates for the new base. Due to the strategy adopted, the rebasing could be from a simple process of changing the prices and volume indicators used for the estimation of constant prices, to a complex activity, which results in the new estimates at current prices (or the benchmark year) in addition to those at constant prices.

### 2.3.4 A4. Dissemination

The main objective of compiling national accounts is to provide comprehensive understanding of an economy and its structure. The dissemination of the results is an activity as important as the compilation of indicators. Presenting national accounts indicators to the public, adding an analysis, providing useful economic interpretations are an important part of national accounts compilation process.

This activity become more necessary when the indicators provided to the users change, due to a new base of calculations. It is necessary to explain to the users the key benefits of the rebasing exercise, means the fact that a more accurate set of economic statistics that is a truer reflection of current realities is provided. Rebasing enables the government and policy makers to have a better understanding of the structure of the economy, an indication of GDP, of sectors where more efforts for development should be channelled in order to create jobs, improve infrastructure and reduce poverty, as an example of a few policy areas.

The dissemination of the results of rebasing exercise should be integrated into the general dissemination strategy of national accounts, having as its main objective to provide data of the expected quality for users. This should take into consideration:

- the details of information disseminated according to target audience
- presentation of results in a comprehensive structure
- provision of all necessary methodological explanations, to help users understand the new estimates of GDP.

National accounts represent a special overview of the economy and the dissemination of data without economic analysis and interpretation of the results is not advised, even if this imposes additional work, it is recommended to disseminate the results along an economic analysis and an interpretation of data. This will help users not familiar with the rebasing process to understand the work done and the results obtained.

### 2.4 Main steps of rebasing process

The main steps involved in the rebasing process follow the same sequence as mentioned in Section 2.3 above. These are further discussed below.

It should be understood that the national accounts are much more than just the GDP estimates, which are normally associated with rebasing of national accounts. This is because the GDP estimates need to be compiled in volume terms (at constant prices) for presenting a realistic assessment of the changes in economic development. However, to present a better picture of economy for more meaningful economic analysis, the objectives for rebasing exercise should not be restricted to just the GDP estimates, but should also include compilation of sequence of accounts (at least up to capital account) for the institutional sectors; and the supply and use tables depending upon the resources available and the data constraints. The minimum requirement data sets (MRDS) for compilation recommended by the ISWGNA, can be used as guidance for this purpose.

As discussed in the previous section, rebasing exercise provides an opportunity to introduce major changes in the national accounts series, though its primary focus is to fix a reference year and use its price structure to compile estimates in volume terms. Normally, these estimates include the aggregates covered under the goods and services account (or production and expenditure GDP or the supplies and uses of goods and services). The income accounts are generally compiled only at current prices and are not compiled in volume terms (though it is possible to compile some of them in real terms using a general price deflator).

Even though current price estimates are independent of the base year (unlike in the case of constant price estimates), they too would undergo revision in the rebased national accounts series. As mentioned in Section 2.1, this is due to the incorporation of new data sources, information available from recent censuses/surveys and methodological changes due to implementation of 2008 SNA. Therefore, it is essential for the statistical institute to comprehensively review the current national accounts and aim to produce additional datasets, for example, the primary, secondary and use of income and capital accounts by institutional sectors and supply and use tables, while rebasing GDP.

#### 2.4.1 Review the current set of national accounts

This is part of the main activity A1 mentioned in the previous section. The first step in the rebasing process for the compiling agency should be to have a comprehensive internal review of the current set of national accounts being compiled and disseminated in the country, against a set of key dimensions, which may include, for example:

- current institutional arrangements of the national accounts compilers;
- scope, and coverage of national accounts;
- concepts and definitions followed in the compilation of national accounts; and
- classifications, and data sources used in national accounts.

The review of current national accounts should be carried out under four aspects, namely, (a) current status of compilations, (b) assessment as to their compliance with 2008 SNA and other international standards, (c) recommendations for bringing the national accounts to closer to the standards, and (d) an implementation plan of recommendations. The implementation plan can have a phased approach, short-term, medium-term and long-term, depending upon the resources and the availability of new data in future to the national accounts compilers. It should never be the target to make large scale improvements in national accounts in one go, unless all required resources are made available as part of major revamping. This should be done in a phased manner. The implementation plan provides the aims and objectives of rebasing exercise and should be considered as an integral part of the exercise.

The IMF's Data Quality Assessment Framework (DQAF)[8] for national accounts can be used to review and assess the national accounts of the country (please see Attachment 1 for a brief note on DQAF). The DQAF provides a structure for assessing existing practices against best practices, including internationally accepted methodologies.

For monitoring the implementation of SNA, the ISWGNA developed a set of six milestones to assess the scope of accounts that are compiled by countries, and further supplemented by three data sets describing (a) minimum set of accounts that need to be compiled; (b) a recommended set of accounts; and (c) a desired set of accounts. The national accounts questionnaire (NAQ) can guide the countries to assess as to what extent the important concepts in the 2008 SNA affecting the level of GDP, gross capital formation and gross national income have been implemented in the national accounts of the countries and accordingly plan for its full compliance.

The milestones, data sets, and national accounts compliance questionnaires of the UN can be used along with the DQAF for the review and assessment purpose (please see Tables 1 to 3 of Attachment 2 for details of these three frameworks).

#### 2.4.1.1 Institutional arrangements

The nature of institutional arrangements plays a role in successfully carrying out the rebasing process, and facilitates the data compilation job involved in rebasing. Adequate institutional support to the compiling agency can play a major role in the quality of national accounts. Therefore, a review of institutional arrangements can be considered to be a pre-requisite in ensuring the quality of data produced.

The review under this heading may include the aspects of current institutional set up of national accounts compiling agency, financial and human resources available, and the data sharing arrangements with the source agencies. Each of these factors should be assessed/examined and recommendations with an action plan for implementation should be prepared.

The main points to be examined under this item should be about the agency that is responsible for compiling national accounts, whether it enjoys sufficient autonomy to compile and disseminate national accounts with least amount of interference from the government and whether it has good understanding of data collection with reference to economic statistics.

[88] For details, please see https://www.imf.org/external/np/sta/dsbb/2003/eng/dqaf.htm

Normally, the statistical institute in the country is considered to be an independent and professional body and is entrusted with the responsibility of compiling national accounts. The institute is also assumed to have an in-depth understanding of economic statistics.

Secondly, the role and position of national accounts department within the structure of statistical institute should be examined as to whether it enjoys a suitable position in the hierarchy and whether it has a say in the data collection activities of the institute and the administrative agencies. Appreciation and consideration to the requests for additional resources for compiling national accounts or for filling up data gaps through additional surveys, depends upon the position of national accounts department in the organisation.

The third aspect of review should be with reference to the staff strength, computing and other resources available to the national accounts department at the moment and whether they are considered to be adequate given the tasks of compiling a premier dataset like national accounts. These factors may include whether the staff has sufficient academic qualifications, and receives regular trainings on national accounts. Capacity building of national accounts staff is an important part of improving national accounts. Other important factors for examination could be the staff turnover and availability of experienced hands in the national accounts department; and whether they have adequate computing equipment.

Lastly, assessment should be done on coordination and data sharing arrangements both within the statistical institute and with other administrative source agencies, whether they exist or not and whether the arrangements are formal or informal in nature. For example, access to micro data of surveys is essential for making conceptual adjustments at the unit level to comply with national accounts standards. Some countries have memorandum of understandings with the administrative agencies on data sharing for the purpose of compiling national accounts. Some countries may have focal points present in different line ministries/departments, which share the data collected and processed by them with the statistical institute or the national accounts department. A key aspect to be examined under this is about the availability of micro-data of surveys and accounts of individual corporations and units of government, to national accountants, and whether they have the ability to process the data and make adjustments for SNA concepts.

The responsibility for implementing 2008 SNA should be seen not as the sole responsibility of the national accounts department, but as a collective responsibility of the statistical system of the country, which includes the statistical institute, survey agencies, administrative departments, etc.

Therefore, as part of the rebasing exercise, it might be necessary to establish a coordination committee with data supplying agencies and key users (as mentioned in Section 2.3.2), for smooth implementation of 2008 SNA and for carrying out the rebasing exercise. The committee can meet frequently during the rebasing process and ensure timely availability of required data and, where necessary, with additional data collection efforts. Formation of such a committee also ensures the involvement of the entire statistical system and user community in the rebasing process, besides helping them to understand SNA, the reasons for revisions (that may arise due to rebasing) and how the source data are used in national accounts compilation (linkages between source data and detailed level national accounts aggregates).

#### 2.4.1.2 Scope and coverage of national accounts

The review under this should be to assess the data that is being compiled as part of national accounts statistics by the country. In some countries, these may include only the production and expenditure GDP at current and constant prices, and only at annual periodicity. In some other countries, these could extend to quarterly GDP estimates, while few countries may be compiling more aggregates or the entire set of accounts recommended in 2008 SNA.

The ISWGNA recommends that the scope of national accounts, which the country compiles can be assessed using

- A set of six milestones; supplemented by
- Three data sets describing (a) the minimum set of accounts that need to be compiled (MRDS); (b) a recommended set of accounts; and (c) a desired set of accounts

The review carried out under the scope would help the country to assess as to what extent its national accounts data deviates from full implementation of 2008 SNA.

It should normally be the objective of those countries whose national accounts are presently at either pre-SNA phase or milestone 1 level, to aim to reach at least milestone 2 in the rebasing exercise. For other countries, the aim should be to reach at least milestone 4, and if resources and data sources permit, higher milestones.

The assessment and the recommendations should include a plan for full implementation of SNA in a phased manner. Those datasets that can be implemented in each of these phases (short, medium and long term) should be identified along with those that are to be compiled as part of rebased national accounts.

The compilation of datasets aimed in the rebased national accounts should at least meet the minimum required datasets recommended by the ISWGNA (see table 2, attachment 2).

**2.4.1.3 Concepts and definitions followed in the compilation of national accounts**

The review under this heading should be to examine whether the national accounts being compiled by the country follow the internationally accepted standards, guidelines, or good practices or how far they deviate from the standards. The review can focus, for example, on grouping of units, sectorisation, economic territory and residency, enterprises and establishments, recording of transactions, production and asset boundaries, accounting rules, etc. The review should be in comparison with the 2008 SNA concepts.

Conceptual compliance of country's national accounts with those of 2008 SNA is very important. This should be given a high priority in the rebasing exercise. Otherwise, national accounts of the country may not be comparable with those of other countries. For example, if a country measures GDP exhaustively while another country omits or poorly measures informal sector and illegal activities, the data between the two countries may not be comparable. This extends to almost all the concepts of 2008 SNA. Therefore, the aim of compilers should be to bring the concepts used in their national accounts as close as possible to those of 2008 SNA.

The national accounts questionnaire (NAQ) (see table 3, Attachment 2) that is submitted to the UNSD can be used for assessment with reference to the concepts followed in country's national accounts. The questionnaire helps in assessing as to what extent the country's

national accounts comply with important concepts in the 2008 SNA that affect the level of GDP, gross capital formation and gross national income.

The outcome of the review, assessment and recommendations and the subsequent follow-up of their implementation should all be part of the rebasing exercise, and seen as a step towards quality implementation of 2008 SNA in the country. As far as possible, the aim should be that based on the rebased data, responses to all questions in the national accounts questionnaire should be in affirmative.

#### 2.4.1.4 Classifications used in national accounts

The review under this item should be to examine the classifications used in country's national accounts (of activities, products, sectors, purposes, etc.) and how they compare with those of international classifications.

The main classifications used in national accounts and/or by the source agencies are:

- **Institutional units:** Financial corporations, Non-financial corporations, General government, Households and Non-profit institutions serving households,
- **Industries**: International Standard Industrial Classification (ISIC)
- **Products**: Central Product classification (CPC) for products
- **Classifications of Expenditure According to Purpose**: Classification of the Functions of Government (COFOG); Classification of Individual Consumption According to Purpose (COICOP); Classification of the Purposes of Non-Profit Institutions Serving Households (COPNI); and Classification of the Outlays of Producers According to Purpose (COPP).
- **Gross fixed capital formation (GFCF):** by products (CPC) and by type of asset: (i) Dwellings; (ii) Other buildings and structures; (iii) Machinery and equipment; (iv) Weapons systems; (v) Cultivated biological resources; (vi) Costs of ownership transfer on non-produced assets; and (vii) Intellectual property products
- **Trade in goods:** Standard International Trade Classification (SITC) and the Harmonized Commodity Description and Coding System (HS)
- **Trade in services**: according to 12 standard components of services, (a) manufacturing services on physical inputs owned by others; (b) maintenance and repair services n.i.e.; (c) transport; (d) travel; (e) construction; (f) insurance and pension services; (g) financial services; (h) charges for the use of intellectual property n.i.e.; (i) telecommunications, computer and information services; (j) other business services; (k) personal, cultural and recreational services; and (l) government goods and services, n.i.e.

The review of classifications used in national accounts should cover the current classifications used, assessment as to their compliance with latest international classifications and recommendations for their implementation in the rebasing exercise to the extent resources and data sources permit.

#### 2.4.1.5 Data sources used in national accounts

The national accounts statistics are compiled from a large number of data sources that include censuses and surveys; administrative statistics; records held by businesses or industry associations; and, a large number of other *ad hoc* sources. These sources vary considerably

among the developing countries mainly on account of the administrative structure, procedures and rules, internal priorities, availability of resources, and economic and political situation prevailing in those countries. The SNA provides a framework for integrating these different sources to compile a set of harmonized and consistent national accounts. Therefore, reliability of national accounts depends largely on the quality and coverage of source data.

Among these data sources, censuses and surveys are normally conducted by statistical offices and also generally take into account the national accounts data needs to some extent. While censuses are conducted infrequently, surveys are expected to be conducted regularly and cover the whole economy and also meet the timeliness and periodicity criteria of national accounts compilations. However, this is not the real situation in some developing countries.

Conducting censuses (such as the economic census, agriculture and livestock census, population census) is costly and time-consuming, periodicity ranges from 5 to 10 years and results are available with considerable time-lag. Therefore, information coming from the censuses is mostly used as a frame for conducting surveys and sometimes used for rebasing national accounts depending on the type of data gathered in these censuses.

The surveys and other datasets that feed into national accounts are mainly the labour force, household budget, investment, agricultural, enterprise/establishment (mining, industry and services), construction, informal/household sector, and surveys on external sector transactions. Just as in the case of censuses but to a lesser extent, conducting surveys is costly and there is a long gestation period between the planning of a survey and the availability of micro-data or results. Therefore, it is a common practice in most developing countries that economic surveys, such as establishment surveys, household income expenditure surveys and labour force surveys, are infrequent and their results actually get used for benchmarking national accounts, rather than for the annual or quarterly national accounts. Only a few developing countries have comprehensive quarterly or annual surveys that provide information required for compiling quarterly and annual national accounts.

The other most important data source for national accounts is the administrative data. These data are essentially collected by the administrative agencies in the countries as part of their administrative functions, or as legal or taxation requirements, or as part of regulatory functions, or for internal needs of policy making or sometimes the data gets generated as a by-product of administrative functions of these agencies. The 2013 ECA survey on the use of administrative data sources in the compilation of the national accounts in Africa showed that administrative data sources are used far more often than statistical surveys by virtually all African countries.

Summarizing, the major sources for economic data are the following:

- Agriculture, livestock, forestry and fishing
    - Agricultural surveys and censuses
    - Area, yield and prices of crops
    - Livestock censuses and annual surveys on yield of livestock products
    - Administrative statistics on agriculture, livestock, forestry and fishing
    - Administrative data maintained by local and regional traditional authorities
    - Reports of agricultural commodity boards
    - Land utilisation statistics/surveys

    - Household income-expenditure surveys
    - Population data
- Mining, manufacturing, utilities and construction
    - Administrative data on mining (output of minerals) and utilities from regulatory bodies
    - Economic censuses
    - Annual manufacturing surveys
    - Construction and/or investment surveys
    - Surveys or administrative data on building materials
    - Annual enterprise surveys covering all non-agricultural economic activities
    - Administrative data on utilities (electricity, gas and water supply)
    - Government budget documents
    - Accounts of companies/corporations – government owned and private
    - Labour force surveys and population censuses
    - Reports of industry associations
    - Tax data disaggregated by products
    - Data on production of industrial goods
- Services
    - Economic censuses
    - Annual enterprise surveys covering all non-agricultural economic activities
    - Wholesale and retail trade surveys
    - Accounts of companies/corporations – government owned and private
    - Financial statistics from central bank
    - Regulatory agencies of insurance companies
    - Government budget documents/government finance statistics
    - Administrative data for services (such as telecom, transport, airlines, etc.)
    - Reports of Industry associations
    - Tax data, disaggregated by products
    - Reports of Research organisations
    - Labour force surveys and population censuses
    - Data on indicators of output of services, such as freight tonne kilometres, passenger kilometres, number of vehicles on road, etc.
- Final consumption expenditure
    - Household income-expenditure surveys
    - Retail trade surveys
    - Tax data on select products, such as alcohol, tobacco, motor vehicles, etc.
    - Government budget documents
    - Surveys on NPISHs
    - Population data
- Gross capital formation
    - Capital expenditure and inventory surveys
    - Annual enterprise surveys covering all enterprises/establishments
    - Government budget documents
- Imports and exports

- Merchandise trade from customs authorities
- Balance of payment statistics

The above stated sources are indicative, and may differ from country to country, but it provides an idea of the enormous and exhaustive data needs for rebasing national accounts. However, all the above stated sources may not be available in the countries.

It is possible to rebase national accounts with limited data sources, such as a population census, labour force survey, economic census/survey, household budget survey, foreign trade statistics, balance of payments, administrative data on agriculture, mining, utilities and services, business accounts and government accounts.

| **Data source** | **Data that can be used in rebasing** |
|---|---|
| Population Census | • Dwellings (Estimation of housing services)<br>• Employment (estimation of production using labour input method for informal sector and non-responding units in the business surveys)<br>• Domestic and personal services provided by employing paid domestic staff |
| Labour force survey | • Employment (estimation of production using labour input method for informal sector and non-responding units in the business surveys)<br>• Domestic and personal services provided by employing paid domestic staff |
| Household budget survey | • Expenditures on products (Household final consumption expenditure)<br>• Production of some items on which data are not available (for example, firewood), can be estimated indirectly from consumption expenditure |
| Economic census/survey | Production and intermediate consumption with product details, value added components, etc. for the units/activities covered in the census/survey |
| Business accounts, government accounts | For estimating national accounts variables for financial and non-financial corporations and general government |
| Administrative data on agriculture, mining, utilities and services | For estimating national accounts variables of concerned activities |
| Foreign trade statistics and balance of payments | Imports/exports of goods and services, primary and secondary incomes and capital transfers to/from rest of the world |
| CPI/PPI/unit value indices | To be used as deflators or inflators |

Countries may have to resort to a combination of these sources, mix and match the data from different sources and apply commodity flow approaches, when source data are incomplete or inadequate, while rebasing national accounts.

The data available for rebasing could be of varying quality, coverage, periodicity and timeliness, and may not exactly follow the national accounts concepts. Generally, the censuses and surveys carried out by the statistical institute follow the national accounts concepts to a large extent. However, there may be major deviations from national accounts concepts with regard to other data sources. Therefore, it is the job of national accountants to examine these data sources and make adjustments to improve their appropriateness for use in the national accounts.

A comprehensive review of the source data used in the compilation of national accounts should be an essential part of rebasing exercise. The review of source data should cover its various dimensions, such as coverage of economic activities, definitions, scope, classifications, items on which information is collected, reference period, frequency, consistency or deviation from SNA concepts, data processing, adjustments for non-reporting, grossing up factors, and availability of published data (and micro-data).

The review of data sources used in national accounts should be followed by an assessment as to their adequacy and suitability for use in its compilation and the extent of missing data that

is needed to improve the scope and concepts, as identified for implementation in the rebasing exercise. Recommendations on how to use the available data and steps for filling up the data gaps either through regular surveys or *ad hoc* methods, should be made for their implementation in the rebasing exercise.

### 2.4.2 Collect all data needed either through the sources or with in house resources

Once a review is made on the current status of national accounts methodologies, data sources, classifications and concepts, and assessments are made on their deviation from standards, a set of recommendations with action plan should be made. These should cover all the dimensions mentioned under 2.4.1. The ultimate goal should be to comply with SNA concepts and reach at least milestone 2 to begin with, in case the countries are at pre-SNA or milestone 1 level. For others, the goal should be to reach at least the next milestone level from where they are at the moment.

The most important sources of data for rebasing are the censuses, surveys and administrative agencies.

Among the censuses, the population census provides information on (a) population, (b) employment, and (c) dwellings. Other indicators from population census that can be used in national accounts indirectly are the number and size of households. The economic census generally provides information on the geographical concentration of units according to industries, which is used as a sampling frame for establishment surveys. However, some comprehensive economic censuses may also provide data on output, employment, wages and assets. The data available from economic census can also be used to update the coefficients, such as value added ratios, value added per worker ratios, etc. The third important census is the agriculture census, which provides data on distribution of holdings by sizes and inputs. Another census that provided information which is useful for rebasing exercise is the livestock census. This census provides data on livestock population by age and categories and inputs. These data are useful in compiling estimates for livestock activity and for the GFCF and change in inventories of livestock.

Among the surveys, the most important ones that provide data for rebasing include enterprise/establishment surveys (mining, manufacturing and services), agricultural surveys (including livestock, forestry and fisheries), construction and investment surveys, surveys on NPISHs, labour force surveys, household budget surveys, informal sector surveys (or 1-2 type surveys), wholesale and retail trade surveys, and surveys on external sector transactions. These surveys provide most data required for the compilation of various aggregates of national accounts.

The administrative data, which is cost effective, timely and easy to obtain, covers a wide range of areas and include the accounts of government containing revenue and expenditure details; accounts of businesses (financial and non-financial companies); databases maintained by central bank/regulatory agencies on banks and insurance, and external transactions; administrative data on mining (output of minerals) and utilities; databases maintained by income tax and VAT authorities; merchandise trade data from customs authorities; social security records and employment registers; statistics compiled by industry associations, research institutions and other professional bodies; and, other administrative data on building permits, hotel occupancy, electricity sales, sales of manufactured goods (computers, consumer

durables, etc.) indicators on postal and telecommunication, net tonne kms and passenger kms, cargo handled in ports, etc.

All the source data that is needed for rebasing should be collected and processed keeping in view the national accounts concepts and the improvements planned in the rebasing exercise. It is preferable to collect micro data wherever possible, as it facilitates scrutinising and validating the data at the unit level and for making adjustments. For example, units showing no output, but having labour and intermediate consumption, or units with abnormal technical coefficients, can be identified for further probing. Micro-data also facilitates in making adjustments for national accounts concepts (applying the principles of non-observed economy) at the unit level itself.

Missing source data required for the identified compilations in the rebasing exercise can be of two types. The first type relates to areas where data are available with an agency in the country but not available to the national accounts compilers. Examples could be the tax data, detailed accounts of local governments, accounts of corporations, data collected by ministries as part of regulatory functions but not compiled into meaningful datasets, data considered to be sensitive (such as defence expenditures in detail) data maintained by industry associations, etc. For some of these cases, additional efforts could be made by the compilers to access such data. The second type relates to cases where data are not available at all, therefore, fresh efforts are needed to collect such data. Examples could be informal sector production, illegal activities, underground production, or even a standard enterprise/establishment survey or a household expenditure survey or an input-output survey, which may be needed to collect data necessary for compiling SUTs. For such cases, efforts should be made to either conduct the missing surveys or data are collected through indirect methods.

To fill up the gaps in the establishment surveys (mostly the surveys covering informal sector), the UN suggests the Fully Integrated Rational Survey Technique (FIRST) (United Nations, 1994) as an option for a survey programme that can be used to efficiently capture comprehensive statistical information from enterprises of all sizes operating in an economy.

The FIRST methodology divides the statistical universe of establishments into two frames:

- a list frame of large and medium registered units included in a business register, which is clearly defined, and
- an area frame including all other units including small-scale units that are not registered. By definition, the informal sector units are found within the second frame.

Several countries use the 1-2 surveys (household-enterprise) model to estimate the small scale/informal sector units.

The UNIDO developed two model questionnaires (one for large units and the other for small units) with the purpose of meeting the requirements of national accounts as well as the SUT. Information from large units is aimed to be collected on the basis of accounts while for the small units, it is based on recall. The questionnaires contain a set of standard modules.

For the purpose of rebasing GDP estimates using the SUTs framework, a carefully designed establishment survey (based on UNIDO questionnaires) can be quite useful (please see Attachment 3 for a model questionnaire), both for estimating production and income side

GDP and for certain components of expenditure GDP (for example, change in inventories), and for compiling SUTs.

### 2.4.3 Compiling rebased national accounts and suggested templates for compilation

The following are suggested as the main sequence of steps involved in rebasing national accounts.

Identification of industry groups for compilation and dissemination of production GDP

*The first step* under this should be to finalise the set of industry groups for (i) compiling production and income side data in the basic worksheets. These can be termed as compilation categories. For example, they could be the 4-digit or 3-digit or 2-digit level ISIC, or a combination of activities at different level, depending upon the source data, (ii) compiling SUTs, for example, these could be at 2-digit level ISIC; and (iii) dissemination, for example, these could be 1 or 2-digit level or for the tabulation categories of ISIC. Ideally, the industries identified for dissemination of GDP data should also be the same for the SUTs, as SUTs are generally placed in public domain. While finalising the industry groups for which data are compiled in the basic worksheets, it should be ensured that all activities listed in ISIC Rev. 4 are exhaustively covered within them, even though some of them may not be relevant for the country. A decision has also to be made that the industry-wise data are compiled for each of the institutional sectors, so as to provide production and income side information in a cross-classification of industries and sectors.

Ensuring GDP exhaustiveness of production GDP

*The second step* in the compilation process should be to ensure that all efforts are made to measure the GDP exhaustively by ensuring that the production boundary includes

- Informal sector
- Illegal activities
- Underground activities
- Production for own final use
- Work in progress for crops and livestock

Besides this, the compilers should also ensure that all the employment that contributed to the production process in the country is accounted for in the production estimated for GDP. This can be done by estimating the employment that is associated with the production from the establishment surveys, and then comparing it with the employment estimated from an independent source, such as the labour force survey. This process of comparison should be done for each of the activities for which output is estimated from establishment surveys. This would give an indication of extent of under coverage of employment in production data of GDP and facilitate in making adjustments for this under coverage through labour input methods. The target should be to compile data on output and employment at as detailed level as possible in a cross-classification of industries and sectors.

Ensuring that minimum data recommended in MRDS and those in milestone 2 are compiled
As discussed earlier, the target data for compilation as part of rebasing exercise should be those included in the MRDS and covered in Milestone 2 at the least. Suggested tables for compilation and dissemination of data are placed at Attachment 4.

### 2.4.4 Dissemination

This item has been discussed in detail in section 2.3.4. In general data dissemination should include all the data that has been compiled as part of rebasing national accounts, tables showing the differences between the current estimates and the estimates from rebased national accounts, a brief press release containing summary information of data, sources and changes made in the national accounts series, a brief publication explaining the revisions and the reasons revisions, a detailed publication containing the sources and methods used in compiling various national accounts aggregates, and a document containing *frequently asked questions.*

Chapter 5 further discusses the topics of documentation of methodology and sources and the FAQs.

**Attachment 1**

## IMF's Data Quality Assessment Framework

The DQAF comprehensively covers the various quality aspects of data collection, processing, and dissemination. The framework includes five *dimensions* of quality and a set of prerequisites for the assessment of data quality.

The elements and indicators within each of these dimensions are:

0. **Prerequisites of quality**: Although not itself a dimension of quality, this group of "pointers to quality" includes elements and indicators that have an overarching role as prerequisites, or institutional preconditions, for quality of statistics. Note that the focus is on the agency, such as a national statistical office, central bank, or a ministry/department. These prerequisites cover the following elements:
    0.1 legal and institutional environment,
    0.2 resources available for the statistical program,
    0.3 relevance, and
    0.4 other quality management.

1. **Assurances of integrity**: This dimension relates to the adherence to the principle of objectivity in the collection, compilation, and dissemination of statistics. The dimension encompasses institutional arrangements that ensure professionalism in statistical policies and practices, transparency, and ethical standards. The three elements for this dimension of quality are the following:
    1.1 professionalism,
    1.2 transparency, and
    1.3 ethical standards.

2. **Methodological soundness**: This dimension covers the idea that the methodological basis for the production of statistics should be sound and that this can be attained by following internationally accepted standards, guidelines, or good practices. This dimension is necessarily dataset-specific, reflecting different methodologies for different datasets. This dimension has four elements, namely:
    2.1 concepts and definitions,
    2.2 scope,
    2.3 classification/sectorization, and
    2.4 basis for recording.

3. **Accuracy and reliability:** This dimension covers the idea that statistical outputs sufficiently portray the reality of the economy. This dimension is also data specific, reflecting the sources used and their processing. The five elements of this dimension cover the following:
    3.1 source data,
    3.2 assessment of source data,
    3.3 statistical techniques,
    3.4 assessment and validation of intermediate data and statistical outputs, and
    3.5 revision studies.
4. **Serviceability**: This dimension relates to the need that statistics are disseminated with an appropriate periodicity in a timely fashion, are consistent internally and with other major

datasets, and follow a regular revision policy. The three elements for this dimension are as follows:

4.1 periodicity and timeliness,
4.2 consistency, and
4.3 revision policy and practice.

5. **Accessibility**: This dimension relates to the need for data and metadata to be presented in a clear and understandable manner on an easily available and impartial basis, that metadata are up-to-date and pertinent, and that a prompt and knowledgeable support service is available. This dimension has three elements, namely:

   5.1 data accessibility,
   5.2 metadata accessibility, and
   5.3 assistance to users.

**Attachment 2**

**Table A2.1 Scope of the implementation of the System of National Accounts 2008: Milestones**

| Implementation milestones | Complementary data systems | SNA-related data and development |
|---|---|---|
| Pre-SNA phases | Basic data on production, turnover, consumption, investment, exports and imports<br>Consumer and producer price indices<br>Balance of payments goods and services account<br>Monetary survey statistics | |
| Milestone 1. Basic indicators of gross domestic product (GDP), Final expenditures on GDP current and constant prices GDP by industry at current and constant prices | Supply and use table worksheets<br>Balance of payments: current, capital and financial accounts<br>Government finance statistics (GFS) transaction accounts | |
| Milestone 2. Gross national income and other primary indicators for rest of the world<br>External account of primary incomes and current transfers<br>Capital and financial accounts | Capital stock statistics<br>International investment position<br>GFS transactions and stocks in assets and liabilities<br>Monetary and financial statistics | Quarterly national accounts<br>Regional accounts<br>Satellite accounts for environment and other satellite accounts<br>Input-output analysis |
| Milestone 3. Institutional sector accounts: first step:<br>for all institutional sectors:<br>Production account<br>for general government:<br>Generation of income, Allocation of primary income, Secondary distribution income, Use of disposable income, Capital and financial accounts | Same as for milestone 2 | Same as for milestone 2 |
| Milestone 4. Institutional sector accounts: intermediate step 1:<br>for all institutional sectors:<br>Generation of income Allocation of primary income Secondary distribution of income Use of disposable income Capital accounts | Same as for milestone 2 | Same as for milestone 2 |
| Milestone 5. Institutional sector accounts: intermediate step 2:<br>for all institutional sectors:<br>Financial account | Same as for milestone 2 | Same as for milestone 2 |
| Milestone 6. Institutional sector accounts: final step:<br>for all institutional sectors:<br>Other changes in assets account<br>Balance sheet | Same as for milestone 2 | Same as for milestone 2 |

**Table A2.2: scope of national accounts implementation according to the 2008 SNA: Datasets**

| NAQ Table number | | Annual accounts | Quarterly accounts |
|---|---|---|---|
| ***GDP, value added and employment*** | | | |
| | Nominal and volume measure of GDP by industry or by expenditure components | Minimum requirement | Minimum requirement |
| 1.1 | Expenditures of the GDP in current prices | Minimum requirement | Optional Min Req. |
| 1.2 | Expenditures of the GDP in constant prices | Minimum requirement | Optional Min Req. |
| 2.1 | Value added and GDP in current prices by industry | Minimum requirement | Optional Min Req. |
| 2.2 | Value added and GDP in constant prices by industry | Minimum requirement | Optional Min Req. |
| 2.3 | Value-added components by industry, current prices | Minimum requirement | Recommended |
| | Employment by industry | Minimum requirement | Recommended |
| ***Integrated accounts and tables, including integrated satellite accounts*** | | | |
| 1.3/4.1 | Accounts for the total economy (until net lending) | Minimum requirement | Minimum requirement |
| | Supply and use table | Recommended | Desirable |
| 5.1 | Cross-classification of output/value added by industries and sectors | Recommended | |
| | Tourism accounts, environmental accounts and other socio-economic accounts | * | |
| ***Purpose classification of expenditures*** | | | |
| 3.1 | General government final consumption (and other) expenditure by purpose in current prices | Recommended | |
| | General government final consumption expenditure by purpose at constant prices | * | |
| 3.2 | Individual consumption (and other) expenditures by purpose in current prices | Recommended | |
| | Individual consumption expenditures by purpose at constant prices | * | |
| | Purpose classification of intermediate and final consumption across all sectors | * | |
| ***Institutional sector accounts (until net lending)*** | | | |

| | | | |
|---|---|---|---|
| 4.2 | Rest of the world accounts (until net lending) | Minimum requirement | Minimum requirement |
| 4.3 | Non-financial corporations sector accounts (until net lending) | Minimum requirement | Recommended |
| 4.4 | Financial corporations accounts (until net lending) | Minimum requirement | Recommended |
| 4.5 | General government sector accounts (until net lending) | Minimum requirement | Recommended |
| 4.6 | Household sector accounts (until net lending) | Minimum requirement | Recommended |
| 4.7 | Non-profit institutions serving households sector accounts (until net lending) | Minimum requirement | Recommended |
| | ***Financial accounts*** | | |
| 4.1-4.7 | Financial accounts for all sectors | Recommended | Desirable |
| | ***Balance sheets and other changes in asset accounts*** | | |
| | Balance sheets, revaluation and other volume changes in asset accounts for all sectors | Recommended | Desirable |

**Table A2.3: Conceptual Compliance Questionnaire for the System of National Accounts 2008**

| Question: Does your country's reported national accounts data currently include estimates for …: | Yes | No | Partly | Not applicable |
|---|---|---|---|---|
| Elements affecting the level of Gross Domestic Product (GDP) | | | | |
| Gross capital formation (GCF)/output | | | | |
| 1. the entire defence expenditure incurred by government included in the GCF? | | | | |
| 2. consumption of fixed capital measured on all government fixed assets (airfields, roads, hospitals, docks, dams and breakwaters and other forms of construction except structures) including military weapon systems? | | | | |
| 3. the expenditure on Research and Development included in the output and GCF? | | | | |
| 4. all (successful and unsuccessful) mineral exploration expenditure capitalized? | | | | |
| 5. purchases of computer software expected to be used for more than a year included in GCF? | | | | |
| 6. expenditure on software development on own account expected to be used for more than a year and for sale included in GCF and output? | | | | |
| 7. the expenditure on all databases expected to be used for more than a year, whether purchased on the market or developed in-house, included in the GCF and output? | | | | |
| 8. expenditure on entertainment, literary or artistic originals included in the GCF and on their development included in the output? | | | | |
| 9. expenditure on valuables included in the GCF? | | | | |
| 10. the natural growth of cultivated forests included in output in GCF? | | | | |
| 11. the output of financial intermediation services indirectly measured (FISIM) calculated on loans and deposits only using interest rates on deposits and loans and a reference rate of interest? | | | | |
| 12. the output of FISIM allocated to users? | | | | |
| 13. the production of all goods that are produced by households whether for sale or not —included in the output? | | | | |
| 14. the activity of the own-account money lenders included in the output? | | | | |
| 15. the value of output of goods and services produced by households and corporations for own final use, when estimated on cost basis, include a return to capital? | | | | |

| Question: Does your country's reported national accounts data currently include estimates for …: | Yes | No | Partly | Not applicable |
|---|---|---|---|---|
| 16. the output of non-life insurance services in the event of catastrophic losses estimated using adjusted claims and adjusted premium supplements? | | | | |
| 17. the output of the Central Bank estimated separately for financial intermediation services, monetary policy services and supervisory services overseeing financial corporations? | | | | |
| 18. the unit undertaking purely ancillary activity, located in a geographically separate location from establishments it serves, treated as a separate establishment? | | | | |
| 19. the output of the activity of non-autonomous pension funds and unfunded pension schemes separately recognised? | | | | |
| Volume estimates | | | | |
| 20. volumes estimated using a chaining procedure on an annual basis? | | | | |
| Social contributions/insurance | | | | |
| 21. unfunded social contributions (for sickness, unemployment, retirement etc.) by enterprises imputed as compensation of employees and included as contributions to social insurance? | | | | |
| 22. non-life insurance estimates include premium supplements rather than being based just on premiums less claims? | | | | |
| 23. life insurance estimates include premium supplements rather than being based just on premiums less claims? | | | | |
| Elements affecting Gross National Income (GNI) | | | | |
| 24. reinvested earnings estimates included in the rest of the world account? | | | | |
| 25. foreign workers' remittances excluded from GNI? | | | | |
| Elements not affecting the level of GDP/GNI | | | | |
| Valuation of output | | | | |
| 26.a output and value added measured at basic prices? a | | | | |
| 26.b output and value added measured at producers' prices? a | | | | |
| 26.c value added measured at factor cost? a (not part of the 2008 SNA) | | | | |
| 27. the goods for processing recorded on a net basis? | | | | |
| Final consumption | | | | |
| 28. government final consumption expenditure broken down into individual and collective consumption? | | | | |
| Status of implementation of the 2008 SNA | | | | |

| Question: Does your country's reported national accounts data currently include estimates for …: | Yes | No | Partly | Not applicable |
|---|---|---|---|---|
| 29. the 2008 SNA has not been implemented in officially reported national accounts, when does the country plan to implement and release data based on the 2008 SNA? (Specify the year.) | | | | |

## Attachment 3

**SURVEY OF INDUSTRIAL ACTIVITIES**
**(excluding construction sector)**
---

**Reporting Period:**

**Part I: Identification and other particulars of enterprise/establishment**

| Item | |
|---|---|
| 1. State/Region | |
| 2. Township | |
| 3. Name of the enterprise | |
| 4. Type of ownership | Give code[9] |
| 5. Registering authority | |
| 6. Main activity | |
| 7. Name of Owner | |
| 8. Name/Post of Respondent | |
| 9. Complete address of the enterprise | |
| 10. Telephone No. | |
| 11. Email id | |

**Part II: Employment particulars of the enterprise/establishment (average during the period)**

| Item | Number | Emoluments paid[10] | Social welfare contributions[11] | Other payments in cash or kind[12] |
|---|---|---|---|---|
| | | | | |
| 12. Working proprietors | | | | |
| 13. Employees, full time | | | | |
| 14. Employees, part time | | | | |
| 15. Family workers[13] | | | | |
| 16. Total | | | | |

**Part III.1: Main income/revenue/receipts/sales/production**

**A. Mining and manufacturing activities (if the unit is able to report on production)**

| Item | Description | Unit | Quantity produced | Unit Price (excluding all taxes) | Value |
|---|---|---|---|---|---|
| | | | | | |
| 17. Main product | | | | | |
| 18. Other product 1 | | | | | |
| 19. Other product 2 | | | | | |
| 20. Other product 3 | | | | | |
| 21. Other product 4 | | | | | |
| 22. All other products | | | | | |
| 23. Total production | | | | | |
| 24. Receipts from goods sold in the same condition as purchased | | | | | |

[9] 1= Government/Public, 2= Cooperative, 3 = Joint venture owned by national and foreign companies 4= Joint venture owned by public and foreign company, 5= Joint venture owned by public and national company(s), 6= Private owned by national(s), 7 = Private owned by foreigner(s), 8=Private households, 9=Non-profit institutions serving households, 10= Other (specify)

[10] Includes, salaries/wages, house rent allowance, transport allowance, bonus and other benefits paid or payable in cash or in kind

[11] Contribution to insurance, provident fund and other social security schemes

[12] Employer's contribution to education, health, day care centres, canteen, etc.

[13] A family member working for more than 1/3rd of natural working hours is classified as family worker.

**B. Trading activities (only margins are to be reported as income; margins = sale value – purchase value of goods)**

| Item | Description | Total income from sales (sale value minus purchase value of goods, excluding all taxes) |
|---|---|---|
| 25. Main product sold | | |
| 26. Other product sold 1 | | |
| 27. Other product sold 2 | | |
| 28. Other product sold 3 | | |
| 29. Other product sold 4 | | |
| 30. All other products | | |
| 31. Total income from sales | | |

**C. Transport activities**

| tem | Total income from sales (excluding all taxes) |
|---|---|
| 32. Passenger transport services | |
| 33. Freight/goods transport services | |
| 34. Receipts from goods sold in the same condition as purchased | |
| 35. Total income from sales | |

**D. All other activities (including mining and manufacturing activities if they have not reported under A)**

| Item | Description | Total value/income from sales (excluding all taxes) |
|---|---|---|
| 36. Main product | | |
| 37. Other product 1 | | |
| 38. Other product 2 | | |
| 39. Other product 3 | | |
| 40. Other product 4 | | |
| 41. All other products | | |
| 42. Total value of sales | | |
| 43. Receipts from goods sold in the same condition as purchased | | |

**Part III.2: Other income (applicable to all activities in A, B, C, D above)**

| Item | Total value/income from sales |
|---|---|
| 44. Subsidies received from government | |
| 45. Income from professional services provided to others | |
| 46. Value of own construction undertaken in the unit | |
| 47. Income from rentals of fixed assets | |
| 48. Income from renting land and buildings | |
| 49. Interest income from deposits | |
| 50. Income from dividends | |
| 51. Bad debts recovered/tax refunds | |
| 52. Claims and compensation from insurance companies | |
| 53. Gains in exchange | |
| 54. Gains in sale of fixed assets | |
| 55. Grants, donations, remittances and gifts received | |
| 56. Income from all other sources | |

**Part IV: Expenses incurred (applicable to all activities in A, B, C, D above)**

| Item | Total expenses |
|---|---|
| 57. Raw materials 1 (please specify) | |
| 58. Raw materials 2 (please specify) | |
| 59. Raw materials 3 (please specify) | |
| 60. Raw materials 4 (please specify) | |
| 61. Raw materials 5 (please specify) | |
| 62. All other raw materials | |
| 63. Fuel | |
| 64. Electricity | |
| 65. Water | |
| 66. Printing and Stationery | |
| 67. Training costs | |
| 68. Telephone, fax, postal | |
| 69. Bank charges paid (do not include interest payments here) | |
| 70. Commissions or charges paid on services received (auditing, accounting, legal, etc.) | |
| 71. Expenses towards engineering and architectural services | |
| 72. Travel and hospitality/entertainment expenses | |
| 73. Advertisement | |
| 74. Insurance | |
| 75. Repair and maintenance of buildings and structures | |
| 76. Repair and maintenance of other fixed assets | |
| 77. Rental payments on fixed assets | |
| 78. Rental payments and land and buildings | |
| 79. Purchase value of goods sold in same condition as purchased (not applicable for trading) | |
| 80. R&D expenditures | |
| 81. Expenditures on mineral exploration | |
| 82. Expenditures on purchase of computer software and databases | |
| 83. Depreciation | |
| 84. Interest paid on loans | |
| 85. Commercial taxes | |
| 86. Mineral taxes | |
| 87. Taxes on land, buildings, motor vehicles, etc. | |
| 88. Income taxes | |
| 89. Other taxes, if any (please specify) | |
| 90. Dividends paid | |
| 91. Donations, gifts, remittances, etc. | |
| 92. All other expenses (please specify) | |

**Part V: Change in inventories (applicable to all activities in A, B, C, D above)**

| Item | Opening stock (as on 1.4.2013) | Closing stock (as on 31.3.2013) |
|---|---|---|
| 93. Finished products | | |
| 94. Semi-finished products | | |
| 95. Raw materials | | |
| 96. Total | | |

**Part VI: Fixed assets (applicable to all activities in A, B, C, D above)**

| Item | Opening stock (as on 1.1….) | Purchased/own constructed during the year | Major repairs | Sales/ disposed | Closing stock (as on 31.12…) |
|---|---|---|---|---|---|
| 97. Land | | | | | |
| 98. Land improvement | | | | | |
| 99. Buildings | | | | | |
| 100.Transport equipment | | | | | |
| 101.Other machinery and equipment | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 102.Computer software and databases | | | | | |
| 103.Mineral exploration | | | | | |
| 104.R&D expenditures | | | | | |
| 105.Capital work in progress | | | | | |

**Attachment 4**

**Tables A4.1 to A4.5: Estimates of Gross Value Added by Institutional sector: Financial corporations/Non-financial corporations/General government/Households, Non-profit institutions serving households (units: local currency unit)**

| INDUSTRY (ISIC) (compilation categories) | Institutional sector | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Production approach | | | Income approach | | | | |
| | Gross value of output at basic prices | Intermediate consumption at purchasers' prices | Gross value added at basic prices | Compensation of employees | Consumption of fixed capital | Other taxes on production | Other subsidies on production (-) | Net operating surplus/mixed income |
| 1 | 2 | 3 | 4=3-2 | 5 | 6 | 7 | 8 | 9=4-(5+6+7-8) |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Total | | | | | | | | |

**Table A4.6: Estimates of Gross value added and Gross domestic product for the country (units: local currency unit)**

| INDUSTRY (ISIC) (compilation categories) | Country name: | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Production approach | | | Income approach | | | | |
| | Gross value of output at basic prices | Intermediate consumption at purchasers' prices | Gross value added at basic prices | Compensation of employees | Consumption of fixed capital | Other taxes on production | Other subsidies on production | Net operating surplus/mixed income |
| 1 | 2 | 3 | 4=3-2 | 5 | 6 | 7 | 8 | 9=4-(5+6+7-8) |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Total | | | GVA at basic prices | | | | | |
| Taxes on products | | | | | | | | |
| Subsidies on products (-) | | | | | | | | |
| Gross Domestic Product | | | GDP (always at purchase | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | rs' prices) | | | | | |

Note: Shaded cells do not have values.

**Table A4.7: Estimates of GDP by expenditure approach (units: local currency unit)**

| | |
|---|---|
| 1. GDP from production approach | |
| 2. Household final consumption expenditure | |
| 1) Food and non-alcoholic beverages, | |
| 2) Alcoholic beverages, tobacco and narcotics, | |
| 3) Clothing and footwear, | |
| 4) Housing, water, electricity, gas and other fuels, | |
| 5) Furnishings, household equipment and routine household maintenance | |
| 6) Health, | |
| 7) Transport, | |
| 8) Communication, | |
| 9) Recreation and culture, | |
| 10) Education, | |
| 11) Restaurants and hotels, | |
| 12) Miscellaneous goods and services | |
| 3. Government final consumption expenditure | |
| 1) General public services, | |
| 2) Defence, | |
| 3) Public order and safety, | |
| 4) Economic affairs, | |
| 5) Environmental protection, | |
| 6) Housing and community amenities, | |
| 7) Health, | |
| 8) Recreation, culture and religion, | |
| 9) Education, | |
| 10) Social protection. | |
| 4. NPISH's final consumption expenditure | |
| 1) Housing, | |
| 2) Health, | |
| 3) Recreation and culture, | |
| 4) Education, | |
| 5) Social protection, | |
| 6) Religion, | |
| 7) Political parties, labour and professional organizations. | |

| | |
|---|---|
| 5. Gross fixed capital formation | |
| 1) Dwellings | |
| 2) Other buildings and structures | |
| 3) Machinery and equipment | |
| 4) Weapons systems | |
| 5) Cultivated biological resources | |
| 6) Costs of ownership transfer on non-produced assets | |
| 7) Intellectual property products | |
| 6. Change in inventories | |
| 1) Finished products | |
| 2) Semi-finished products | |
| 3) Raw materials | |
| 7. Acquisition less disposals of valuables | |
| 8. Exports of goods and services, f.o.b. | |
| 1) Exports of goods | |
| 2) Exports of services | |
| (a) manufacturing services on physical inputs owned by others | |
| (b) maintenance and repair services n.i.e. | |
| (c) transport | |
| (d) travel | |
| (e) construction | |
| (f) insurance and pension services | |
| (g) financial services | |
| (h) charges for the use of intellectual property n.i.e. | |
| (i) telecommunications, computer and information services | |
| (j) other business services | |
| (k) personal, cultural and recreational services | |
| (l) government goods and services, n.i.e. | |
| 9. Imports of goods and services, f.o.b. (less) | |
| 1) Imports of goods, c.i.f. | |
| 2) Imports of services (with adjustment for c.i.f. to f.o.b.) | |
| (a) manufacturing services on physical inputs owned by others | |
| (b) maintenance and repair services n.i.e. | |

| | |
|---|---|
| (c) transport | |
| (d) travel | |
| (e) construction | |
| (f) insurance and pension services | |
| (g) financial services | |
| (h) charges for the use of intellectual property n.i.e. | |
| (i) telecommunications, computer and information services | |
| (j) other business services | |
| (k) personal, cultural and recreational services | |
| (l) government goods and services, n.i.e. | |
| 10. Statistical Discrepancy (1-(2+3+4+5+6+7+8-9)) | |
| 11. Gross Domestic Product by expenditure approach (2+3+4+5+6+7+8-9+10) | |

**Table A4.8: Goods and services account (units: local currency unit)**

| Resources | | | | Uses | | |
|---|---|---|---|---|---|---|
| P.1 | Output | | | P.2 | Intermediate consumption | |
| P.11 | Market output | | | P.3 | Final consumption expenditure | |
| P.12 | Output for own use (35, 42) | | | | Household final consumption expenditure | |
| P.13 | Other non-market output | | | | Government final consumption expenditure | |
| D.21 | Taxes on products | | | | NPISHs final consumption expenditure | |
| D.31 | Subsidies on products | | | P.5 | Gross capital formation | |
| P.7 | Imports of goods and services | | | P.51 | Gross fixed capital formation | |
| P.71 | Imports of goods, cif | | | P.52 | Changes in inventories | |
| P.72 | Imports of services | | | P.6 | Exports of goods and services | |
| | | | | P.61 | Exports of goods | |
| | | | | P.62 | Exports of services | |
| | Total resources | | | | Total uses | |

**Table A4.9: Supply table with transformation from basic prices to purchasers' prices**

| Products↓ X industries→ | Domestic production at basic prices | | | | Imp. c.i.f. (total f.o.b.) | *C.i.f./ f.o.b.* adjustment | Total supply at basic prices | Transport costs and trade margins | Taxes less subsidies on products | Total supply at purchasers' prices |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Industry 1** | …… | **Industry last** | Total dom. Supply at basic prices | | | | | | |
| (1) | (2) | (3) | (4) | (5) = (2) +(3) +(4) | (6) | (7) | (8) = (5) +(6) +(7) | (9) | (10) | (11) = (8) +(9) +(10) |
| **Product 1** | | | | | | | | | | |
| **:** | | | | | | | | | | |
| **Product last** | | | | | | | | | | |
| 4. C.i.f./f.o.b. adj. | | | | | | | | | | |
| 5. Purchases of residents abroad | | | | | | | | | | |
| 6. Purchases by non-residents in the economy | | | | | | | | | | |
| 7. Total | | | | | | | | | | |

Note: The column (9) should be broken into separate columns for Trade: wholesale and retail trade; Transport: Road, water, air, support services; Column (10) should be broken into separate columns for taxes on products and subsidies on products

**Table A4.10: Use table at purchasers' prices**

| Products↓ X industries→ | Intermediate consumption | | | | Exports, f.o.b. | Final consumption expenditure | | | Gross capital formation | | | Total uses at purchasers' prices |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Industry 1** | …… …… | **Industry last** | Total inter industry uses at purchasers' prices | | Household final consumption expenditure | NPISHs final consumption expenditure | Government final consumption expenditure | Gross fixed capital formation | Change in inventories | Acquisitions less disposals of valuables | |
| (1) | (12) | (13) | (14) | (15) = (12) +(13) +(14) | (16) | (17) | (18) | (19) | (20) | (21) | (22) | (23) = (sum 15 to 22) |
| **Product 1** | | | | | | | | | | | | |
| **:** | | | | | | | | | | | | |
| **Product last** | | | | | | | | | | | | |
| 4. C.i.f./f.o.b. adj. | | | | | | | | | | | | |
| 5. Purchases of residents abroad | | | | | | | | | | | | |
| 6. Purchases by non-residents in the economy | | | | | | | | | | | | |
| 7. Total | | | | | | | | | | | | |

## Table A4.11: REST OF THE WORLD ACCOUNTS (S2)

| | | USES | RESSOURCES |
|---|---|---|---|
| | **I. EXTERNAL ACCOUNT OF GOODS AND SERVICES** | | |
| ***P.6*** | ***Exports of goods and services*** | | |
| P.61 | Exports of goods | | |
| P.62 | Exports of services | | |
| ***P.7*** | ***Imports of goods and services*** | | |
| P.71 | Imports of goods | | |
| P.72 | Imports of services | | |
| **B.11** | **External balance of goods and services** | | |

| **SNA code** | **II. EXTERNAL ACCOUNT OF PRIMARY INCOME AND CURRENT TRANSFERS** | USES | RESSOURCES |
|---|---|---|---|
| ***D.1*** | ***Compensation of employees*** | | |
| D.11 | Wages and salaries | | |
| ***D.4*** | ***Property income*** | | |
| D.41 | Interest | | |
| D.42 | Distributed income of corporation | | |
| D.421 | Dividends | | |
| D.43 | Reinvested earnings on direct foreign investment | | |
| D44 | Other investment income | | |
| D45 | Rents | | |
| ***D.5*** | ***Current taxes on income and wealth*** | | |
| D.51 | Taxes on income | | |
| D59 | Other current taxes | | |
| D61 | Net social contributions | | |
| D62 | Social benefits other than social transfers in kind | | |
| ***D.7*** | ***Other current transfers*** | | |
| D71 | Net non-life insurance premiums | | |
| D72 | Non-life insurance claims | | |
| D73 | Current transfers within general government | | |
| D.74 | Current international cooperation | | |
| D.75 | Miscellaneous current transfers | | |
| **B.12** | **Current external balance** | | |

| | **III.1CAPITAL ACCOUNT** | Changes in assets | Changes in liabilities and net worth |
|---|---|---|---|
| | | | |
| B.12 | Current external balance | | |
| D.9 | Capital transfers, receivable | | |
| D91 | Capital taxes | | |
| D92 | Investment grants | | |
| D.99 | Other capital transfers | | |
| D.9 | Capital transfers, payable | | |
| D91 | Capital taxes | | |
| D92 | Investment grants | | |
| D.99 | Other capital transfers | | |
| K.2 | Acquisitions less disposals of non-produced non-financial assets | | |
| **B.9** | **Net lending (+) / net borrowing (-)** | | |
| **B.10.1** | **Change in net worth due to saving and capital transfers account** | | |

## Table A4.12: Integrated economic account for the total economy

| SNA code | Transactions | Uses | | | Resources | | |
|---|---|---|---|---|---|---|---|
| | | Total economy | RoW account | Total | Total economy | RoW account | Total |
| | | S1 | S2 | | S1 | S2 | |
| | **EXTERNAL ACCOUNT OF GOODS AND SERVICES** | | | | | | |
| P6 | Exports of goods and services | | | | | | |
| P61 | Exports of goods | | | | | | |
| P62 | Exports of services | | | | | | |
| P7 | Imports of goods and services | | | | | | |
| P71 | Imports of goods | | | | | | |
| P72 | Imports of services | | | | | | |
| **B11** | **External balance of goods and services** | | | | | | |
| | **PRODUCTION ACCOUNT** | | | | | | |
| P1 | Output | | | | | | |
| P11 | - Market output | | | | | | |
| P12 | - Output for own final use | | | | | | |
| P13 | - Other non-market output | | | | | | |
| P 2 | Intermediate consumption | | | | | | |
| D21-D31 | Taxes less subsidies on products | | | | | | |
| **B1** | **Gross value added** | | | | | | |
| **B1*** | **Gross domestic product** | | | | | | |
| | **GENERATION OF INCOME ACCOUNT** | | | | | | |
| B1 | Gross value added | | | | | | |
| D1 | Compensation of employees | | | | | | |
| D11 | Gross wages and salaries | | | | | | |
| D12 | Employers' social contributions | | | | | | |
| D121 | Employers` actual social contributions | | | | | | |
| D122 | Employers` imputed social contributions | | | | | | |
| D2 | Taxes on production and imports | | | | | | |
| D21 | Taxes on products | | | | | | |
| D211 | Value added taxes | | | | | | |
| D212 | Taxes and duties on imports excluding VAT | | | | | | |
| D2121 | Import duties | | | | | | |
| D2122 | Taxes on imports excluding VAT and duties | | | | | | |
| D214 | Taxes on products except VAT and import taxes | | | | | | |
| D29 | Other taxes on production | | | | | | |
| | - building taxes | | | | | | |
| | - sample fiscal taxes | | | | | | |
| | - means of transport taxes | | | | | | |
| | - other taxes | | | | | | |
| D3 | Subsidies | | | | | | |
| D31 | Subsidies on products | | | | | | |
| D39 | Other subsidies on production | | | | | | |
| **B2** | **Gross operating surplus** | | | | | | |
| | **ALLOCATION OF PRIMARY INCOME ACCOUNT** | | | | | | |
| B2 | Gross operating surplus | | | | | | |
| D1 | Compensation of employees | | | | | | |
| D11 | Gross wages and salaries | | | | | | |
| D12 | employers` social contributions | | | | | | |
| D121 | Employers` actual social contributions | | | | | | |
| D122 | Employers` imputed social contributions | | | | | | |

| SNA code | Transactions | Uses | | | Resources | | |
|---|---|---|---|---|---|---|---|
| | | Total economy | RoW account | Total | Total economy | RoW account | Total |
| | | S1 | S2 | | S1 | S2 | |
| D2 | Taxes on production and imports | | | | | | |
| D21 | Taxes on products | | | | | | |
| D211 | Value added taxes | | | | | | |
| D212 | Taxes and duties on imports excluding VAT | | | | | | |
| D2121 | Import duties | | | | | | |
| D2122 | Taxes on imports excluding VAT and duties | | | | | | |
| D214 | Taxes on products except VAT & import taxes | | | | | | |
| D29 | Other taxes on production | | | | | | |
| D3 | Subsidies | | | | | | |
| D31 | Subsidies on products | | | | | | |
| D39 | Other subsidies on production | | | | | | |
| D4 | Property income | | | | | | |
| D41 | Interest | | | | | | |
| D42 | Distributed income of corporations | | | | | | |
| D421 | Dividends | | | | | | |
| D422 | Withdrawals from income of quasi-corpns. | | | | | | |
| D43 | Reinvested earnings on direct foreign inv. | | | | | | |
| D44 | Other investment income | | | | | | |
| D45 | Rent | | | | | | |
| **B5** | **Balance of primary incomes/Gross national income** | | | | | | |
| | **SECONDARY DISTRIBUTION OF INCOME ACCOUNT** | | | | | | |
| B5 | Balance of primary incomes/Gross national income | | | | | | |
| D5 | Current taxes on income, wealth, etc. | | | | | | |
| D51 | Taxes on income | | | | | | |
| D59 | Other current taxes | | | | | | |
| D61 | Social contributions | | | | | | |
| D611 | Actual social contributions | | | | | | |
| D6111 | Employers, actual social contributions | | | | | | |
| D6112 | Employees, social contributions | | | | | | |
| D6113 | Social contributions by self and non-employed persons | | | | | | |
| D612 | Imputed social contributions | | | | | | |
| D62 | Social benefits other than social transfers in kind | | | | | | |
| D7 | Other current transfers | | | | | | |
| D71 | Net non-life insurance premiums | | | | | | |
| D72 | Non-life insurance claims | | | | | | |
| D73 | Current transfers within general govt | | | | | | |
| D74 | Current international cooperation | | | | | | |
| D75 | Miscellaneous current transfers | | | | | | |
| **B6** | **Gross disposable income** | | | | | | |
| | **USE OF DISPOSABLE INCOME ACCOUNT** | | | | | | |
| B6 | Gross disposable income | | | | | | |
| P3 | Final consumption expenditure | | | | | | |
| P31 | Individual consumption expenditure | | | | | | |
| P32 | Collective consumption expenditure | | | | | | |
| **B8** | Gross saving | | | | | | |
| **B12** | Current external balance | | | | | | |

| SNA code | Transactions | Uses | | | Resources | | |
|---|---|---|---|---|---|---|---|
| | | Total economy | RoW account | Total | Total economy | RoW account | Total |
| | | S1 | S2 | | S1 | S2 | |
| **CAPITAL ACCOUNT: CHANGE IN NET WORTH DUE TO SAVING AND CAPITAL TRANSFERS ACCOUNT** | | | | | | | |
| B8 | Gross saving | | | | | | |
| D9 | Capital transfers, receivable | | | | | | |
| D92 | Investment grants, receivable | | | | | | |
| D99 | Other capital transfers, receivable | | | | | | |
| D9 | Capital transfers, payable | | | | | | |
| D92 | Investment grants, payable | | | | | | |
| D99 | Other capital transfers, payable | | | | | | |
| P51 | Gross fixed capital formation | | | | | | |
| P52 | Changes in inventories | | | | | | |
| K2 | Acquisitions less disposals of non-produced non-financial assets | | | | | | |
| **B9** | **Net lending (+)/net borrowing (-)** | | | | | | |
| **B10.1** | **Changes in net worth due to saving and capital transfers** | | | | | | |

# Chapter 3: Volume measurement in national accounts

*This chapter discusses the issues and principles involved, and the data sources and methods used in compiling volume measures of GDP by type of transactions and by type of industries. Text for this chapter has mainly been drawn from the three publications, System of National Accounts 2008 (UN, et al, 2008, referred to as 2008 SNA), Handbook on price and volume measures in national accounts (EU, 2016, referred to as EU Handbook), and The 2008 SNA - compilation in brief (World Bank, 2014, referred to as WB Compilation in brief).*

## 3.1 Introduction

The annual and quarterly national accounts are compiled and disseminated by statistical offices in both nominal and volume terms. The values of national accounts variables in volumes are obtained by decomposing the corresponding data in nominal values in terms of prices and volumes. The volume measures of these variables facilitate in monitoring the economy in real terms.

### *Volumes vs quantities*

The value of a transaction for a single homogeneous product equals price multiplied by quantity. While values are additive, quantities of different products or even those of the same product with different qualities, characteristics and specifications (for example, computers or even seemingly homogeneous products like potatoes), are not additive. Firstly, the products can be dissimilar or unrelated and secondly, products with same generic name too may change in quality and characteristics over time and may also be available in different grades or specifications or at different prices in different markets at the same time[14]. Quantities are additive only for a single homogeneous product. For aggregating quantities of different products, weights based on their prices (either in the base year or the reference year or the current year depending upon the nature of compilation) are applied. However, in the national accounts, production is expressed in values in terms of a common unit of currency, so that they are invariant to the choice of quantity unit and are additive across different products.

Though it is appropriate to use the term '*quantity*' for a single homogeneous product, for aggregate products (which is essentially the focus of compiling national accounts), the term '*volume'* is used instead of quantity in the SNA. The 2008 SNA mentions "*The quantities compared over time must be those for homogeneous items and the resulting quantity changes for different goods and services must be weighted by their economic importance, as measured by their relative values in one or other, or both, periods. For this reason, volume is a more correct and appropriate term than quantity in order to emphasize that quantities must be adjusted to reflect changes in quality*."[15]

## 3.2 General methods to derive volume measures

[14] Please see System of National Accounts 2008 handbook, chapters 15.64 to 15.75 for discussion on causes of price variation

[15] *System of National Accounts 2008*. S.L.: Commission of the European Communities, 2009 Chapter 15.13

Broadly, the volume measures can be obtained through three methods, namely:

1) deflation, in which the current-price values of transactions are divided by an appropriate price index;
2) volume extrapolation, in which base year values are extrapolated by the appropriate quantity indicator; and
3) quantity revaluation, in which the current year quantities are multiplied by base year prices.

Among these three methods, deflation is preferred because prices usually show less variation than quantities, sampling errors associated with price indices tend to be smaller, and price indices can capture quality changes better than quantity revaluation and volume extrapolation methods[16].

There are four major types of price indices available to derive volume measures in the national accounts: consumer price indices (CPIs), producer price indices (PPIs), export price indices (XPIs) and import price indices (MPIs). CPIs are measures of purchasers' prices and PPIs are measures of basic prices. XPIs are measures of FOB prices; MPIs may measure FOB or CIF prices.

The EU handbook describes possible methods that can be used for the estimation of prices and volumes and classifies them into three groups:

A methods: most appropriate methods;
B methods: those methods which can be used in case an A method cannot be applied; and
C methods: those methods which shall not be used.

The handbook suggests that for each approach, there is a variety of different indicators that can be chosen. To assess the appropriateness of an indicator the following general criteria were suggested:

- completeness of the coverage of the product heading by the indicator. For example, whether the indicator covers all of the products under the heading or just a selection of them, such as only those products sold to households;
- valuation basis of the indicator. For e.g. market output, this should be basic prices, rather than, for example, purchasers' prices or input costs, whilst for e.g. final consumption expenditure it should be purchasers' prices;
- indicator should take quality changes into account, recording them within the volume estimates;
- conceptual consistency between the indicator and the national accounts concepts.

Indicators satisfying all four criteria generally will constitute A methods. If one or more criteria are not satisfied, the methods will become B methods or C methods according to how far away the method is from an A method.

[16] See section 2.3 of EU Handbook for more detailed discussion on why deflation with a price index is preferred

### 3.3 Volume measurement in national accounts: Main principles

#### 3.3.1 Reference year for volume estimates

The volume estimates are compiled using the prices of a reference year, which could be a single base year, generally used in most developing countries[17] for a national accounts time series for estimating aggregates at constant prices. The other alternative for estimating volumes of national accounts variables is to use previous year prices. The advantage of using a single base year for constant price estimates is that it is relatively easy to compile the data and simple for users to understand. On the other hand, there are two major disadvantages in using a single base year. Firstly, if the base year is old or the relative prices of commodities change rapidly (economies with high inflation or rise or fall in prices of certain products, for example, crude petroleum) after the base year, the constant price estimates may give inaccurate growth rates for these years. This is because the prices prevailing in the base year of different products produced in the economy are used to value the quantities produced in the current year and the relative prices of commodities may have changed significantly in the recent years (for example, prices of crude petroleum or minerals may have fallen significantly while those of food products would have risen, between the two years of comparison). Secondly, growth rates would change when the base year is revised due to changes in the weights derived from the prices of new base year. Changes in growth rates and/or estimates of past period following the revision of base year (especially after a long gap from the old base year) is not understood by the users and normally draws criticism from them. Therefore, periodic revision (say, once in 5 years) of base years is important.

In order to overcome the problems associated with fixed base year, SNA recommends using the previous year prices or a system of chain linking for volume measures. Chain linking means linking year 1 to year 2 with year 1 weights then linking year 2 to year 3 with year 2 weights and computing the implicit change from year 1 to year 3 as the product of these two links rather than using year 1 weights for year 3. The main disadvantage of this method is the loss of additivity between the aggregates and its components, which may not be easily understood by the users. Users need to be informed carefully about the method and the reasons for loss of additivity in this method. While the theoretical advantages of this approach are clear, it may not always be possible to follow this advice directly, usually because the detailed information needed for current weights may not be available[18]. In such a case, the use of single base years will have to be continued, but it should be ensured by the countries that the base years are revised every 5 years. Efforts should, however, continued to be made by countries to use previous year prices for constant price measurement, because of its many advantages, especially in avoiding major changes in growth rates following revision of base years; and the use of updated weights.

#### 3.3.2 Scope of volume estimates in national accounts

The scope of price and volume measures in national accounts is generally restricted to the aggregates included in the *goods and services account*. The income components of value added

[17] Base year is the year whose current price values are used to weight the price and volume measures derived at the elementary level of aggregation, in subsequent years in the same national accounts series.
[18] *The 2008 SNA – compilation in brief.* World Bank Group. 2014. Chapter 9.9

can only be measured in real terms. The scope does not extend to income accounts, as it is conceptually impossible to factor all the flows in these accounts, including current transfers, into price and volume components. However, any income flow can be deflated by a price index for a numeraire set of goods and services to measure the increase or decrease of the purchasing power of the income over the numeraire but this is quite different from decomposing a flow into its own price and volume components[19]. Thus, the distinction between volume measures and real income measures in national accounts are clearly established and should be understood by the compilers of data.

### 3.3.3 Level of detailed volume estimates

It is recommended that volume estimates are compiled at as detailed level of estimation of output and intermediate consumption and expenditures as possible and the source data permits. For value added estimates, these should be at the minimum at 2-digit level of ISIC Rev.4. However, relevance of activities for countries should determine the choice of activities for which value added estimates are compiled. For example, in some countries, some economic activities at 2-digit level (for example, Division 01: Crop and animal production, hunting and related service activities) may be too aggregated and may need to be disaggregated further. At the same time, some activities at 2-digit level may be too small (for example Division 92: Gambling and betting activities) in some countries and may need to be clubbed with other activities within the Section.

Volume estimates in national accounts are compiled for each of the following categories:

- **By transaction category**
  - Value added
    - Market and non-market output
    - Intermediate consumption
  - Expenditure
    - Final consumption expenditure
    - Gross fixed capital formation
    - Changes in inventories
    - Exports and imports of goods and services
  - Taxes and subsidies
  - Consumption of fixed capital and capital stock
- **By industry**

SNA recommends compilation of GDP estimates using the framework of supply and use tables (SUTs), both at current and constant prices. The advantage of compiling price and volume measures through SUTs, is that it provides consistency and coherence to a set of independent measures (components of production, income, and expenditure aggregates), whose estimation is more difficult in volume terms than at current prices, as they are not based on direct evidence. Another advantage of compiling price and volume measures within an accounting framework is that implicit price or volume measures can be derived for certain balancing items, such as gross value added, which are otherwise not available from any other sources.

[19] *System of National Accounts 2008*. S.L.: Commission of the European Communities, 2009 Chapter 15.178

### 3.4 Volume estimates by transaction category and by industry

#### 3.4.1 Volume estimates by transaction category

##### 3.4.1.1 Market output and output for own final use

The best method to obtain volume estimates for all market output is by deflating the current price values with producer price indices (PPIs) at the most detailed level of aggregation. It is necessary that PPIs used for deflation represent (i) only pure price change, (ii) products of constant quality and (iii) they are conceptually related to basic price valuation of national accounts. Mostly, producers' prices of products used in the compilation of PPIs may actually correspond to basic prices valuation of national accounts, as these prices are likely to exclude product taxes. Otherwise, adjustments to bring them to basic prices may need to be made in the PPIs used for deflation of output.

Alternative to deflation method is extrapolation of base year (or previous year in the case of chain volume series) estimates with appropriate volume indices at their most detailed level. As with PPIs, the volume indices used for extrapolation should be fully representative of volume changes in the products.

The second best methods include use of less appropriate PPIs or CPIs while deflating current price values or using a less representative output volume index. The methods that should be avoided include input based price or volume indicators, secondary indicators, overall CPI, and quantity revaluation (except in the case of homogeneous products).

For products such as those of margin industries including financial services, it is very difficult to derive price indices and special steps must be taken to derive volume measures. Output of a margin industry is usually calculated as the margin rate multiplied by the value of a transaction in the current year in volume terms (deflated to base year value). In the case of FISIM, the reference rate and the rates of bank interest in the base year are used in conjunction with figures of loans and deposits in volume terms (deflated by the general price increase since the base year).

SNA recommends valuing output for own final use at the basic prices of similar products sold on the market. Therefore, the methods to derive volumes of output for this category are the same as those followed for market output of similar products.

##### 3.4.1.2 Other non-market output

Other non-market output refers to the production of government units and NPISHs. Value of output of government units or NPISHs is estimated by summing the costs of production, namely, intermediate consumption, compensation of employees, other taxes less subsidies on production (if any) and consumption of fixed capital. For volume estimation, it is preferable to deflate each of these costs separately and then to aggregate the results. For deflating compensation of employees, wage index if available, can be used. Otherwise, estimates may be compiled using

the number of hours worked by employees in different grades and the average rates of pay for each grade. This year's volume terms figure is obtained by multiplying the number in each grade in this year by the average pay in the base year[20]. For intermediate consumption and consumption of fixed capital, a general price index (WPI/PPI/CPI as appropriate) and the deflator for gross fixed capital formation, respectively, could be used.

For individual services, SNA recommends the "output volume method," especially for health and education. It is based on the calculation of a volume indicator of output using adequately weighted measures of output of the various categories of non-market goods and services produced (for example, number of health procedures or number of students, etc. with suitable weighting method for aggregation of these volumes)[21].

### 3.4.1.3 Intermediate consumption

Most likely, developing countries may not have price indices for inputs or input PPIs, though they might have in place the PPIs which are based on outputs. If input PPIs are available, they can be used to deflate current values of intermediate consumption. Otherwise, output PPIs, MPIs and, to a limited extent, CPIs may be used instead.

If item level details of intermediate consumption are available, then it is possible to apply either price deflators that are specific to purchasers, or volume indicators, wherever possible. For example, data on electricity consumption or fertilizer consumption in agriculture may be available in quantity terms from the distributors, and these could be used as volume indicators to extrapolate the base year estimate of intermediate consumption of electricity and fertilizers in agriculture.

SNA suggests the use of supply and use framework as the most robust method for estimating intermediate consumption in volume terms.

### 3.4.1.4 Value added

The recommended method for volume measures of value added is through double deflation, i.e. deflating the current price values of output by an appropriate price index of output and the current price values of intermediate consumption by an input price index, and then deriving the value added as a residual. However, estimates obtained through double deflation are subject to the errors of measurement in the volume estimates of both output and intermediate consumption. In certain cases, when the value added is relatively small compared to output, the volume measure of value added may turn out to be negative if input prices rise faster than those of output. It is therefore, advisable to exercise caution in such cases while using double deflation method.

An alternative to double deflation method is the use of single indicator to extrapolate value added directly in proportion to the volume changes in the corresponding levels of output. For example, manufacturing production index at 2-digit level of ISIC could be used to extrapolate

[20] *The 2008 SNA – compilation in brief.* World Bank Group. 2014. Chapter 9.29
[21] See Para 15.122 and 15.123 2008 SNA, for further discussion on output volume method

the base year estimates of value added of manufacturing at the same level of ISIC, to obtain estimates of value added in the current year at constant prices. Sometimes, the single indicator could be based on inputs, as in the case of non-market industries or even in market industries, like construction. The main disadvantage of using the single indicator method is the assumption that the ratio of intermediate consumption to output in the base year is constant between the two years being compared. SNA suggests that the choice to be made between the use of a single indicator method (which may yield biased results) or a double deflation method (which may yield volatile results), for an industry group, must be based on judgement and data availability.

### 3.1.4.5 Final consumption expenditure by households

Household final consumption expenditure (HFCE) should be deflated at as detailed a degree as possible, rather than deflating the single figure of total HFCE. Such product level expenditure data should be available if HFCE is compiled from an expenditure survey or other primary sources or using the commodity flow method at product level. Otherwise, the detailed product level HFCE estimates should be obtained from the supply and use tables. The deflators used for HFCE at product level are normally the CPIs that correspond to the product in question. For certain products, it is not uncommon to estimate HFCE by volume extrapolation, for example, electricity consumption by households in KWH or the data on volume of sales obtained from retail trade surveys. For volume measure of the rental services of owner-occupied dwellings, index of market rentals, if available, can be used for deflation. Alternatively, volume index of dwellings compiled with appropriate weights for different types and structures of such dwellings could be used for extrapolation.

For subsistence production, the same deflators should be used as have been used on the production side.

### 3.1.4.6 Final consumption expenditure by government and NPISHs

The final consumption expenditure of general government and NPISHs consists of their non-market output less any revenue from incidental sales plus the value of goods and services purchased from market producers for onwards transmission to individual households at prices that are not economically significant less any partial payments. Each of these items should be expressed in volume terms separately (as discussed earlier under the heading other non-market output). For goods and services transferred to households, the price indices used should be those paid for the goods less the proportion that households pay in the base year.

### 3.1.4.7 Gross fixed capital formation

The two important issues that need to be addressed while deriving volumes for GFCF are (a) the available PPIs for standard products used as capital formation could be producer specific, whereas GFCF is specific to purchaser. Therefore, adjustments to the deflators may be needed using best available information; and (b) price indices for equipment vary considerably in their growth rates, and therefore, different types of equipment need to be deflated separately using the matching price indices.

Intellectual property products are generally not well covered by available price indices, as they are heterogeneous, and some are produced for own use for which there may be no observed market prices. Among these, software and databases need to be dealt under three categories, packaged (or off-the shelf), custom-made and own account and databases and each of them deflated by an appropriate price index[22]. For own account produced assets, including those of Research and experimental development (R&D), the choice for deflation lies between deriving pseudo output price indices and using input price indices[23].

### 3.1.4.8 Changes in inventories

Changes in inventories can take positive, negative or zero values. Volume estimation should be undertaken at a detailed level for different types of inventories, (work-in-progress, finished goods, materials and supplies, goods for resale). Deflators should relate to the products in inventories rather than to the industry holding those inventories. PPIs, MPIs, CPIs and labour cost indices are all commonly used in deriving deflators, with adjustments to the appropriate valuation basis. Since inventories may include imported goods, purely domestic deflators can only be approximate and if there have been major exchange rate changes, some adjustment for this may be desirable. If chain index is used for estimating volumes, changes in inventories should be derived by first deriving chain volume estimates of the opening and closing stocks of inventories separately and then differencing them.

### 3.4.1.9 Acquisition less disposals of valuables

National statistical offices generally do not compile specific price indices for valuables. Different products covered in this aggregate should be deflated by the available price indices that are most suitable for these products.

### 3.4.1.10 Exports and imports of goods and services

Due to the availability of detailed XPI and MPI for goods, it should be a simple matter to deflate the current value estimates of exports and imports of goods at as detailed a level as practical. However, unit value indices are not price indices[24] since their changes may be due to price and (compositional) quantity changes, rather than to a specified basket of goods, as is normally the case for price indices. Despite this drawback in unit value indices, they are used by many countries as surrogates for price indices. Alternatively, if price indices are compiled using data

[22] Methods for compiling price indices for heterogeneous groups of products and products whose specifications are changing rapidly are described in the Handbook on Hedonic Indices and Quality Adjustments and in Producer Price Index Manual: Theory and Practice, (the International Labour Organization, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations, Economic Commission for Europe and the World Bank, 2004)

[23] *System of National Accounts* 2008. S.L.: Commission of the European Communities, 2009 Chapter 15.155

[24] A price index is based on the observation of prices of a fixed sample of products in two different periods. A 'unit value' is calculated by dividing the total value with the total quantity. While price index uses fixed products (same specification, location and outlet, etc.), unit value indices include all the products transacted, irrespective of quality, specification, composition and origin, etc. This can cause a large variability in the unit value index. Also, changes that should be included in volume component are in fact included in the price component in unit value indices.

from a sample of establishments on the prices of representative items (defined according to detailed specifications so that the change in price of the same item specification can be measured over time) exported and imported, they can be used as deflators.

Price indices for international trade in services are less comprehensive than in other areas. If MPIs and XPIs are available for exports and imports of services, they can be readily used to derive the required volume estimates. If not, volume estimates of exports of services can be mostly derived using an assortment of PPIs and CPIs. For example, volume estimates of freight transport services could be derived using PPIs according to the form of transport, while volume estimates of accommodation services could be derived using the appropriate CPIs. If MPIs are not available for imports of services then price indices of the countries exporting the services, adjusted for changes in the exchange rate, may have to be used[25].

#### 3.4.1.11 Taxes and subsidies on products

Taxes on products are of two kinds, specific taxes linked to the volume of the product and *ad valorem* taxes levied on the value of the product. In both cases, the base year tax rates should be applied to current values of items at base year prices (current values deflated by appropriate price indices). Estimates of volumes for subsidies are carried out by similar procedure.

#### 3.4.1.12 Compensation of employees

The quantity unit for compensation of employees may be considered to be an hour's work of a given type and level of skill. Different qualities of work must be recognized and quantity relatives calculated for each separate type of work. The price associated with each type of work is the compensation paid per hour which may vary considerably between different types of work. A volume measure of work done may be calculated as an average of the quantity relatives (calculated as ratio of current year quantities to base year quantities) for different kinds of work weighted by the relative values of compensation of employees in the base year. Alternatively, a "price" index may be calculated for work by calculating a weighted average of the proportionate changes in hourly rates of compensation for different types of work, again using relative compensation of employees as weights[26].

#### 3.4.1.13 Consumption of fixed capital and capital stock

Estimates of consumption of fixed capital (CFC) are derived simultaneously when the estimates of capital stock are compiled using the perpetual inventory method (PIM). Measures of consumption of fixed capital may be derived by subtracting the closing stock of assets from the opening stock plus gross capital formation as long as average-period prices are used for each component in order to eliminate holding gains and losses (and assuming no other volume changes in assets)[27].

[25] *System of National Accounts 2008*. S.L.: Commission of the European Communities, 2009 Chapter 15.165
[26] *System of National Accounts 2008*. S.L.: Commission of the European Communities, 2009 Chapter 15.174
[27] *System of National Accounts 2008*. S.L.: Commission of the European Communities, 2009 Chapter 15.168

For a given type of asset, time series of gross fixed capital formation are deflated by means of the purchasers' price index of the same asset type, so that the quantities of assets are expressed in volume terms of a particular reference period. These time series in volume terms are then aggregated to yield a capital stock measure, where account is taken of retirement, efficiency losses or consumption of fixed capital, depending on the nature of the stock measure constructed. The resulting stock measure is thus expressed in volume terms of the reference period chosen. The next step is to aggregate the movements in capital stocks of individual asset types in volume terms.

#### 3.4.1.14 Net operating surplus and net mixed income

When GDP is determined as the difference between output and intermediate consumption plus taxes less subsidies on production, gross value added is derived as an accounting residual. This is so in both current values and volume terms. If volume estimates of consumption of fixed capital and compensation of employees are available, net operating surplus and net mixed income can be derived but only in real terms and without a volume and price dimension. Thus it is not possible to derive an independent measure of GDP from the income approach since one item is always derived residually.

### 3.4.2 Volume estimates of output/value added by activities

#### 3.4.2.1 Agriculture, forestry and fishing

The recommended method for estimating volume measures of value added of these activities is the double indicator method, that is, by deflating the current price estimates of output and the intermediate consumption (at product level) by the respective PPIs that are appropriate to these measures and then deriving the value added in volumes as a residual.

Alternatively, output may be estimated by extrapolating base year data with a volume index or by revaluing the current year production in quantities with base year prices, at detailed product level.

#### 3.4.2.2 Mining and quarrying

Generally, detailed data are available on both production and prices in the case of products of mining and quarrying, as this is a regulated activity and the activity is undertaken by major companies. Therefore, it is possible to adopt the double indicator method or the other methods of extrapolation with volume index or quantity revaluation, mentioned above.

#### 3.4.2.3 Manufacturing

The preferred method to estimate volumes of value added is the double deflation method, i.e., by separately deflating the current values of output and intermediate consumption by appropriate price indices and then deriving the value added as a residual. Manufactured products change in quality and specifications quickly, therefore, the price indices applied as deflators should have factored these changes. Extrapolation with a volume index (such as the production index of

manufactured goods) of output is also a method used by some developing countries. It should be ensured that the volume index used is not a quantity index and includes the quality changes in products.

The next best alternative is to use single indicator method, that is, by extrapolating the value added directly with a volume index. This method is particularly suitable in cases where the value added in relation to output is very small and ensures that the value added is not negative, a possibility that can occur with double deflation.

In general, quantity revaluation methods should be avoided for manufacturing due to rapid changes in the quality and characteristics of manufactured products over time, except for few homogeneous products where there are precise quality standards, for example, bulk chemicals, wood pulp and petroleum.

### 3.4.2.4 Electricity, gas, and water supply

Products in this activity are relatively homogeneous, and the activities are carried out by few large companies or the government units. The methods for volume estimates for value added could include double indicator methods, extrapolation with volume indices or even quantity revaluation. The next best alternative is to use single indicator method.

For distribution activities, the methods for volume estimation should be based on whether output is estimated on net basis (i.e., margins earned is the output) or on gross basis. If output is estimated on net basis, then the methods suggested below under trade activity should be followed. To properly account for quality changes, both sales and purchases may be deflated separately. Alternatively, quantity of the product distributed can be assumed to be the same as quantity of electricity output (output = distribution) and output data can be used to extrapolate base year estimate.

### 3.4.2.5 Construction

Estimating volumes of construction is complicated as the activity covers a broad range of products that include dwellings, non-non-residential buildings, civil engineering, repair and maintenance, and own account construction by households; and covers both new construction as well as major renovation and minor repair and maintenance of structures.

The best option for volume estimates is to deflate the output by output price indices. However, very few developing countries compile these type of indices, though many of them compile input price indices and use these indices to estimate volumes of construction. The second best method is to extrapolate the base year estimates with hours of work in construction, if such data are available. Generally, use of other volume indicators such as number of building permits issued or the square meters involved in the permits, should be avoided.

### 3.4.2.6 Trade

For estimating volumes of margin services, the best method is to deflate sales and purchases with corresponding price indices, and then deriving the margins. However, in practice, the base year margin proportion multiplied by volume of sales at basic prices (current values deflated by an appropriate price index) provides a simpler alternative. This method is similar to extrapolating the base year estimates with volume of sales or a volume index of sales (which is computed by deflating sales at detailed level).

**Table 3.1: Estimating volumes of margin: wholesale/retail trade**
***(example taken from WB compilation in brief)***

| | Year 1 | Year 2 | Growth |
|---|---|---|---|
| 1. Basic item price | 100 | 110 | 10.0 |
| 2. Number of items | 80 | 90 | 12.5 |
| 3. Value (1*2) | 8000 | 9900 | 23.8 |
| 4. Margin% | 5 | 6 | 20.0 |
| 5. Margin value (3*4) | 400 | 594 | 48.5 |
| 6. Item plus margin (3+5) | 8400 | 10494 | 24.9 |
| 7. Volumes of margin (2*4 of Year 1) | 400 | 450 | 12.5 |
| Estimating volumes of margin for year 2 | | | |
| 8. Remove the margin from the current value for year 2 (divide by the margin %) | | 9900 | |
| 9. Deflate by price growth | 8000 | 9000 | 12.5 |
| 10. Apply the base year margin rate (5%) | 400 | 450 | 12.5 |

A reasonable approximation to total wholesale and retail margins may be to use the total supply of goods and services available for domestic use, less margins, in the current year; deflated by a general wholesale or producer price index, then apply the average margin rate from the base year.

### 3.4.2.7 Financial services

**FISIM**

For estimating FISIM in volumes, data on deposits and loans at base year prices is needed. However, it is difficult to find a price for deposits and loans. Therefore, a general inflation index is used as the appropriate deflator for deflating loans and deposits in the current year to derive volumes of loans and deposits. These volumes multiplied by the difference between the bank interest rate and the reference rate in the base year, provides the estimates of FISIM in volume terms.

**Table 3.2: Estimating FISIM in volumes**
***(example taken from WB compilation in brief)***

| | Year 1 | Year 2 | Growth |
|---|---|---|---|
| 1. Value of loans | 10000 | 15000 | 50.0 |
| 2. Bank interest | 7.0 | 5.0 | -28.6 |
| 3. Reference rate | 5.0 | 3.5 | -30.0 |

| | | | |
|---|---|---|---|
| 4. FISIM (1*(2-3)/100) | 200 | 225 | 12.5 |
| 5. General inflation index | 100 | 105 | 5.0 |
| 6. Value of loans at year 1 prices (1/5*100) | 10000 | 14286 | 42.9 |
| 7. FISIM ((6*(2-3 of year 1)/100) | 200 | 286 | 42.9 |

**Foreign exchange margins**

Foreign exchange margin is the financial service charge associated with converting foreign currency. The margin rate is the different between buying/selling rate and the average of buying and selling exchange rates. The actual margins of the forex dealers are calculated by the difference between value of items at the buying or selling rate and the value of items at the mid-point rate between buying and selling (margin rate). For estimating volumes of these margins, the base year margin rate is applied on the current year value of items.

**Table 3.3: Estimating foreign exchange margins in volumes**
***(example taken from WB compilation in brief)***

| | Year 1 | Year 2 | Growth |
|---|---|---|---|
| 1. Number of items the importer buys | 500 | 600 | 20.0 |
| 2. Purchase price ($) | 2.0 | 2.25 | 12.5 |
| 3. Exchange rate of local currency ($): buying | 1.2 | 1.5 | 25.0 |
| 4. Exchange rate of local currency ($): selling | 1.1 | 1.3 | 18.2 |
| 5. Average exchange rate (average of 3 and 4) ($) | 1.15 | 1.4 | 21.7 |
| 6. Margin in exchange rate for financial services ($) (3-5 or 5-4) | 0.05 | 0.1 | 100.0 |
| 7. Total value of items which the importer pays (in local currency units) (1*2*3) | 1200 | 2025 | 68.8 |
| *7.1 Value of imports (SNA) (in local currency units) (1*2*5)* | *1150* | *1890* | *64.3* |
| *7.2 Charges for financial services (in local currency units) (1*2*6 or 7-7.1)* | *50* | *135* | *170.0* |
| 8. Value of items at year 1 margin and exchange rate (in local currency units) (7.1) | 1150 | 1380 | 20.0 |
| 9. Service margin (in local currency units) (7.2) | 50 | 60 | 20.0 |

### 3.4.2.8 Dwelling services of owner-occupiers

The use of the same price, quality and quantity information for the estimation at constant prices as for current prices would be the best method for estimating volumes of these services. Alternatively, CPIs for privately rented dwellings (index of market rentals) would be an appropriate price index that can be used as deflator; or the stock of owner-occupied dwellings, broken down in sufficient detail (or a volume index of dwellings compiled with appropriate weights for different types and structures of such dwellings) can be used as volume indicator to extrapolate base year estimates.

### 3.4.2.9 Public services

The value of the output of government units or NPISHs is estimated by summing the costs of production, namely, intermediate consumption, compensation of employees and consumption of fixed capital. For volume estimation, it is preferable to deflate each of these costs separately and then aggregate the results. For deflating compensation of employees, wage index if available, can be used. Otherwise, the estimates could be compiled using the number of hours worked by employees as a volume indicator. Another alternative is to have numbers of staff in different grades and the average rates of pay for each grade. This year's volume terms figure is obtained by multiplying the number in each grade in this year by the average pay in the base year. For deflating intermediate consumption and consumption of fixed capital, a general price index (WPI/PPI/CPI as appropriate) and the deflator for gross fixed capital formation, respectively, could be used.

For individual services, SNA recommends the "output volume method," especially for health and education. It is based on the calculation of a volume indicator of output using adequately weighted measures of output of the various categories of non-market goods and services produced (for example, number of health procedures or number of students, etc. with suitable weighting method for aggregation of these volumes).

#### 3.4.2.10 Other private services

Most likely, developing countries may not have service price indices that can be used for estimating volumes of output of these services. In such cases, the available CPIs with adjustments to basic prices could be used.

Alternatively, availability of appropriate single indicator may have to be explored for each of the services. The indicators could vary from service to service. For the hotels and restaurants, these could be bed nights (occupancy) and meals served, respectively. Data available for different compositions should be aggregated with appropriate weights. For transportation, the indicators could be passenger kilometres, and freight tonne kilometres. For transport support services, indicators based on cargo handled in ports, time the service has been used, or time and volume of the service used, could be used with suitable adjustment for different price bands. In the case of postal, and telecommunication services, volumes of range of different products offered may be available which could be aggregated with corresponding prices in the base year.

For some services, for example, film admissions or entry to sporting events, it is possible to think of using the number of attendees times the average price in the base year. For many professional services, such as the services provided by lawyers or accountants, charges may be made on the basis of the number of hours the work takes. Here, and more generally for services, the largest cost item to the enterprise providing the service is likely to be compensation of employees and so a measure of changes in wage rates may be the best way to derive a volume measure[28].

### 3.5 Use of SUTs framework

[28] *The 2008 SNA – compilation in brief.* World Bank Group. 2014. Chapters 9.32-9.37

SNA recommends compilation of GDP estimates using the framework of supply and use tables (SUTs), both at current and constant prices. The framework is based on the two following identities:

| Products | | |
|---|---|---|
| Domestic production+ imports + trade margins + separately invoiced transport costs + taxes less subsidies on products | = | Intermediate consumption + final consumption + gross fixed capital formation + change in inventories + acquisition less disposals of valuables + exports |
| Industries | | |
| Output | = | intermediate consumption + gross value added (or total inputs) |

The advantage of compiling price and volume measures through SUTs, is that it provides consistency and coherence to a set of independent measures (components of production, income, and expenditure aggregates), whose estimation is more difficult in volume terms than at current prices, as they are not based on direct evidence. This framework also ensures that the flows covered in the two tables are broken into their price and volume components in a consistent and systematic manner.

For detailed guidelines on compiling SUTs, the following three documents may be consulted:

- *Handbook on SUT: Compilation, Application, and Practices Relevant to Africa* (Draft), UNECA
- *The 2008 SNA*, European Commission, IMF, OECD, UN, World Bank, 2009; Chapter 14: The supply and use tables and goods and services account
- *Eurostat Manual of Supply, Use and Input-Output Tables*, European Union (2008)

SUTs at constant prices can be compiled in two ways.

- *Sequential approach*: SUTs at current prices are compiled in the first instance and then the two tables are deflated at product level to obtain SUTs at constant prices.
- *Simultaneous approach*: SUTs both at current and constant prices are compiled at the same time.

The first approach is easier to manage, whereas the second approach facilitates making corrections in the SUTs at current prices, when problems are encountered while compiling constant price SUTs.

If complete set of prices are available, SUTs at current and constant prices can have the same dimension for industries and products. However, if prices are only available at an aggregated level, one may decide to compile the SUTs at constant prices at that aggregation level only. For compiling SUTs at constant prices, it is necessary to have in place SUTs at current prices for the years t and t-1. Generally, deflation at product level is undertaken on the SUTs at basic prices; then the valuation matrices at constant prices are compiled using the base year rates and ratios.

The methods for deriving values of products at constant prices in the SUTs are same as those mentioned earlier.

### 3.6 SNA recommendations on volume measures: Summary[29]

SNA summarises the recommendations on expressing national accounts in volume terms as follows:

a) Volume estimates of transactions in goods and services are best compiled in a supply and use framework, preferably in conjunction with, and at the same time as, the current value estimates. This implies working at as detailed a level of products as resources permit.
b) In general, but not always, it is best to derive volume estimates by deflating the current value with an appropriate price index, rather than constructing the volume estimates directly. It is therefore very important to have a comprehensive set of price indices available.
c) The price indices used as deflators should match the values being deflated as closely as possible in terms of scope, valuation and timing.
d) If it is not practical to derive estimates of value added in real terms from a supply and use framework and either the volume estimates of output and intermediate consumption are not robust or the latter are not available then satisfactory estimates can often be obtained using an indicator of output, at least in the short term. For quarterly data this is the preferred approach, albeit with the estimates benchmarked to annual data. An output indicator derived by deflation is generally preferred to one derived by quantity extrapolation.
e) Estimates of output and value added in volume and real terms should only be derived using inputs as a last resort since they do not reflect any productivity change.
f) The preferred measure of year-to-year movements of GDP volume is a Fisher volume index; changes over longer periods being obtained by chaining, that is, by cumulating the year-to-year movements.
g) The preferred measure of year-to-year inflation for GDP and other aggregates is, therefore, a Fisher price index; price changes over long periods being obtained by chaining the year-to-year price movements, or implicitly by dividing the Fisher chain volume index into an index of the current value series.
h) Chain indices that use Laspeyres volume indices to measure year-to-year movements in the volume of GDP and the associated implicit Paasche price indices to measure year-to-year inflation provide acceptable alternatives to Fisher indices.
i) Chain indices for aggregates cannot be additively consistent with their components whichever formula is used, but this need not prevent time series of values being compiled by extrapolating base year values by the appropriate chain indices.

# Chapter 4: Annual rebasing: chain linking and Linking the past data

*This chapter presents the topic of annual rebasing (chain-linking) and in brief the methods to link the past national accounts series with the new base year of GDP.*

[29] *System of National Accounts 2008*. S.L.: Commission of the European Communities, 2009 Chapter 15.180

## 4.1 Chain linking

### 4.1.1 Introduction

A primary objective in compiling national accounts (NA) is to obtain an accurate price and volume decomposition of annual transactions in goods and services. This decomposition provides the basis for measuring growth and inflation in macroeconomic aggregates, such as gross domestic product (GDP) in volume terms.

As noted in the previous chapters, over time the pattern of relative prices in the base period tends to become progressively less relevant to the economic situations of later periods to the point where it becomes unacceptable to continue using them to measure volume changes from one period to the next. It is then necessary to update the weights. With long time series, it is as inappropriate to use the most current weights for a date long in the past as it is to use the weights from a long time in the past for the current period. It is therefore necessary to link the old series to the new reweighted series by multiplication. This is a simple numerical operation requiring estimates for an overlapping period of the index or series calculated using both the old and new weights.

The change of base year has an impact on the growth rates of GDP. Normally relative prices tend to change in a way that is inversely related to changes in relative volumes (i.e. the commodities for which prices become cheaper tend to have a higher volume growth). As a result, the overall measure of growth based on a Laspeyres fixed-base formula will tend to overstate the growth in years after the base year compared with the growth rate which would be calculated if a more up-to-date set of relative prices were used. Thus when constant price estimates are rebased, the growth rates observed for major aggregates will change from those, which were based on, earlier base year and previously published. Sometimes the changes can be very significant, which can lead to problems for national accountants in trying to explain why the constant price GDP growth rates have been “revised” compared with those previously published.

The 2008 SNA (chapter 15) defines basic principles for deriving price and volume measures within the system of national accounts in accord with index number theory and international standards of price statistics.

### 4.1.2 Necessity of chain linked measures

A key recommendation in the 2008 SNA, is to move away from the traditional national accounts measures “at constant prices” toward chain-linked measures. Annual chain indices are superior to fixed-base indices, because weights are updated every year to reflect the current economic conditions. Chaining also avoids the need for re-weighting price and volume series when the base year is updated every five or ten years, which usually generates large revisions in the history of price and volume developments.

To obtain accurate estimates of volume changes, the above approaches need to be applied at a detailed level of goods and services that make up these aggregates. Detailed level means that the volume estimates of GDP by production should be obtained from volume estimates of economic

activities with at least 2-digit level of International Standard Industrial Classification (ISIC). Working at a detailed elementary level is crucial for assuming that a fixed-base Laspeyres price index is close to the ideal current period-weighted Paasche price index.

Whether the chaining is done so as to preserve the earlier reference period in the new series or to change the reference period of the old series to the new one, the calculations have to be undertaken at each level of aggregation. Each component as well as each aggregate has to be linked individually because of non-additivity.

The more frequently weights are updated the more representative will the resulting price or volume series be. Annual chain indices result from compiling annual indices over two consecutive years each with updated weights. These "links" are combined by successive multiplication to form a series. In order to understand the properties and behaviour of chain indices in general, it is necessary to establish first how chain Laspeyres and Paasche indices behave in comparison with fixed base indices.

In general, if fixed base indices are replaced by chain indices, the index number spread between Laspeyres and Paasche is likely to be greatly reduced. Chain indices thus have an advantage over fixed base ones. The relationship between a fixed base index and the corresponding chain index is not always the same, however, as it depends upon the paths followed by individual prices and quantities over time.

As the 2008 SNA presents, on theoretical grounds, the long-time series of volume and price indices are best derived by being chained. There are a number of matters to consider for the chain -linking, including data requirements, computing requirements, human resource requirements, loss of additivity, revisions and informing users. They refer to:

- If annual current values and corresponding volume or price data are available, then annual chaining is possible. No other data are required.
- The computing requirements of deriving annual chain indices are greater than those for fixed-weighted Laspeyres-type indices and should not be attempted without adequate, tailored software. The complexity of the software needed depends on the formula used and the method of linking. For instance, it is quite simple to develop software to derive annually chained Laspeyres- type quarterly volume measures using the annual overlap method.
- Experience has shown that if the benefits of chain volume measures, along with the loss of additivity, are carefully explained to users via documentation and seminars before their introduction, chain volume measures are generally accepted. Particular attention should be given to informing the key users, including economic journalists, well beforehand.
- When volume estimates are rebased, say every five or ten years, then it is typically the case that the growth rates are revised. If price and volume relativities have been changing rapidly, then the changes in the growth rates can be dramatic. Such is usually the case for any aggregate in which computers have a significant share. With annual chaining history is only "rewritten" a little each year, not in one large jump every five or ten years. Not surprisingly, the sort of big revisions associated with chaining only every five or ten

years can have a detrimental effect on user confidence in the national accounts, not least because users learn they can expect similar revisions in the future. Annual chaining not only measures changes better, it is likely to increase confidence in the resulting national accounts volume indices.[30]

On balance, situations favourable to the use of chain Laspeyres and Paasche indices over time seem more likely than those that are unfavourable. The underlying economic forces that are responsible for the observed long-term changes in relative prices and quantities, such as technological progress and increasing incomes, do not often go into reverse. Hence, it is generally recommended that annual indices be chained. The price and volume components of monthly and quarterly data are usually subject to much greater variation than their annual counterparts due to seasonality and short-term irregularities. Therefore, the advantages of chaining at these higher frequencies are less and chaining should definitely not be applied to seasonal data that are not adjusted for seasonal fluctuations.

### 4.1.3 Chain-linking indices

The 2008 SNA recommends moving away from the traditional fixed-base year constant price estimates to chain-linked volume measures. Constant price estimates use the average prices of a particular year (the base period) to weight together the corresponding quantities. Constant price data have the advantage for the users of the component series being additive, unlike alternative volume measures. The pattern of relative prices in the base year, however, is less representative of economic conditions for periods farther away from the base year. Therefore, from time to time, it is necessary to update the base period to adopt weights that better reflect the current conditions (i.e., with respect to production technology and user preferences).

Different base periods, and thus different sets of price weights, give different perspectives. When the base period is changed, data for the distant past should not be recalculated (rebased). Instead, to form a consistent time series, data on the old base should be linked to data on the new base. Change of base period and chain-linking can be done with different frequencies: every ten years, every five years, every year, or every quarter/month. The 2008 SNA recommends changing the base period, and thus conducting the chain-linking, annually.

The concepts of base, weight, and reference period should be distinguished clearly. In particular, the term “base period” is sometimes used for different concepts. Similarly, the terms “base period,” “weight period,” and “reference period” are sometimes used interchangeably.

Following the 2008 SNA and the current dominant national accounts practice, the following terminology is used: ·

- Base period for (i) the base of the price or quantity ratios being weighted together (e.g., period 0 is the base for the quantity ratio qq j t j 0) and (ii) the pricing year (the base year) for the constant price data.

[30] *System of National Accounts 2008*. S.L.: Commission of the European Communities, 2009 Chapter 15

- Weight period for the period(s) from which the weights are taken. The weight period is equal to the base period for a Laspeyres index and to the current period for a Paasche index. Symmetric index formulas like Fisher and Tornquist have two weight periods—the base period and the current period. · Reference period for the period for which the index series is expressed as equal to 100. The reference period can be changed by simply dividing the index series with its level in any period chosen as the new reference period.

Chain-linking means constructing long-run price or volume measures by cumulating movements in short-term indices with different base periods. For example, a period-to-period chain-linked index measuring the changes from period 0 to t (i.e., $CI^{0\to t}$) can be constructed by multiplying a series of short-term indices measuring the change from one period to the next as follows:

$$CI^{0\to t} = I^{0\to 1} \times I^{1\to 2} \times \ldots \times I^{t-2\to t-1} \times I^{t-1\to t} = \prod_{i=0}^{t} I^{i\to i+1}$$

where $I^{t-1\to t}$ represents a price or volume index measuring the change from period t−1 to t, with period t−1 as base and reference period.

The corresponding run, or time series, of chain-linked index numbers where the links are chained together so as to express the full time series on a fixed reference period is given by

$$CI^{0\to 0} = 1$$
$$CI^{0\to 1} = I^{0\to 1}$$
$$CI^{0\to 2} = I^{0\to 1} \times I^{1\to 2}$$
$$\ldots.$$
$$CI^{0\to t} = I^{0\to 1} \times I^{1\to 2} \times \ldots \times I^{t-2\to t-1} \times I^{t-1\to t} = \prod_{i=0}^{t} I^{i\to i+1}$$

Chain-linked indices do not have a particular base or weight period. Each link $I^{i\to i+1}$ of the chain linked index has a base period and a weight period, and which are changing from link to link. By the same token, the full run of index numbers derived by chaining each link together does not have a particular base period—it has a fixed reference period.

The reference period can be chosen freely without altering the rates of change in the series. For the chain-linked index time series, period 0 is referred to as the index's reference period and is conventionally expressed as equal to 100.

The reference period can be changed simply by dividing the index series with its level in any period chosen as a new reference period. For instance, the reference period for the run of index numbers can be changed from period 0 to period 2 by dividing all elements of the run by $CI^{0\to 2}$

$$CI^{2\to 0} = CI^{0\to 0}/CI^{0\to 2}$$
$$CI^{2\to 1} = CI^{0\to 1}/CI^{0\to 2}$$
$$CI^{2\to 2} = CI^{0\to 2}/CI^{0\to 2} = 1$$
$$\ldots.$$
$$CI^{t\to 2} = CI^{0\to t}/CI^{0\to 2}$$

Any two index series with different base and reference periods can be linked to measure the change from the first year to the last year as follows: $CI^{0\to t} = I^{0\to h} \times I^{h\to t}$

The chain-linked index series will constitute a period-to-period chain-linked Laspeyres volume index series if, for each link, the short-term indices $I^{t-1\to t}$ are constructed as Laspeyres volume indices with the previous period as base and reference period: that is, if

$$LQ^{t-1\to t} = \sum_i \frac{q_i^t}{q_i^{t-1}} \times w_i^{t-1} = \sum_i \frac{p_i^{t-i} \times q_i^t}{p_i^{t-i} \times q_i^{t-1}} = \sum_i \frac{p_i^{t-i} \times q_i^t}{V_i^{t-i}}$$

where

$LQ^{t-1\to t}$ represents a Laspeyres volume index measuring the volume change from period t-1 to t, with period t-1 as base and reference period;
$p_i^{t-i}$ is the price of transaction i in period t–1 (the "price weights");
$q_i^t$ is the quantity of transaction i in period t;
$w_i^{t-1}$ is the base period "share weight": that is, the transaction's share in the total value of period t-1;
and $V_i^{t-i}$ is the total value at current prices in period t-1.

Similarly, the chain-linked index series will constitute a period-to-period chain linked Paasche price index series if, for each link, the short-term indices $I^{t-1\to t}$ are constructed as Paasche price indices with the previous period as base and reference period: that is, if

$$PP^{t-1\to t} = \sum_i \frac{p_i^t}{p_i^{t-1}} \times w_i^t = \sum_i \frac{p_i^t \times q_i^t}{p_i^{t-i} \times q_i^t} = \sum_i \frac{V_i^t}{p_i^{t-i} \times q_i^t}$$

Growth rates and index numbers computed for series that can take positive, negative, and zero values—such as changes in inventories and crop harvest data—generally are misleading and meaningless. The preferred solution to analyse price and volume effects for such series is to calculate their contribution to percent change, as explained later in this section.

As an alternative, the 2008 SNA provides a solution to calculate pseudo chain volume series from variables that change sign:

- identify two associated time series that take only positive values and are such that the difference yields the target series,
- apply chain-linking to the two series separately, and
- derive the chain volume series as a difference.

The chain volume series is called pseudo chain because it is derived as the difference of two chained components, which are not additive by construction. Possible examples are a chain volume series of changes in inventories as a chain volume series of closing inventories less a chain volume series of opening inventories, or a chain volume series of external trade balance as a difference between chain volume series of exports and imports.

*Drift problem in case of price and quantity oscillation*

Chain-linking should not be done more frequently than annually. This is mainly because short-term volatility in relative prices (e.g., caused by sampling errors and seasonal effects) can cause volume measures that are chain-linked more frequently than annually to show substantial drift, particularly so for non-superlative index formulas like Laspeyres and Paasche. Similarly, short-term volatility in relative quantities can cause price measures that are chain linked more frequently than annually to show substantial drift. The purpose of chain-linking is to take into account long-term trends in changes in relative prices, not temporary short-term variations.

The example below illustrates the drift problem by using the well-known index formula: Laspeyres, Paasche and Fisher.

**Table 4.1 Volume indices**

| **Observation/Year** | **Year1** | **Year2** | **Year3** | **Year4** |
|---|---|---|---|---|
| Price item A | 2 | 3 | 4 | 2 |
| Price item B | 5 | 4 | 2 | 5 |
| Quantities item A | 50 | 40 | 60 | 50 |
| Quantities item B | 60 | 70 | 30 | 60 |
| Total value | 400 | 400 | 300 | 400 |
| **Volume Indices** | **Year1** | **Year2** | **Year3** | **Year4** |
| Fixed-based Laspeyres (year 1 based) | 100.0 | 107.5 | 67.5 | 100.0 |
| Fixed-based Paasche (year 1 based) | 100.0 | 102.6 | 93.8 | 100.0 |
| Fixed-based Fisher (year 1 based) | 100.0 | 105.0 | 79.5 | 100.0 |
| Yearly chain-linked Laspeyres | 100.0 | 107.5 | 80.6 | 86.0 |
| Yearly chain-linked Paasche | 100.0 | 102.6 | 102.6 | 151.9 |
| Yearly chain-linked Fisher | 100.0 | 105.0 | 90.9 | 114.3 |

The volume indices calculate by using the Laspeyres formula:

Fixed base index

$$LQ^{1\to t} = \sum_i \frac{p_i^1 \times q_i^t}{V_i^1}$$

$$LQ^{1\to 2} = \frac{2\times 40 + 5\times 70}{400} = \frac{430}{400} = 107.5\%$$

$$LQ^{1\to 3} = \frac{2\times 60 + 5\times 30}{400} = \frac{270}{400} = 67.5\%$$

$$LQ^{1\to 4} = \frac{2\times 50 + 5\times 60}{400} = \frac{400}{400} = 100.0\%$$

Chain based index

$$LQ^{t-1\to t} = \sum_i \frac{p_i^{t-i} \times q_i^t}{V_i^{t-i}}$$

$$LQ^{1\to 2} = \frac{2\times 40 + 5\times 70}{400} = \frac{430}{400} = 107.5\%$$

$$LQ^{2\to 3} = \frac{3\times 60 + 4\times 30}{400} = \frac{300}{400} = 75{,}0\%$$

$$LQ^{3\to4} = \frac{4\times50 + 2\times60}{300} = \frac{400}{400} = 106.7\%$$

The chain linking time series are obtained by using the formula presented above:

$$LQ^{1\to2} = 107.5\%$$
$$LQ^{1\to3} = LQ^{1\to2} \times LQ^{2\to3} = 107.5\% \times 0.75 = 80.6\%$$
$$LQ^{1\to4} = LQ^{1\to2} \times LQ^{2\to3} \times LQ^{3\to4} = 107.5\% \times 0.75 \times 1.067 = 86.0\%$$

The volume indices calculate by using the Paasche formula:

Fixed base index

$$PQ^{1\to t} = \sum_i \frac{V_i^t}{p_i^t \times q_i^1}$$
$$PQ^{1\to2} = \frac{400}{3\times50 + 4\times60} = \frac{400}{390} = 102.6\%$$
$$PQ^{1\to3} = \frac{300}{4\times50 + 2\times60} = \frac{300}{320} = 93.8\%$$
$$PQ^{1\to4} = \frac{400}{2\times50 + 5\times60} = \frac{400}{400} = 100.0\%$$

Chain based index

$$PQ^{t-1\to t} = \sum_i \frac{V_i^t}{p_i^t \times q_i^{t-1}}$$
$$PQ^{1\to2} = \frac{400}{3\times50 + 4\times60} = \frac{400}{390} = 102.6\%$$
$$PQ^{2\to3} = \frac{300}{4\times40 + 2\times70} = \frac{300}{300} = 100{,}0\%$$
$$PQ^{3\to4} = \frac{400}{2\times60 + 5\times30} = \frac{400}{270} = 148.1\%$$

The chain linking time series are obtained by using the formula presented above:

$$PQ^{1\to2} = 102.6\%$$
$$PQ^{1\to3} = PQ^{1\to2} \times PQ^{2\to3} = 102.6\% \times 1.000 = 80.6\%$$
$$PQ^{1\to4} = PQ^{1\to2} \times PQ^{2\to3} \times PQ^{3\to4} = 102.6\% \times 1.00 \times 1.481 = 151.9\%$$

### 4.1.4 Non-additive chain linked

In contrast to fixed base volume measures, chain-linked volume measures are not additive.

To preserve the correct volume changes, related series should be linked independently of any aggregation or accounting relationships that exist between them; as a result, additivity is lost. Additivity is a specific version of the consistency in aggregation property for index numbers. Consistency in aggregation means that an aggregate can be constructed both directly by aggregating the detailed components and indirectly by aggregating sub-aggregates using the

same aggregation formula. Lack of additivity is an intrinsic characteristic of a chain-linking system and should be communicated clearly to users.

Before the application of any chain-linking techniques, however, annually weighted Laspeyres-type indices are consistent in aggregation within each link— both across variables and between different frequencies. The corresponding volume estimates at previous year's prices are additive. This formula makes it possible to calculate volume estimates at previous year's prices of an aggregate as the sum of volume estimates at previous year's prices of its components. Additivity is maintained because the weight period (the previous year) coincides with the base period and the system of weights (the current price data from the previous year) is additive. Additivity of these estimates is crucial to compile SUTs in volume terms and to calculate additive contributions to percent change. All other indices in common use are not additive within each link.

For the sake of the simplicity we took the data of the example used in the point of the drift problem. Using the prices and quantities we calculated the current prices value, volume measures by using the Laspeyres formula, previous year's prices and chain linking indices.

The chain volume measures are calculated by multiplying the value of each product and of total in the year 1 with the corresponding chain linking measured for each year.

The discrepancies show the lack of additivity of chained linked volume measures.

**Table 4.2 Chain linking calculation**

| | Product | Year 1 | Year 2 | Year 3 | Year 4 |
|---|---|---|---|---|---|
| Current prices | A | 100.0 | 120.0 | 240.0 | 100.0 |
| | B | 300.0 | 280.0 | 60.0 | 300.0 |
| | Total | 400.0 | 400.0 | 300.0 | 400.0 |
| Previous year's prices | A | | 80 | 180 | 200 |
| | B | | 350 | 120 | 120 |
| | Total | | 430 | 300 | 320 |
| Volume measures (%) (previous year =100) | A | | 80.00 | 150.00 | 83.33 |
| | B | | 116.67 | 42.86 | 200.00 |
| | Total | | 107.50 | 75.00 | 106.67 |
| Chain linking indices (year 1 =100) | A | 100.0 | 80.00 | 120.00 | 100.00 |
| | B | 100.0 | 116.67 | 50.00 | 100.00 |
| | Total | 100.0 | 107.50 | 80.63 | 86.00 |
| Chain volume measures | A | | 80 | 144 | 240 |
| | B | | 350 | 140 | 60 |
| | Total | | 430 | 322.5 | 258 |
| Discrepancies | Total | | 0 | 38.5 | -42.0 |

*Volume measures*

The volume is calculated by divided the value of the year t at the prices of the previous year to the current prices value of the year t-1. The example of calculation for the product A is:

Product A, year 2; 80: 100 X100 = 80%

Product A, year 3;180: 120 x100=150%

Product A, year 4; 200: 240 x 100= 83,33%

*Chain linking indices (year 1 = 100)*

Product A year 2; 100 x 80 = 80%

Product A, year 3; 80 x 150 = 120%

Product A, year 4; 120 x 83,33 = 100%

*Chain volume measures*
The values in constant prices is calculated based on the values in current prices of the previous year multiply with the new indices chained

Product A year 2; 100 x 80 = 80

Product A, year 3; 120 x 120 = 144

Product A, year 4; 240 x 100 = 240

Finally, it can be observed that the sum of values of the two products A and B at constant prices, are different from the values obtained directly, at the level of economy, due to the non-additivity problem.

## 4.2 Linking old national accounts series with new base year

### 4.2.1 Introduction

A national accounts time series of a country is specific to its base year. For example, a country may have a national accounts series with a new base year 2010 and a previous national accounts series with base year 2000, which is not linked to the new base year series. The data in these two series may not be comparable, either in their current or constant price values, because of the differences in data sources, methods, classifications, scope, concepts and the level of details adopted in these two series.

Therefore, whenever a country rebases its national accounts and introduces a new series on the new base year, a break in the time series of national accounts data occurs. The data of all the previous national accounts series with different base years is no longer comparable with new

series data[31]. This is because the country may have incorporated many changes in the new series in respect of classifications, source data, and concepts and possibly would have also implemented some or most of the SNA recommendations.

Breaks in national accounts series following revisions of base years, result in loss of comparable long time series data. Users need these data for various purposes. For example, government may need them for monitoring the economy, economic analysis, policy making, fixing growth targets, etc.; companies may need them for business and investment decisions; and, researchers may need them for analytical work, forecasting and for building econometric models. Therefore, to cater to the needs of various users, it is necessary for countries to reconstruct the past national accounts data that is comparable and consistent in concepts and classifications with those adopted for the new base year series.

The reconstruction of earlier time series in terms of new series is called "backcasting", a term somehow derived from "forecasting"[32]. It is a statistical technique employed to ensure the coherence of the time series across time while maintaining the economic history of a country[33].

For the sake of convenience, henceforth, the rebased national accounts series would be termed as *new series*; the earlier time series as, *old series*, and all the unlinked series prior to the old series as *set of unlinked historical series*. *Backcasting* would refer to reconstructing the old series in terms of new series.

### 4.2.2 Scope of data in backcasting

The scope of the data to be backcast depends upon several factors. The foremost of these is the identification of national accounts at detailed level that would need to be taken up in the backcasting exercise or the kind of statistics to be back-casted. For example, whether it involves backcasting value added alone at as detailed industry group level as possible or the exercise includes the underlying related variables such as, output, intermediate consumption, value added components and employment. On the expenditure side, whether backcasting would involve the individual products/purposes, or at the level of main aggregate, such as the household and government final consumption expenditure.

At the same time, the scope of backcast data need not be same for the entire back series. It can be different for different past periods, depending upon the availability of source data or the compiled/published data for those periods. A compromise can be the backcasting of data at

[31] Unless the new series makes no changes in sources, classifications and methods and only uses the price of new base year for valuation at constant prices, in which case, the current price data of new series will still be comparable with that of earlier series, as the values would be same for the common year in the two series.

[32] Handbook on National Accounting Backcasting Methodology (draft). New York City: United Nations Statistics Division.

[33] Ilaria Di Matteo, United Nations Statistics Division, ECE Meeting of the Group of Experts on National Accounts, 22-25 May 2018, Geneva (https://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/ge.20/2018/mtg1/3a_Item_7_Backcasting_UNSD_23_May_2018.pdf)

detailed level for the recent years in the past (say last 10 years) and at aggregate level for years before that.

Once the scope of data for backcasting exercise is identified, the most important factor to be considered is the extent of detailed level data in the old series or in the different unlinked historical series that was compiled and is available to the compilers to facilitate the identified variables for backcasting. For example, whether the country has only a single time series containing all the past national accounts statistics, or several unlinked historical series each with different base years, and at what disaggregated level, data are available in each of these series.

Another important factor to be examined before backcasting is the availability of micro data and other source data in the database that was used by the compilers to compile the national accounts in the old series. This is particularly useful if the country decides to rework the back series (or at least for the recent past years) using the methods and concepts followed in the new series or the micro-data approach. This method is also particularly useful if the new series introduces changes in classifications of activities and purposes and also in the treatment of certain transactions (for example, an expenditure transaction was treated as intermediate consumption in the old series, but treated as GFCF in the new series), because these changes can be coded in the micro database and the series can be backcast using these new codes.

The other considerations for determining the scope of national accounts in backcasting, though minor in nature, are the kind of resources (manpower, financial and computing) available to the compilers; and the time frame available for backcasting.

In general, countries should make efforts to backcast all the past national accounts series (linked or unlinked) since the country has started compiling these data, so that no data that was previously compiled is lost due to the compilation constraints (unless it is considered that some of the historical data are unreliable and not suitable for backcasting).

It is most likely that the scope of data compiled may be different in different historical series and definitely fewer than those in the new series. For example, a country may have three old series, linked or unlinked to each other, and a new series,

- 1980 to 1990 (base year 1980) containing only production GDP estimates using ISIC Rev 2;
- 1990 to 2000 (base year 1990) containing both production using ISIC Rev 3 and expenditure GDP estimates; and
- 2000 to 2010 (base year 2000) containing estimates of GNI, Saving and net lending in addition to production (using ISIC Rev 3.1) and expenditure GDP estimates; and
- new series from 2010 onwards (base year 2010), containing these data but compiled in accordance with 2008 SNA recommended classifications (using ISIC Rev 4) and concepts.

In such a case, it is only possible in normal circumstances to produce a consistent backcast series that includes (i) production GDP data for 1980-1989; (ii) production and expenditure GDP data for 1990-1999; and (iii) production and expenditure GDP and additional accounts and aggregates

for the period 2000-2009. Therefore, the scope of backcast data for different periods in the past, depends on the availability of source data or compiled data or published data to the national accounts compilers for these years.

However, it is possible to expand the scope of accounts and aggregates for certain earlier time periods even though they were not published or compiled at that time, provided source data of reasonable quality is available now for those periods. In the above example, it is possible to compile backcast expenditure GDP data for 1980-1989 with additional efforts, if some source data that can now facilitate compilation of these aggregates is available. Mostly, historical data on imports and exports of goods and services should be available. Commodity flow methods can be used to estimate household consumption expenditure and GFCF of machinery and equipment. Links between production and expenditure GDP (government output and government consumption expenditure; output of construction and GFCF of construction) can be used to estimate other aggregates. Appropriate price indices (rescaled to new base year) may be available to produce constant price estimates. Similarly, estimates of GNI, Saving and net lending/borrowing can be compiled for total economy for previous periods in the backcasting exercise, as historical data on primary and secondary incomes and capital transfers should be available in the historical series of balance of payments statistics.

### 4.2.3 Backcasting methods

Three standard methods for backcasting have been recommended in the draft *UN Handbook on National Accounting Backcasting Methodology*. These are: (a) Methods based on detailed re-working of individual data (micro-approaches); (b) Methods based on conversion coefficients[34] (macro-approaches); and, (c) Methods applying interpolation between benchmarks (combined micro and macro- approaches). Within each of these methods, there are several possibilities or options for backcasting depending upon the availability of source data, resources, etc., breaks in the old series, and the choice between maintaining additivity and the historical growth rates in the backcast series.

Each of these methods and their variants has its own merits and demerits. The choice of which one is most suitable for a country depends upon a number of factors, such as the availability of microdata of units, details available in the source data, database maintained by the national accounts compilers, compiled/published data for the previous period, kind of statistics to be back-cast and the financial, technical and manpower resources available.

The main considerations for backcasting comprise:

- changes made in the national accounts while rebasing relating mainly to (a) classifications, (b) source data, and (c) concepts and methods;
- scope of data identified for backcasting;
- methods applicable for backcasting; and
- different choices/approaches in backcasting.

[34] Ratio between new series value to old series value in the common year

Each of the three standard methods described above can be used to account for the changes made in the new series in the backcast series. The scope of data in backcasting includes the variables, aggregates and accounts identified (as discussed earlier in this section). The compilers have various choices while applying the backcasting methods. These include,

- reworking the entire old series on new base year concepts, classifications and methods (which will ensure additivity but changes in growth rates); or
- applying the coefficients derived from the data in the two series for the common year (or years) and then retropolating the time series based on these coefficients (which ensures same growth rates, but loses additivity feature); or
- applying the coefficients derived from the data in the two series for few benchmark years (at the break points in the old series) and then deriving the conversion coefficients for different periods between the break points through interpolation.
- Other choices in backcasting include whether to apply the methods for a single variable (for example, value added) and then use technical coefficients to derive estimates for other related variables (such as output, intermediate consumption, employment, etc.) or for all the variables of interest separately.

The scope of compilation work and the choice of methods and variables for backcasting are summarised below:

1. Changes in the new series that need to be accounted for in backcasting
    a) Changes in classifications, source data, and concepts and methods.
2. Scope of data identified for backcasting
    a) Choice of variables, aggregates and accounts identified for backcasting
3. Alternative approaches to compilation
    a) *Reworking the time series*: the entire old series is compiled on new base year concepts, classifications and methods (this ensures additivity but changes growth rates)
    b) *Conversion coefficients for the common year*: conversion coefficients for the identified scope of data for common year (base year of new series) are compiled and then applied on the old time series (no change in growth rates, but additivity feature is lost)
    *c) Interpolating conversion coefficients*: coefficients are estimated for benchmark years and the periods between the benchmark years, in the time series
        i. Step 1: conversion coefficients for the identified scope of data are compiled for few benchmark years (at the break points in the old series);
        ii. Step 2: conversion coefficients for the periods between these break points are estimated through interpolation. This will give separate conversion coefficients for the same variable for different periods in the time series
        iii. Step 3: conversion coefficients for different periods are then applied on the old series data for the corresponding periods to compile backcast data
        iv. Alternatively, a single set of conversion coefficients can be compiled as average of conversion coefficients of different periods, and then applied on the entire old time series.
    d) *Choice of focus variables*: Choice of variables of interest either for micro data approach or for compiling conversion coefficients could be (i) all the variables of

interest (such as output, intermediate consumption, value added, etc.) or a single variable (such as value added) which will be used as a link to estimate other variables of interest by applying technical ratios (such as output to value added, employment to value added, etc.)

e) *Combination of above approaches and choice of variables*: backcasting can be taken up using one method for certain period and other methods for other years in the same time series. For example, reworking the estimates or micro-data approach for the last 10 years and applying conversion coefficients for years before that.

4. Methods available for backcasting
    a) Micro data approach
    b) Macro data approach or proportionate approach
    c) Mix of these two approaches

The methods, including various options, for backcasting are further discussed in the following paragraphs. The text for this part is mostly drawn from the draft UN Handbook mentioned earlier.

#### 4.2.3.1 Micro data approach

The "micro-data approach" in backcasting national accounts is mainly used for reclassifying the units according to new classification in the new series based on the available unit level data or micro data (mainly for the businesses) that was earlier used to compile estimates in the old series. The approach mainly classifies the production units in terms of new classification used in the new series. For example, a unit with the activity of repair of electric lighting equipment was earlier classified under 3150 in ISIC Rev 3.1, but will be reclassified under 3314 in ISIC Rev 4 in this approach.

For using this approach, source data should be available at unit level (micro data), if not for the entire old series, at least for one common year (which is usually the base year). For classification changes, this approach consists in double coding the activities of the units with old activity code (according to old activity classification, for example ISIC Rev. 3.1) and the new activity code (according to new activity classification (for example ISIC Rev. 4) and then re-compute the time series on the basis of the new code.

If micro data are available for certain past period (say, last 10 years), the old series can be reworked on the basis of new codes for this period. When changing a classification, "detailed reworking of micro-data" means to assign a new activity code (in terms of the new classification) to each statistical unit and for every period of backcasting. Once this assignment has been done, each series has to be re-worked, in order to have the series expressed in terms of the new classification. The procedure involved is as follows:

- Each unit in the database was previously provided an activity code[35] in line with classification system used in the old series.

[35] It is necessary to identify the activity of each unit for estimation of its output, intermediate consumption, value added components, employment, etc.

- These units will now be assigned a new principal activity code that is in line with the new classification system used in the new series. (as mentioned earlier, for example, repair of electric lighting equipment was classified under 3150 in ISIC Rev 3.1, but is reclassified under 3314 in ISIC Rev 4).
- The double coding of units with old and new activity codes helps in reclassifying the micro units and expressing the new series in terms of new classification.
- The re-aggregation of the series simply consists in summing up the data (all the identified variables such as output, intermediate consumption, employment, etc.) corresponding to the various industries defined in terms of new classification.

However, in situations where the compilers have limited resources or the micro data are available only for the common year (between the two series), the following procedure is applicable:

- Procedure of double-coding according to the principal activity of the units is carried out only for the common year.
- This double coding, for the common year, provides for each unit the conversion between the principal activity expressed in terms of the old and the new classifications.
- This correspondence is applied to all the years (periods) of the series where the unit appears, providing data according to the new classification

If the assignment of the activity code to each unit is made on the basis of detailed and reliable information, the approach based on micro-data will provide results more reliable than those obtained using methods based on macro-data. The main advantage of the micro approach with respect to macro-approaches consists in the fact that the micro-approach best retains the structural changes of the economy. The macro approach assumes fixed ratios of the overlapping year, for the entire series.

Another advantage of the micro-approach is that it does not require the choice of a specific variable to work with. On the other hand, when applying macro-approaches, it is necessary to choose a variable of reference for the identification of the conversion factors to be used when retropolating, and it usually is the value added or the number of employees. As a consequence, it is only the structure observed on this variable that determines the conversion matrices, whereas the other possible variable of interests (e.g. turnover, investments etc.) may have a completely different structure.

The micro-approach is applicable only if complete information on the economic activities of the units observed in the series is still available. Though, this method provides most reliable reconstructed time series, it is very costly and coefficients of variation are high.

Further, the approach is possible mostly in the case of developed economies, where data on individual businesses is available every year. On the other hand, developing economies compile national accounts based on infrequent/periodic censuses and surveys, limited administrative data and other *ad hoc* sources. Also, the national accounts compilers may not have access to micro data of even these fewer data sources. Therefore, applicability of microdata approach is very limited in these economies.

This approach can also be used in other areas where individual observations (such as item level receipts and expenditures of different units of government) or detailed worksheets used for compilation of national accounts in the old series, are available with compilers and changes in the new series may relate to either classification or other changes (for example, changes in the treatment of transactions from intermediate consumption to GFCF or changes in purposes of expenditures).

#### 4.2.3.2 Macro data approach

The macrodata approach follows a "proportional approach" in which conversion coefficients are compiled at the most detailed possible level of aggregates using the common year data (between old and new series) of these variables. These coefficients are then applied on the old series (both at current and constant prices) to form a time series that is consistent with the new series. In other words, the proportional method is equivalent to applying the growth rate of the old time series to the revised levels of the new series, for each variable being backcast.

The steps involved in this approach are:

1. Identify the detailed levels of activities (within these, different variables such as output, intermediate consumption, value added and its components, employment, etc.), products and aggregates that would be covered in the backcasting exercise.

2. Prepare concordance tables based on conversions coefficients for each detailed level identified for backcasting. The conversion coefficient at the most disaggregated level is calculated as new series value in the base year (which is also the common year between the two series) divided by the old series value. The current and constant price values are same for the base year. Therefore, same data are used for compiling coefficients separately for backcasting current and constant price values in the old series. Though the main purpose of backcasting is to have a comparable volume series of national accounts, it is necessary to also include current price values in the backcasting because of the changes in the levels in the new series.

   Ideally, the conversion coefficients would be calculated on the basis of data for at least one year, which would be the changeover year between one classification and another. For improving the quality of the conversion coefficients it is recommended to extend the period of double coding, for instance by another year, in order to give the new classification time to settle down, and to have the coefficients calculated on the basis of data which has already undergone some corrections.

3. Apply the conversion coefficients on the old series data, at most detailed level to obtain a consistent time series of national accounts.

When the coefficients are applied (or the series retropolated with growth rates in the old series), independently at detailed level and for the aggregates, there will be loss of additivity between

components and aggregates, though they all (aggregates and components) retain the growth rates of the old series.

The conversion coefficients can be applied for all variables within an activity (for example, output, intermediate consumption, value added components, employment, etc.) separately, which may result in the loss of relationship between these variables. For example, output minus intermediate consumption may not equal value added (as each of these three variables are estimated separately using separate conversion coefficients). Another option is to compile only one conversion coefficient for an identified variable (for example, value added) and then apply the technical coefficients to estimate output, intermediate consumption, employment, etc. (using the value added to output ratio, value added to employment ratio, etc.). This method will ensure the macro relationships between variables, but will not retain their own structure of evolution over the years. Technical coefficients change in both, short or long term periods, but this method will not capture these changes as it retains the structure of the base year throughout the backcast series.

Generally, conversion coefficients are compiled on the basis of common year data (which is usually the base year of new series). However, it is possible to establish conversion coefficients for a number of ("benchmark") years in the old series. One could on this basis determine whether the conversion coefficients at a single point in time are appropriate. And if found appropriate, data could be estimated through interpolation between the benchmark years when the conversion coefficients are applied.

Macro data approach is easy to adopt, easy to compute, less data intensive, less costly, requires less resources and easy for users to understand. The approach also retains economic history in the sense that the growth rates of old series are retained at all levels after backcasting.

#### 4.2.3.3 Methods applying interpolation between benchmarks (combined micro and macro-approaches)

The reconstruction of old time series can be done at micro-level, at macro level or a combination of the two. This approach involves in deriving conversion coefficients for each of the historical old series and assumes the availability of micro data for these benchmark periods (or the base years of each of the historical old series).

The steps involved in this procedure are:

1. Identify the benchmark periods or the break points in the historical time series, which could be the base years of different historical series or the points when major structural changes in the economy occurred
2. Double code the units in the micro data with new classification for each of the benchmark years
3. Based on the double coding, estimate conversion coefficients for the benchmark years (say, for the years 2000 and 2010). This step is followed by estimating conversion coefficients for each period (for example, from 2001 to 2009) through interpolation.
4. As in the earlier two methods, conversion coefficients can be estimated for each variable separately or only for one variable (say, value added) and then use technical ratios to

estimate all variables of interest. Another variant of this is to combine all the conversion coefficients (average) of the benchmark years (separately at detailed level and for variables of interest) and then apply these ratios to all the periods of the time series.

This method has the advantage of using the data at several benchmark points and captures the major structural changes in the economy that had taken place. The interpolation techniques adopted in this method also ensure that the conversion coefficients are more realistic rather than being constant over the entire time series. On the flip side, the method requires micro data at break points, which is generally limited in the case of developing countries.

### 4.2.4 Key issues in backcasting

In the previous paragraphs, three standard methods for backcasting as mentioned in the UN draft Handbook on Backcasting have been presented. While presenting these methods, a number of variants of the methods have also been discussed. There are few practical issues that need to be addressed by the compilers while backcasting old national accounts series. All the methods and their variants have advantages and drawbacks.

Developing countries in Africa need to decide on the best choices of methods depending upon the country practices and user understanding of the data. Firstly, compilers in these countries may find it difficult to adopt micro data approach, as the source data for compiling national accounts is limited to few benchmark censuses/surveys, administrative data and other adhoc sources. They may not have access to the extensive data of businesses that most developed countries have. Further, the micro data of even these limited censuses/surveys may not be available to the national accounts compilers. Therefore, the macro data approach is the most feasible option for backcasting for these countries.

The other main practical issues for developing countries in the backcasting exercise are with reference (a) level of details (activities, products, aggregates, variables, etc.) at which backcasting can possibly be taken up; and (b) choice between maintaining growth rates and additivity. These two issues are discussed below:

**Level of details: activities**

The changes in classifications used in the compilations and dissemination of national accounts data are on account of recent revisions in the international classifications. These are primarily related to industry and product classifications (ISIC and CPC) and purpose classifications (COICOP, COFOG and COPNI) used in the production and expenditure GDP.

Developing countries normally use a standard activity classification based on nomenclatures, rather than a 2 or 3-digit ISIC for compilation and dissemination of national accounts. For example, the main activities for which summary data are disseminated could be about 20 in number, such as agriculture, livestock, forestry, fisheries, mining, manufacturing, utilities, construction, etc. data are, however, compiled for a larger number of categories at sub-activities level, which may comply with ISIC and which may or may not be disseminated to the public and may remain in the database maintained by the compilers. It is preferable that backcasting be

taken up at the most detailed level at which the old series data are available to the compilers, as discussed earlier under the sub-section on scope of data.

Generally, developing countries tend to use the same activity classification or with slight modifications (by expanding or merging or redistributing the sub-activities), while rebasing national accounts. This practice is followed for the sake of comparability and historical reasons. The industry classification according to latest international classifications is determined *ex-post facto*, rather than using the new industry classification for activities in the rebased GDP and determining the nomenclatures based on the new classification.

However, there can be exceptions to this practice and some African nations may use the latest international classification for compiling and disseminating national accounts, as they may follow the classification system used by source agencies for collecting data, which could be the latest international classification.

For the backcasting exercise, one of the options for developing countries is to simply use the conversion coefficients between old and new activities at detailed level and rework the time series. This requires one to one correspondence between the activities at detailed level in the old and new series. To achieve this, it may be necessary to transform the old series data to correspond to that in the new series, in terms of classification and coverage, to the extent feasible and data sources permit, before backcasting. Once the two series are made harmonious in terms of classification of data compilation and dissemination categories, backcasting exercise becomes easier following the proportionate approach. Other changes made in the new series relating to sources of data, concepts and methods can also be accounted for in the backcasting using proportionate approach.

For transforming the old series data to correspond to the new series activity groups, there are four possibilities[36]:

(i) **No change in the activities and their coverage**: The industry grouping and the coverage of activities in each of the industries is broadly the same in both the old and new series. For example, meat production from slaughtering is included under livestock (animal production) in both the series for historical reasons in the country, though this is incorrect according to ISIC Rev.4[37]. Backcasting the data using the macro approach may pose less challenges.

(ii) **Changes are made in the activities, but disaggregated data are available in the old series**: The industry grouping and the coverage of activities within the industries differs between the old and new series. However, data are available at detailed level in the old series that can facilitate rearranging the old series data to correspond to the industry grouping and the coverage of activities according to the new series. Concordance between old and new classifications (or double coding at detailed level) can be established at the detailed level for this purpose. For example, meat from slaughtering was included in livestock in the old series, but is included in manufacturing in the new

[36] The suggested method is also applicable for products or purposes in GDP expenditures
[37] Raising of animals is included in Section A and meat production in Section C of ISIC Rev.4

series, in accordance with ISIC Rev.4. The data on meat from slaughtering can be separated from livestock and included under manufacturing in the old series. The rearrangement of old series data makes its classification comparable with that in the new series. The backcasting exercise can then be taken up, once the two series are made comparable in classifications and coverage.

(iii) **Changes are made in the activities, but data needed at detailed level is not available in the old series.** The industry grouping and the coverage of activities in each of the industries differs between the old and new series. Further, data are not available at detailed level in the old series that can facilitate rearranging the old series data to correspond to the industry grouping and the coverage of activities according to the new series. For example, some activities were not separately identified in the old series, because they were either less significant or included in a broad group (such as 'others', 'repairs', etc.). In this case, using the proportions available in the new series can be used to split the data in the broad group of old series between the activities identified separately in the new series. For example, growing of flowers was part of 'others' in the old series, but is identified separately in the new series. The values in the new series are for flowers: 100 and for others: 400 and in the old series for others: 500. A ratio of 20% (100/500) estimated from new series can be applied on 'others' in all the years of old series to obtain the value for growing of flowers separately in the old series. The industry grouping at detailed level in the two systems can be made comparable in this manner; and

(iv) **The activities in the new series are new and did not exist in the old series:** It is possible that the new series introduces new activities that have recently emerged in the economy, for example some of the information and communication services. If their contribution in the recent past can be estimated separately, then the method suggested in (iii) above can be adopted. Otherwise, efforts should be made to estimate their contribution for the years since these activities started appearing in the economy.

The above suggested methods for backcasting for changes in activities are also applicable in the case of changes made in concepts and methods in the new series. For example, expenditures on weapon systems is included in GFCF in the new series, whereas it was included in GFCE in the old series. Either of (ii) and (iii) methods suggested above can be applied in this case, depending upon the availability of data on such expenditures separately in the old series.

**Maintaining growth rates or additivity**

The most important guiding factor for backcasting is in ensuring that the resultant data are consistent with the old series in terms of maintaining economic history, as far as possible. While maintaining historical growth rates of the old series in the backcast series, additivity is lost between aggregates and their components (for example, gross value added of industries will not add up to total GVA, when growth rates are maintained at industry level and at the overall economy level) and this may not be easily understood by the users. On the other hand, if additivity is ensured between components and aggregates, the growth rates at either overall level or at the industry level will differ with those in the old series, which may draw criticism from the users for changing economic history.

The following three tables illustrate the problem with reference to additivity and maintaining growth rates in backcasting. The method used for backcasting each component is proportionate method[38] (applying the ratio of values in new series to old series of the common year 2010, on the old series) in this illustration.

**Table 4.3: Maintaining growth rates for components and aggregate, but losing additivity**

| Industry (GVA) | Old series (base year 2000) | | | New series (base year 2010) | | |
|---|---|---|---|---|---|---|
| | 2009 | 2010 | Growth rate (%) | 2009 (backcast) | 2010 | Growth rate (%) |
| Agriculture | 100 | 110 | 10.0 | 250 | 275 | 10.0 |
| Mining | 50 | 45 | -10.0 | 155 | 140 | -10.0 |
| Manufacturing, utilities and construction | 150 | 160 | 6.7 | 525 | 560 | 6.7 |
| Trade and Transport | 200 | 180 | -10.0 | 820 | 738 | -10.0 |
| Other services | 500 | 550 | 10.0 | 950 | 1045 | 10.0 |
| **Total (proportionate method)** | **1000** | **1045** | **4.5** | **2639** | **2758** | **4.5** |
| **Total: Sum of industries** | **1000** | **1045** | | **2700** | **2758** | |

* Note that components do not add up to total estimated by proportionate method in 2009 (backcast), but growth rates for 2010 are same in both series for components and aggregate,

**Table 4.4: Maintaining additivity, but changes overall growth rate**

| Industry (GVA) | Old series (base year 2000) | | | New series (base year 2010) | | |
|---|---|---|---|---|---|---|
| | 2009 | 2010 | Growth rate (%) | 2009 (backcast) | 2010 | Growth rate (%) |
| Agriculture | 100 | 110 | 10.0 | 250 | 275 | 10.0 |
| Mining | 50 | 45 | -10.0 | 155 | 140 | -10.0 |
| Manufacturing, utilities and construction | 150 | 160 | 6.7 | 525 | 560 | 6.7 |
| Trade and Transport | 200 | 180 | -10.0 | 820 | 738 | -10.0 |
| Other services | 500 | 550 | 10.0 | 950 | 1045 | 10.0 |
| **Total: Sum of industries** | **1000** | **1045** | **4.5** | **2700** | **2758** | **2.1** |

* Note that components add up to total in 2009 (backcast) and growth rates for industries is same for 2010 in both series, but overall growth rate for 2010 are different in the two series.

[38] Also known as splicing method in which two consecutive series with common year are rescaled to form a continuous series.

**Table 4.5: Maintaining additivity and overall growth rate, but change in growth rates of industries**

| Industry (GVA) | Old series (base year 2000) | | | New series (base year 2010) | | |
|---|---|---|---|---|---|---|
| | 2009 | 2010 | Growth rate (%) | 2009 (backcast) | 2010 | Growth rate (%) |
| Agriculture | 100 | 110 | 10.0 | 244 | 275 | 12.6 |
| Mining | 50 | 45 | -10.0 | 151 | 140 | -7.9 |
| Manufacturing, utilities and construction | 150 | 160 | 6.7 | 513 | 560 | 9.1 |
| Trade and Transport | 200 | 180 | -10.0 | 801 | 738 | -7.9 |
| Other services | 500 | 550 | 10.0 | 928 | 1045 | 12.6 |
| **Total: Sum of industries** | 1000 | 1045 | 4.5 | 2639 | 2758 | 4.5 |

* Note that components add up to total in 2009 (backcast) and overall growth rate is same for 2010 in both series, but growth rates for industries is different in the two series for 2010

Resolving the conflict between losing additivity but ensuring same growth rates; and maintaining additivity but changing the growth rates, is a choice that is left to countries keeping in view the country practices and the users' understanding of the data. Ideally, the best method for backcasting is the one in which the growth rates of old series are maintained at all levels in the backcast series, though this results in loss of additivity. Users need to be educated about this statistical feature.

Different countries follow different approaches for ensuring consistency between backcast series and old series. Some countries may even follow a mix of the above three approaches. For example, they may follow the approaches mentioned in tables (2) or (3) for the recent past years, and table (1) for other years in the past. For example, for the last 5 or 10 years, countries may maintain additivity between components and aggregates (with changes in the growth rates), and for the years prior to that they may ensure that the growth rates of components and aggregates in the backcast series remain same as in the old series (losing additivity feature).

### 4.2.5 Summary, Evaluation of results and dissemination of data

Following the revision of base year, a break in national accounts time series occurs. The previous data are no more comparable with that of new rebased series, either in their current (because of level changes) or constant price values.

Users need a consistent time series national accounts for various purposes. It is, therefore, essential for countries to transform the old series data so that it is made consistent and comparable with the new series.

It may not be possible to backcast the entire set of national accounts that was compiled and disseminated in the old series. Therefore, scope of data for backcasting needs to be decided before taking up this exercise.

There are three standard methods available for backcasting with several variants and options for each of these methods. Each of these methods have merits and drawbacks. Therefore, countries

need to choose the best options for backcasting keeping in view the availability of detailed data in the old series, source data, resources and country practices.

The quality of backcast data depends upon the level of details at which the backcasting exercise is undertaken and ideally this should be done at as detailed level as the source data permits. For example, backcasting could be taken up at as detailed activity level as data are available in the old series and within that separately for output, intermediate consumption, value added and its components and employment, for production approach data. For expenditure approach, the details could be as available in the old series. Though, this is a very elaborate exercise and increases the workload of compilers, it improves transparency in the compilations and provides more consistency checks and validation to the results.

Another option, which is easier to follow in the backcasting is identifying a reference variable, such as the value added or employment and using the structural ratios to estimate other variables, such as output, intermediate consumption, value added components, etc. This implies that backcasting needs to be done only for one variable (say, value added) and all other variables (output, etc.) are estimated on the basis of its relation (structural ratio) with these variables. This method is easier to adopt, but it assumes that the structural ratios are constant. Generally, other variables may have their own individual structures, which is lost in this method.

The proportionate method is the easiest for developing countries with limited access to micro data or extensively detailed source data, for backcasting. Maintaining historical growth rates in the recast time series, should be the prime criterion in backcasting exercise using this approach.

Whichever methods are used for backcasting, it is essential for countries to apply stringent scrutiny of derived data and evaluate the results with regard to the levels, growth rates, implicit price deflators and shares in the GDP in comparison to those in the earlier series. At the same time, it is important to maintain the macro relationships between the various aggregates, to the extent feasible. For example, the relationship between output, intermediate consumption and value added, between GVA and GDP, between GDP and GNI and so on for the rest of the main aggregates of GNDI, saving and net lending.

Comparative tables showing the old series values, growth rates, proportions, implicit price deflators, etc. with those of backcast series should be prepared for evaluating the results and could be disseminated to the public for improving transparency in compilations.

It is important to prepare a sources and methods document for the backcast series describing how the data was compiled. This document together with detailed results and the comparative statements, should be disseminated to the public.

# Chapter 5: Documenting the data sources and methods used in rebasing; frequently asked questions

*This chapter discusses the documentation of various steps involved and the sources and methods used in the rebasing of national accounts. It includes also the frequently asked questions concerning re-basing and chain linking methods of GDP*.

## 5.1 Introduction

Documentation of rebased national accounts is useful in many ways to the data producers, source data agencies and to the users. It improves the transparency of data compiled and facilitates in preparing publications for dissemination purpose.

For the data compilers, documentation serves as a guide in their day-to-day job, to respond to user queries, to the new staff as part of their training, and to review the sources and methods as and when an occasion arises (for example, when a source agency stops supplying data or when better quality data with improved coverage becomes available or when a new survey results become available or a new method to estimate informal sector or illegal activities is facilitated).

For the data providers, documentation helps in understanding how their data are relevant and how it has been used in the compilation of national accounts. This also facilitates in reviewing whether the data produced by them is in alignment with that of national accounts in terms of scope, coverage and concepts, whether the source data has been appropriately used in national accounts compilation and whether the contribution of their activities is properly reflected in the GDP estimates. Based on the outcome of assessment, data providers can initiate steps to fill the data-gaps.

The user community includes the media, academics, researchers, government agencies and international agencies. The documentation helps in improving the user awareness of sources and methods used in the compilation of national accounts. Some of these users, for example, the Ministry of Finance and the Central Bank use the data extensively for policy purposes and for them it is important to have full insights into the scope, coverage, definitions, classifications, concepts and the data and methods used in these estimates. Similarly, for researchers, econometricians and forecasters, understanding the metadata of national accounts is of immense importance. Comprehensive documentation on the compilation practices of national accounts helps the users in using the data appropriately in their analysis and policy making. Besides, documentation also helps in improving the transparency of national accounts.

## 5.2 Documentations

Broadly, the documents to be prepared as part of rebasing exercise can be placed under two categories: those that should be released before rebasing and those that should be released along with the rebased national accounts statistics. The documents to be covered under these two categories could be:

### A. Before the release of rebased national accounts statistics

- Review and assessment of current national accounts
- Strategy and action plan to implement 2008 SNA in a phased manner with focus on the tasks identified for implementation in the rebasing exercise together with an indication on the possible changes in methods and estimates.

**B. After the release of rebased national accounts statistics**

- Sources and methods used for the base year in the rebased national accounts together with the estimates for the base year, with explanation for changes in methods and estimates
- Sources and methods used for compiling annual/quarterly national accounts together with the estimates for the years for which data has been compiled
- Sources and methods used for linking the past data (before the base year or back casting) of the previous base year series together with the estimates for the past years
- A user guide in the form of *frequently asked questions*.

It may not be necessary to separately produce documents mentioned above. Some of them could be combined, for example, the two documents under A can be combined into one document. Similarly, documents mentioned under the first two bullets of B can be combined into one. The reason behind mentioning each of these documents is to provide an idea of the extent of documentation that should be done by national accounts, for future use by the data compilers and for the benefit of user community.

**A.1 Review and assessment of current national accounts**

The review and assessment of current national accounts (as discussed in sections 2.3.1 and 2.4.1) should be properly documented and published. This helps in understanding the current status of national accounts, its scope and coverage, areas of weaknesses, data gaps, and deviations in concepts with reference to the international standards, besides ascertaining the gaps in statistical capacity. The assessment helps in preparing a road map for full implementation of 2008 SNA in the medium or long-term depending upon the resources available to the national accounts compilers.

The contents of this documentation on Review and Assessment of current national accounts should follow the same items as discussed in section 2.4.1, namely,

- Institutional arrangements
- Scope and coverage
- Concepts and definitions followed
- Classifications used
- Data sources used in the compilation

The documentation under each of these headings, should include the current practices and an assessment of these practices in comparison to the required standards with an indication of the extent of deviation from the standards.

**A.2 Strategy and action plan to implement 2008 SNA**

The recommendations and action plan emanating from the review and assessment phase should be documented here, both for monitoring their implementation and for the information of the data providers and users. The document sets the tone for future direction of improving national accounts in compliance with 2008 SNA in a phased (short, medium and long term) and time bound manner, with clearly laid down timelines.

This document is also useful in many other areas, for example, for securing resources (financial and manpower) from the government, for seeking technical assistance from international/donor agencies, for capacity building of the data compilers, and for negotiating with data providers for additional data that is needed for implementing 2008 SNA. The implementation of the strategic plan should be seen as a step towards strengthening the planning and policy making process.

The contents of this document should have the recommendations and implementation plans for each of the broad headings discussed in A1 above. For example, under scope and coverage, the recommendations could be implementation of milestone 2 data sets in the short term (or Phase I), milestone 4 data sets in medium term (or Phase II), and milestone 5 (or 6) datasets in the long term (Phase III), as discussed in detail in Section 2.4.1 earlier.

As a supplement to this document, it is preferable to provide information to the users on the possible changes in rebased national accounts data, extent of changes (indicative), and the reasons for the changes. This will help in preparing the users in advance on the possible changes in national accounts statistics that may arise when the new national accounts series on a new base year is released.

**B1. Estimates and sources and methods used for the base year in the rebased national accounts**

This item has been discussed in detail in section 2.3.4. This is an important document in the rebasing exercise and is expected to provide detailed information on rebased national accounts and the changes made in these data along with the reasons for the changes. This document will be referred frequently by the national accounts compilers and other users in explaining/ understanding the sources and methods used and changes made in the new national accounts series.

Broadly, the contents of this publication may include

- Historical background of national accounts of the country
- The practice of changing base years in the country
- Why the particular year has been chosen as the base year
- Steps taken towards compliance with 2008 SNA in the new national accounts series
- Consultations held with stakeholders in the rebasing process
- Assurance of data quality (for example validation of source data, compiling estimates using micro-data after applying scrutiny checks, components adding up to aggregates, consistency of same data presented in different tables, and validating estimates with previous data, etc.)
- Brief description of data sources used

- Estimates (with shares) of different aggregates, by type of source data. For example, industry output disaggregated by each source: administrative data, establishment survey, informal sector survey, employment based (labour input method), commodity flow methods and other sources

Estimates by source of data (in currency units) and shares (in bracket)

| Aggregate | Government accounts | Companies accounts | Administrative data | Establishment survey /census | Informal sector survey | Employment based (labour input method | Commodity flow method | Other sources | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

- Compilation methods, including the concepts, definitions, scope and concepts used
- Brief economic analysis based on the new data
- Tables showing new base year estimates and comparing them with earlier estimates at detailed level, along with explanation of changes in the two sets of data
- Presentation of SUTs, if they have been compiled as part of rebasing, along with summary data compiled from SUTs (such as goods and services account, production and generation of income accounts) and a brief economic analysis based on SUTs. It is preferable to prepare a separate document on SUTs, as it has additional focused users (for example, input output table compilers, econometricians, etc.).
- Concepts and definitions, including glossary of terms used in national accounts

**B.2 Sources and methods used for compiling annual/quarterly national accounts and the estimates for the years for which data has been compiled**

This is another documentation that is extremely useful to both national accountants and users. This document presents the sources and methods used for compiling the annual/quarterly national accounts both in nominal and in volume terms.

The contents of this document should include

- Concepts used in national accounts
- Scope of national accounts compiled
- Special efforts made to estimate non-observed economy problem areas
- Data sources and estimation methods including the weak areas and future plans to improve the estimates:
    - Production and income approach GDP
    - Expenditure approach GDP
    - Sequence of accounts
    - Supply and use tables (if this is not included in a separate document)

    - Quarterly estimates of GDP
- Annual and quarterly estimates both at nominal prices and in volumes (where applicable)
    - Production and income approach GDP (gross value of output, intermediate consumption, gross value added, compensation of employees, other taxes less subsidies on production, consumption of fixed capital, net operating surplus/mixed income and employment), by activities and taxes on products less subsidies on products for the total economy
    - Expenditure approach GDP (with details of each expenditure aggregate, as discussed in Table 7 of Attachment 4 in chapter 2)
    - Tables showing growth rates, shares in GDP, implicit price deflators (IPDs) and inflation estimated from IPDs
    - Sequence of accounts
- Concepts and definitions, including glossary of terms used in national accounts

**B.3 Sources and methods used for linking the past data (before the base year) of the previous base year series and the estimates for the past years**

This document presents the sources and methods used for back casting of national accounts together with the estimates for the past years (before the base year) both in nominal and in volume terms. Both annual and quarterly estimates should be presented in this document.

The contents of this document should include:

- Purpose of back casting data and presenting the estimates
- Data sources and methods used for current and constant price estimates
    - Production and income approach GDP
    - Expenditure approach GDP
    - Other aggregates/accounts (if compiled)
    - Quarterly estimates of GDP
- Estimates, annual and quarterly both at nominal prices and in volumes (where applicable)
    - Production and income approach GDP (gross value of output, intermediate consumption, gross value added, compensation of employees, other taxes less subsidies on production, consumption of fixed capital, net operating surplus/mixed income and employment), by activities and taxes on products less subsidies on products for the total economy
    - Expenditure approach GDP (as detailed as possible for each expenditure aggregate)
    - Tables showing growth rates, shares in GDP, implicit price deflators (IPDs) and inflation estimated from IPDs
    - Other aggregates/accounts (if compiled).

**5.3 Frequently asked questions (FAQs)**

**FAQs on GDP rebasing**

**Q1. What is GDP rebasing / re-benchmarking?**

Answer:
Rebasing/ re-benchmarking of the national account series (GDP) is the process of replacing an old base year used to compile volume measures of GDP with a new and more recent base year or price structure.

**Q.2 What is the difference between base year and reference year?**

- Base year: the year preceding the accounting period (t-1) the prices of which are taken as a base for the calculations of accounting periods.
- Reference year: a year (currently, 2000) that is used as a base for presenting chain-linked indices and volumes. In case of chained indices, this year = 100. After some time, reference year can be changed (e.g. from 2000 to 2005). Chained indices and values change when changing the reference year, but the growth rates remain exactly the same.

**Q3. Why does GDP need to be rebased?**

Answer:
Over the time, many changes in the global economy influenced the economic development of the country. The national accounts should present the economic situation which enables policy makers and analysts to use a more accurate set of economic statistics that is a truer reflection of current realities. Rebasing enables government to have a better understanding of the structure of the economy, an indication of growth in different economic sectors in order to take the adequate measures to grow the economy, create jobs, improve infrastructure and reduce poverty.

**Q4. What are the benefits of rebasing Gross Domestic Product (GDP)?**

Answer:
Rebasing GDP provides some benefits such as:

- describe current economic condition i.e. size and economic growth rate during a given period of time
- improve the quality of GDP
- improve the international comparability of the GDP

**Q5. What are the implications of GDP rebasing?**

Answer:

The rebasing of GDP brings some impacts on macroeconomic indicators such as:
Increase in nominal GDP, which will lead to an increase in the income group from low into medium or high income country (GDP per capita) and change economic structure.
Changing the macroeconomic indicators such as tax ratios, debt ratios, investment and saving ratios, current account, and economic growth.

Changing the data base for modelling and forecasting.

**Q6. Why a special year is used as the reference year?**

Answer:
The choice of a new base year is due to the following reasons:

- Economy is relatively stable in this year
- The renewal concepts, definition, coverage, and methodology as are recommended by the SNA 2008.
- Availability of new data source to improve quality of GDP such as Population Census, tax reform, special surveys, etc.
- Availability of SUTs as the framework that could be used for GDP benchmarking exercise.

**Q7. How often should a country rebase?**

Answer:
The UN Statistical Commission (UNSC) recommends that countries rebase every 5 years, although some countries do at intervals of less than 5 years.

**Q8. How long is taken to complete the exercise?**

Answer:
The preparatory work for the rebasing exercise depend of the strategy adopted. Based on it, the change of the base year and the rebasing of GDP means:

- in the new base year only the reference period for the individual price and volume indices are changed
- the base year means the implementation only of new available data, or some changes in the compilation methods used for national accounts estimates
- the base year correspond to a new benchmark year.

The duration of the rebasing exercise can take from one year (in the first option) to three-four years, if new surveys are carried out and new methodological concepts are implemented (the third option).

**Q9. Which are the results?**

Answer:
As result of the rebasing exercise, new data on GDP are available. The structure of GDP by the three approaches in the new base changes due to the implementation of new data sources, new concepts, improvement of the compilation procedures, etc. are available in the data provided. The growth rates of GDP and of all components change. A new time series of GDP is available.

**Q10. Where the users can find the results?**

Answer:
The new data on GDP and time series should be disseminated to the domestic and international users, along very clear methodological notes. The notes present in detail the new data sources used, the changes in the methodology applied and compilation method used. The data are, usually, presented in a special publication and included also on the web-site of the statistical office.

Other possible questions for which answers may be prepared by the countries:

1. What are the main changes made in the new series?
2. Have the growth rates changed in the new series compared with the earlier series in GDP? If so, what are the main reasons for the changes and in which industry?
3. Has the structure of economy changed according to the new series?
4. How the informal sector was estimated in the new series and what is its share in employment and GDP?
5. Have there been changes in the consumption pattern of households? If so, what are the details?
6. How was the new series data validated?
7. How can users access the new series data? Is it available on internet?

**FAQs on Chain linking method**

**Q1. Why did the statistical office start calculating GDP by chain-linking method?**

Answer
A weak point of the constant price calculations by fixed base year is that the price structure of the base year reflects ever less the real economic situation as the accounting period becomes more distant. Therefore, after a certain period (usually in every five years), fixed base year has to be moved ahead and the respective GDP data has to be re-based i.e. recalculated according to the new base year. In addition, over years, product structure changes, especially in fast growing economies, for that reason the product structure of fixed base year reflects the real situation of the accounting year ever less accurately as the accounting period becomes more distant. Therefore, the closer the base year to the accounting year is, the more exact constant price calculations are.

A single fixed base year is not applied to chain-linking since every previous calendar year is used as a base for calculations, means that every year preceding the accounting year serves as a base year, therefore calculations must be made at previous year prices.

For the member states of the European Union, the obligation to make national accounts calculations at previous year prices proceeds from the Regulation (EC) No 1392/2007 of the European Parliament and of the Council of 13 November 2007 amending Council Regulation (EC) No 2223/96 with respect to the transmission of national accounts data. For other countries, the implementation of the 2008 SNA is a request for the elaboration of chain –linking measure.

**Q2. What kind of advantages does chain-linking method have?**

Answer:
The main advantages are:

- The real growth of GDP components is calculated using the most up-to-date (last years) weights. Therefore, growth rates reflect the economic changes more accurately even far away from the reference year.
- Regular re-basing is no longer necessary. Re-referencing will not change growth rates. In principle, reference year can be chosen arbitrarily. Usually, reference year is changed, for example in every five years, like in case of fixed base year.
- Improved international comparability of the GDP and the growth of its components. Almost all the EU Member States and the majority of developed countries (e.g. USA, Canada, Japan, Norway, Switzerland) apply the chain-linking method to the GDP constant price calculations.

**Q3. Which are the disadvantages of chain-linking method?**

Answer:
The main disadvantages are:

- Loss of additivity of volumes in all years except the reference year and the year following the reference year. Non-additivity arises for purely mathematical reasons, whereas the discrepancies cannot be interpreted as indications of quality. Reason for non-additivity is that chain-linked volumes are calculated by separately extrapolating both aggregate numbers and its components. In addition, different weights are applied to the calculations of different periods (weights of fixed base year vs previous year). Thus, the reason is purely mathematical by nature and does not refer to a low quality of calculations. The farther away from the reference year, the larger the discrepancies are.
- Chain-linking for variables with a potentially changing sign is aggravated, e.g. change in inventories. In this case, contribution to the GDP growth is only calculated.
- In case of chain-linking method, computational complexity should be pointed out as this method involves more computational stages than the fixed base year calculation method - in addition to deflating, indicators should be chained according to reference year.
- Chain-linked indices are more complicated for the users of statistics to interpret, this concerns in particular the volume levels when compared to a fixed base year, e.g. in relation to non-additivity.

**Q4. The adoption of chain-linking method has brought about several new indices: values at previous year prices, chain-linked volumes by reference year 2000, chained indices and contribution to GDP growth. What is the difference between these indices?**

Answer:

- Values at previous year prices: quarterly indices of accounting period calculated (deflated) on the base of the average prices of previous year.
- Chained index: since values of the GDP components at previous year prices are not comparable by different years due to the changing base years, special indices are calculated for chain-linking consecutive years.

- Chain-linked volumes by reference year: values calculated with chained indices on the base of reference year (value of the reference year is multiplied by the chained index of accounting period).
- Contribution to the GDP growth is calculated for all GDP components. Above all, this is needed in case of such indices which have both negative and positive values in time series and for which chain-linking is aggravated because of that (e.g., in case of changes in inventories). Simply saying, contribution to the GDP growth is the value gained by multiplying the change of computable component and the share thereof in the GDP.

**Q5. Based on what indices can the change of the GDP and its components be found?**

Answer:
Since values of the GDP components at previous year prices are not comparable due to the changing base years, special indices are calculated for chain-linking consecutive years, and based on them, the chained volumes are calculated by the reference year. Chained indices or chain-linked volumes have to be used for calculating the change of the GDP and its components. Changes of the GDP components calculated on the base of these indices give the same results.

**Q6. Why do the growth rates of GDP components calculated by chain-linking method differ from those calculated at constant prices?**

Answer:
Growth rates of the GDP components calculated by chain-linking method differ to some extent from the growth rates calculated at the constant prices of fixed base year. Main reasons for the discrepancies between the growth rates calculated at constant prices base year and the chain-linked growth rates are as follows:

- Since price structure of the previous year is used as a base in case of chain-linking method, and price structure of the fixed base year is used as a base at constant price calculations, larger discrepancies emerge in the growth rates gained by different methods if cyclical changes in prices and volumes are involved. The less volatile the price change in time series is, the smaller are the discrepancies arising from the calculations by two different methods.
- Similarly, to the volatility of prices, changes in product structure have an impact on the results of calculations as well. The more the product structure changes in time series, the bigger discrepancies arise, as a rule, from the calculations of growth rates by chain-linking method and at constant prices base year.
- The use of volume indices brings about bigger discrepancies for some components between the growth rates calculated by the two calculation methods.

# Chapter 6: Good practices followed by countries

To be collected from countries (after the face to face seminar), identifying topics and countries.

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