

NATIONAL ACCOUNTS METHODS TO ACHIEVE EXHAUSTIVENESS

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5. NATIONAL ACCOUNTS METHODS TO ACHIEVE EXHAUSTIVENESS

5.1. Introduction

5.1. This chapter supports the third line of action in the NOE measurement strategy, namely identifying improvements in the national accounts compilation procedures that will ensure that GDP estimates are exhaustive. Ideally, the NOE should be addressed through the improvement of the basic data collection programme. This is the fourth line of action and is discussed in Chapter 6. However, such efforts may take a long time and, even then, the basic data can never be expected to cover all production falling within the 1993 SNA boundary. There will always some productive activities that cannot be directly observed. Thus, this chapter describes *indirect methods* for compiling the national accounts that can be used where the basic data are insufficient but measurements (*adjustments for the NOE*) can be derived on the basis of indicator series or estimates from other parts of the accounts.

5.2. The focus is on methods for measuring productive activities that are non-observed because they are underground, informal sector, undertaken by households for their own final use, or missed due to deficiencies in the basic data collection programme. Measurement of illegal production poses different challenges and is not explicitly covered in this chapter, though several of the compilation methods described may actually include illegal productive activities without separately identifying them as such. Specific methods for dealing with illegal production are suggested in Chapter 9.

5.3. The compilation methods for covering non-observed activities rely on *indicators* of these activities that have been captured in existing data. The prime objective is to use available data to produce an exhaustive measure of GDP while avoiding double counting. Based on an assessment of the incidence, extent, and nature of the NOE (by the methods described in Chapter 4) a broad range of available data should be analysed to determine if and how they could be used as indicators for measurement of non-observed activities. In this context there are a number of considerations to be taken into account, as follows.

5.4. *Coverage is often partial.* Each data collection has its own reference population. Some sources represent total activity, such as a nation-wide household budget survey or a household labour force survey. However, many sources have a specific reference population. Therefore, indirect indicators of production derived from existing sources may still be incomplete, particularly where household unincorporated enterprises prevail. Thus, it is important to identify activities that are not represented in the existing data.

5.5. *Deficiencies in coverage and content.* Existing data collections may be deficient due to problems in the coverage of units, in data reporting, and in survey design and operation. If there are biases in the data, they should be corrected to the extent possible. The information and ratios used to make adjustments for the NOE should be based on corrected survey data, otherwise biases in these data will distort the adjustments.

5.6. *Overlap in coverage.* The existing data sources may have overlaps in coverage. If sources with overlapping coverage are used, care should be taken to avoid double counting. It is important to note that some activities are usually not covered by any survey while other surveys provide overlapping coverage. For example, a manufacturing establishment survey covering establishments with five or more employees and an urban household non-agricultural production survey may have

overlaps in coverage (household manufacturing enterprises with five or more employees) but exclude household manufacturing activity in rural areas.

5.7. *Classifications used in various sources may differ.* The classifications used in the various sources may differ from each other and from those used in the national accounts. Often the breakdowns of the income and expenditure items in source data lack details for estimating intermediate consumption, value added, or capital formation. For example, the data may contain an item “other costs”, which could include transactions that should be classified as intermediate consumption, components of value added, capital formation, or other flows.

5.8. *Concepts and accounting rules may differ.* Source data may use concepts, definitions and accounting rules that differ from the national accounts. For example, wages in-kind in the business accounts may have been recorded as expenses on materials rather than compensation of employees. Information gathered in data collections may not always be on an accrual basis. The collection reference period may not coincide with the accounting period used in the national accounts. Accounting conventions could also differ. For example, business accounts generally use historic cost for inventories and capital stock, whereas national accounts use current replacement cost.

5.9. *Indicators are often by-products.* It is important to determine whether an indicator of production is collected as a *primary data item* or as a *by-product*. For instance, labour force information in a household labour survey or data on the stock of dwellings in a housing census are collected as primary data. In contrast, information on employment in a household budget survey or data on economic activities in a population census are usually collected as a by-product. Data collected as a by-product may have several shortcomings because the survey procedures are not primarily designed for them. Most of the indicators of production obtained from administrative sources can be considered as by-products of an official record-keeping function, and may suffer from problems relating to coverage, time of recording, valuation, and consistency over time.

5.10. *Information is partial.* Compilation of value added by economic activity requires data on output and intermediate consumption (current values and volume measures). Any single indicator of production (such as labour inputs, other inputs, demand for products) provides only a limited part of the information needed to estimate value added at current prices and in volume terms. Thus, even if a good indicator of output is available, appropriate procedures and supplementary data are needed to prepare the value added estimates. In some cases, ad-hoc supplementary surveys or investigations may be useful or needed to make efficient use of existing source data.

5.11. *Information is irregular or infrequent.* While some sources are available on a regular basis, others may be available only infrequently. While infrequent sources are valuable in establishing benchmark estimates, appropriate procedures need to be designed for regular compilation of annual or quarterly GDP estimates.

5.12. In summary, the chapter presents data sources and methods for including non-observed activities in GDP estimates compiled by production and expenditure approaches, and it describes a supply and use framework for ensuring GDP figures are comprehensive and consistent through reconciliation of the estimates derived using the different approaches. Sections 5.2-5.5 refer to the production approach, describing general methods (including the labour input method), industry specific methods, compilation issues, and the Italian approach, respectively. Section 5.6 deals with expenditure approach methods and Section 5.7 describes the set-up and use of supply and use tables.

5.2. Production Approach: General Methods

5.2.1. Introduction

5.13. This section describes *general* methods, *i.e.*, compilation procedures that, in principle, can be applied to any branch of economic activity, provided that the required data are available. The choice of an

appropriate method depends on the availability and quality of the data that can be used to derive indicators of production. Such indicators may refer to uses in production or other uses. They may refer to:

- total production including non-observed production, for example total labour input, total capital stock, etc.; or
- a part of total production including a part of non-observed production, for example household purchases of various types of personal services; or
- a part of non-observed production, for example building permits for private residential construction, taxes collected from entrepreneurs, etc.

5.14. The process of incorporating non-observed production in GDP estimates involves complex procedures. The following points should be taken into account.

- Some procedures yield estimates of total production for a specific activity without separately identifying various types of non-observed activities.
- *Ad-hoc* supplementary data are often required to make efficient use of existing sources; for example, value added estimates can be derived from output estimates obtained from a commodity flow method using a value added/output ratio calculated from an ad-hoc study.
- The compilation should be based on detailed and specific adjustments using specific sources and known linkages and relationships.
- Where possible, alternative estimates should be derived, compared, and assessed for plausibility of the results. Data relating to similar topics but from different sources should be compared and analysed to identify errors or remaining gaps.
- The assumptions underlying the estimation procedures should be made explicit in the calculations and reviewed regularly for their plausibility.

5.15. General indirect compilation methods that can be used to include the NOE in GDP estimates compiled by the production approach may be divided by type into *supply based* approaches, including the *labour input* approach, *demand based* approaches, *income based* approaches, and *commodity flow* approaches. These are described in the following subsection.

5.2.2. Supply Based Methods

5.16. Supply based methods rely on data about the supply of inputs that are used in producing goods and services. Inputs may include a number of primary raw materials, just one major raw material, labour, land, fixed capital stock, etc. If data on the supply of one or several inputs used in a given production activity are available, the total production of the activity that uses these inputs can be estimated.

5.17. Input/output and input/value added ratios are needed to calculate output and value added estimates from the input data. Preferably, these ratios should be obtained through ad-hoc surveys for the current period because productivity or relative prices of inputs and outputs may be changing. If ratios from the past are used, it is recommended that volume (constant price) measures of output and value added are derived first and current values obtained by using appropriate price indicators. Fixed ratios from previous periods can be used if a fixed technology assumption is valid, but should not be applied to current values in a later period if there have been changes in relative prices.

5.18. In making supply based adjustments factors to consider include:

- changes in productivity;
- changes in capital utilisation;
- the uses of certain inputs for purposes other than production;
- valuation differences between supply (time and place) and use (time and place);
- creation and updating of comprehensive benchmark estimates; and
- supplementary information to derive output and value added estimates from input indicators.

5.19. The particulars of using supply based methods depend on circumstances, as illustrated by the following examples for agricultural production and housing construction. In the Russian Federation

adjustments for the production of cereal and other crops by agricultural enterprises are made on the basis of quantities of seeds required per hectare. First, an estimate of the unrecorded cultivated area is determined using data on consumption of seeds reported by enterprises and the average standard quantity of seeds per hectare in various regions. Total production is then derived by multiplying the estimated total area under a crop by the estimated average yield per hectare. Adjustments for livestock products are made on the basis of the average quantity of meat produced per tonne of forage consumed. The reported data on the quantities of forage consumption are considered reliable. Average production per tonne of forage is determined from rural household surveys and expert judgement. (See Goskomstat of Russia, 1998, pp. 91-92.)

5.20. In many countries, the output of the construction industry is calculated using data on supply of construction materials. For example, in India the output of *pucca construction*, defined as construction using modern manufactured construction materials, is calculated using the estimated supply of basic construction materials in the domestic market. The available commodities are evaluated at the prices at the building site using information on retail prices, dealers' margins, transport costs, and taxes on products. The ratio of the cost of basic materials to output is derived from research studies on various categories of construction (Central Statistical Organisation, Government of India, 1989 pp. 99-104).

5.2.3. Labour Input Method

5.21. The most significant supply based procedure is the labour input method. It was pioneered by Istat during the 1980s and is sufficiently widely applied to merit a section of its own. At the core of the method are three basic steps:

- obtain estimates of the supply of labour input to GDP, for selected economic activity and size of enterprise, from a household labour force survey and/or other demographic sources;
- obtain estimates of output per unit of labour input and value added per unit of labour input for the same activity and size breakdown from regular or special purpose enterprise survey; and
- multiply the labour input estimates by the per unit ratios to get output and value added for the activity and size categories.

5.22. In effect, in each economic activity by size category, the labour input estimates are providing the weighting factors by which to inflate enterprise survey based estimates of output and value added to totals. This procedure can be expected to give a more exhaustive coverage of production if the household survey data give more complete coverage of labour input to GDP than do the enterprise survey data. There are two reasons to suppose that this is likely.

- Household based surveys pick up labour inputs to enterprises that are not included in enterprise surveys, for example because these enterprises are too small to be registered in the files from which the survey frames are constructed or because they are too small to be included within the survey.
- Individuals may report their labour inputs to household surveys whereas enterprises may conceal those same inputs in order to evade taxes or administrative regulations.

5.23. The method depends upon reliable estimates of labour input and per unit ratios at a detailed level of economic activity and size breakdown. It can be applied only for those branches of the economy for which these data are available. Typically the level of detail available is limited by the labour force survey. Thus, broad application of the method implies the need for a very strong labour force survey. The method can be used to estimate production in total within an economic activity branch, or just that part of production that is non-observed through enterprise surveys. In more detail, the elements of the method are as follows.

5.24. *Estimation of labour input to production based on data from households.* Data are obtained from a household labour force survey, supplemented with any other relevant information from demographic and administrative sources on labour participation. The household survey must include questions about kind of activity, hours worked, and size of employing enterprise(s). These questions provide the basis for an activity by size breakdown and for converting employment data into standard labour input units, such as

hours worked or full-time equivalent employment. Together with the sample size and response rates, the questions also determine the level of breakdown at which the data can be considered reliable.

5.25. *Estimation of labour input to production based on data from enterprises.* Data should be broken down by activity and size of enterprise to at least the level of detail supported by the household surveys. They must also provide sufficient information to be able to convert data about employees into standard labour input units.

5.26. *Standardisation of labour input estimates.* Data from household surveys are usually in terms of employment. Data from enterprises are usually in terms of jobs. A person can have more than one job. Thus, in order that data from the two sources can be meaningfully compared, they must be converted to the same standard units of labour input, either hours worked or fulltime equivalent employment. In addition any differences in reference period or geographic coverage between the two sources must be taken into account.

5.27. *Comparison of the sets of estimates.* Enterprise based and household based estimates of labour input are compared. The discrepancies are analysed, taking into account the quality characteristics of the different sources. As noted above, the household surveys can be expected to provide greater coverage and are thus regarded as the primary source. However, account must be taken of the fact that the enterprise based data can be considered to provide a more reliable activity by size breakdown.

5.28. *Identification of labour input missing from enterprise surveys.* An excess of the household based estimates over the enterprise based estimates is a measure of production (in labour input units) that is non-observed by the enterprise surveys. It is a lower bound as some labour input could be missing from both sources.

5.29. *Estimation of output and value added per unit of labour input ratios.* These ratios are required at the same level of activity by size breakdown as that for which the labour inputs are computed. Ideally these ratios are obtained using special purpose surveys or studies. If this is not feasible, data from enterprise surveys and administrative files can be used. The need to adjust for underreporting of output should be considered.

5.30. *Estimation of contribution to GDP as product of labour input and ratios.* The final step is to compute, output and value added for the selected economic activities and size groups.

5.31. An example of an application of the labour input method is contained within the exercise prescribed by the European Commission for the EU Member States to assess exhaustiveness. As was outlined in Section 4.2 in context of assessment methods, and as detailed by Hayes and Lozano (1998), this exercise includes the use of the labour input method for assessment and possible adjustment. The labour input underlying GDP estimates compiled by any other means are compared with those generated by labour input method. A larger value of the latter suggests that there is non-measured production that should be compensated for. In computing the adjustments it is proposed that:

- for each branch, the value added per unit of labour input for non-observed production may be assumed to equal that for which production is actually measured;
- allowance is made for the likely differences in sizes of the enterprises to which extra labour input has been provided, and for any other significant characteristics;
- the resulting adjustments do not duplicate the effects of other calculations or adjustments made in the accounts.

5.32. Another application of the method is within the framework of the Italian Approach to compilation of GDP as described later, in Section 5.4

5.2.4. Demand Based Methods

5.33. Demand based methods aim at determining production by using indicator data on specific uses of goods and services. These indicators can be any use of goods and services that sufficiently describe their production. They could be household final consumption expenditures of a certain commodity (*e.g.* health and personal services), uses of major products as raw materials (*e.g.* processing of

agricultural products), exports (*e.g.* major export commodities), or administrative data indicating demand for a product (*e.g.* motor vehicle registrations and building permits). After a measure of output has been obtained, value added estimates can be derived using output/value added ratios, as for supply-based methods.

5.34. Demand indicators are usually incomplete. In most cases, only data on one or a limited number of major uses are available. For instance, the export value of a commodity that is mainly exported does not cover domestic uses of that commodity. Likewise, household consumption of personal services does not cover other uses, such as uses by producers, or exports, but it may include imports, *i.e.*, expenditures abroad by resident households. Therefore, all the possible uses of a given product must be considered. Demand-based methods work best when a product has one major use for which a comprehensive estimate can be prepared. There are also differences between valuation of uses and output. All uses are to be valued at purchasers' prices, while outputs are to be valued at basic or producers' prices (see 1993 SNA: 6.204 – 6.217).

5.35. Specific applications of demand-based methods vary from country to country. For example, in Ghana the output of building repair and maintenance is calculated as one month's rental value, thus relating its measure to the stock of buildings. (For details see AFRISTAT (1997).) In Nepal, output for motor vehicle repair services is derived on the basis of number of vehicles by types and average repair and maintenance expenses (Central Bureau of Statistics Nepal, 1994).

5.2.5. Income Based Methods

5.36. Data on some categories of income are available from administrative sources and can be used to obtain an indication of production covered by the administrative system. Information on income taxes or social security contributions paid by self-employed persons (or private entrepreneurs) are often readily available. However, adjustments are usually necessary to account for activities not covered by tax laws and for underreporting of incomes for tax purposes.

5.37. Calzaroni and Madelin (2000) describe how adjustment coefficients for output and value added are calculated by Institut national de la statistique et des études économiques (INSEE) in France using data from tax audits conducted by the French taxation authorities. The data are transmitted without enterprise identification details to INSEE. The adjustment procedures vary according to the tax system applicable to the enterprise. The data are stratified by legal form, sector of activity, and size of enterprise. The statements of position before and after the audit and the reason for changes are examined. Only upward adjustments resulting from the concealment or omission of receipts are considered. Based on these data, adjustment coefficients are computed separately for corporate enterprises and unincorporated enterprises by sector.

5.38. In many countries, the output estimates for certain professional business services, such as accounting and legal services, and personal services, such as private health practitioners' services, are made on the basis of average income per practitioner obtained from tax records, from market studies, or through consultations with a few practitioners.

5.2.6. Commodity Flow Method

5.39. The commodity flow method involves balancing total supplies and uses of individual products. It is used to estimate the output of a commodity by balancing the supply and use of that commodity, using the following equation:

output = the sum of all intermediate consumption, final consumption, changes (positive or negative) in inventories, gross fixed capital formation, acquisition less disposals of valuables, and exports *minus* imports.

5.40. This method is effective if a product is primarily used for one or a limited number of uses, and if accurate data on these uses are available. Also, output prices (basic or producers' prices) differ from the prices paid by purchasers so that allowances should be made for the price differences when output of a product is derived using the commodity flow method. The method may be useful for analysing the

prices paid by final purchasers of a good and the prices received by the producers as well as for assessing the accuracy of distribution margins.

5.41. A specific application of a commodity flow method is to derive the output of retail trade from the supply of commodities. Often data on supply of commodities are compiled at a detailed level (usually separately for agricultural products, domestic manufacturing products, and imported goods). Information on shares of the product flows passing through retail trade, and on margin rates, are obtained from benchmark surveys, spot checks, and interviews. These data can then be combined with the data on supply of commodities to estimate the output of retail trade.

5.3. Production Approach: Industry Specific Methods

5.42. In addition to the general compilation methods described in Section 5.2, there are methods appropriate for specific industries. These methods can be used to cover all production within an industry, or to provide a complementary estimate if there are gaps in the coverage of the regular statistics. Such gaps are most likely to concern small-scale activities undertaken by household unincorporated enterprises. Large or medium size business enterprises may also be not covered through regular collections. As emphasised earlier, using complementary sources and methods may result in overlaps and gaps, which need to be identified and eliminated.

5.43. Examples of the sort of administrative and survey data that may be available are listed in Annex 3. However, the actual situation in a country may be quite different. Various types of data sources and compilation methods that are commonly used in different industries are described below.

Agriculture

5.44. Agriculture is an activity in which small-scale household production is pre-eminent. If no regular data are available covering agricultural output, intermediate consumption, and value added, estimates can be based on data on areas under cultivation, yields, and costs. Data on areas under cultivation and average yield rates are often used to estimate the quantity of crop production. If there is a regular system of crop statistics, up to date information on areas under cultivation are usually available. Data on land use patterns obtained from agriculture censuses and/or land resource maps based on an aerial survey or a cadastral survey may be used to estimate areas under cultivation. Average yield rates are best established through crop-cutting surveys. Agricultural surveys, farm management surveys, or studies on crop cultivation may also provide yield rates. These sources often also provide data on the cost structure, which can be used to derive value added estimates. Typically these sources and methods provide estimates for total agricultural production. Care should be taken to account for the fact that such crop-based estimates may overlap with data from other industries that have agriculture as a secondary activity.

5.45. Nutritional statistics may also be useful. For major cereal products, government bodies may have prepared food balance estimates. The sources and assumptions used to prepare food balances may provide useful supplementary information.

5.46. Annual data on number of livestock, if available, are a good source for estimating the contribution of animal husbandry. If they are available only infrequently, the annual change may be extrapolated from the benchmark estimates using reproduction and slaughter rates, with adjustments for exports and imports as necessary.

5.47. Data on major inputs, such as seeds and fertilisers, may be applicable if data on distribution of such inputs are available, for example, when seeds are distributed through a central channel. Industrial purchases of outputs (such as sugar cane, animal hides, and wool) may be used as indicators if a substantial portion of output is processed in manufacturing industries. Data on sales to marketing boards or exports may also be of use.

5.48. Household surveys of income and expenditure may provide data on household production for own final use as well as for markets.

Mining and quarrying

5.49. Mining and quarrying are usually capital-intensive activities performed by large enterprises that are comprehensively covered in regular statistics. Nevertheless, some small-scale activity may not be covered. Data on mining and quarrying activities undertaken by households are usually lacking. It may be possible to use information from the licensing system on production or employment. If employment data are available, average revenue per establishment is needed, which can be established through ad-hoc studies. Alternatively, reasonably comprehensive estimates for certain mining and quarrying products may be made on the basis of data on intermediate consumption of these products by manufacturing and construction (duly adjusted for exports and imports).

Manufacturing

5.50. Manufacturing, although often capital-intensive, is an activity in which households also engage, usually employing less capital-intensive technology. Surveys of manufacturing activity are usually conducted on a regular basis, but cover only enterprises above a certain cut-off size. This necessitates complementary estimates for small-scale production. Comprehensive benchmarks may be available from periodic manufacturing censuses if these also cover small-scale operators. Data on employment, exports of manufactured products, imports of raw materials, and taxes may be used, where relevant, in combination with the benchmarks to derive estimates for current periods. Household manufacturing activity, particularly for own consumption, is difficult to capture. However, data on household manufacturing activity may be obtained from household income and expenditure surveys or occasional surveys of cottage industries.

Construction

5.51. Construction of private residential dwellings is often left out of regular data collections. However, infrequent or one-time survey data are often available. Building permits or projections of housing demand can be used as an indication of housing construction. Additional details may be obtained from housing or population censuses.

5.52. In many cases, construction activity as a whole is measured through an indirect approach. In such an approach the value of construction output is estimated by the commodity flow method, from which an estimate of the supply of construction materials going into construction activity is first derived. This estimate of the net supply of materials is then used with input/output ratios obtained from benchmark or other comprehensive source data to estimate the volume of output. It should be emphasised that changes in the mixture of various types of construction affect the input/output ratios needed to derive output measures. Care should also be taken to avoid duplication as enterprises not in the construction industry may be involved in construction as a secondary activity and may include this in reporting their total output.

5.53. Building permits, data on building starts or various construction stages may also provide a basis for measuring construction activity. Separate data on repairs and maintenance, particularly related to dwellings, are usually not available. Data on housing stock together with some estimates for average dwelling maintenance cost can be used.

Trade

5.54. Trade is an activity in which small-scale operators are usually pre-eminent (at least, in numbers). If direct information on small-scale retailing activity is lacking (which is often the case) it may be possible to combine estimates of the supply of groups of products with information on the proportion of the total supply distributed through retail channels to derive retail turnover. Gross retail trading margin rates are needed to derive output estimates. Such margin rates are best established by conducting ad-hoc spot check surveys. The comprehensiveness of estimates obtained through such a commodity flow method depends on the coverage of the supply statistics. It is often the case that

import statistics do not properly include shuttle trade imports. Comprehensive supply data can also be used to validate and adjust retail trade survey data.

5.55. It should be emphasised that using such indirect sources can result in double counting because trade is often performed as a secondary activity, which may thus be included in the estimates for other industries.

5.56. Data on purchases of goods by households collected in household expenditure surveys may also be used to derive retail turnover. However, allowances should be made for retail purchases by other users (industries, governments, tourists, etc.).

5.57. Revenues from trading activity that is not covered in regular trade surveys may be captured through data on employment, if available. Tax administration systems and local government bodies may also provide useful information, for example, on the number of small traders filing tax documents or registered with tax authorities. An estimate of trade margins can also be derived from the use table within a supply and use framework by applying estimated trade margin rates to various uses flows.

Restaurants and hotels

5.58. Information may be lacking for small restaurants, bars, cafés, other eating places, and for lodging and boarding houses. Employment or taxes paid by producers or registration records maintained by local bodies or business associations may be used as a basis for estimating value added. Household expenditure surveys can be used to estimate data on restaurants and hotel services consumed by households. However, adjustments should be made for other domestic uses, such as intermediate consumption (purchases of restaurant or lodging services by enterprises), exports (purchases of these services by non-residents) and imports (purchases abroad by resident households).

5.59. Information from value added tax systems may cover a sizeable portion of hotel activity. Indicators from tourism statistics, such as tourist arrivals, hotel bed-nights, length of stay, average expenses (often available by type of tourists) can also be used. Tipping may be an important part of output and value added for the hotel and restaurant industry in many countries, but may not be captured even in surveys of the hotel industry. Thus special studies may be necessary. Employment in the industry can be used as an indicator for measuring the amount of tipping.

Transportation and communication services

5.60. Data on road transport by taxis, mini-buses and trucks are unavailable in many countries. Information on vehicle registrations and traffic statistics are possible indirect sources. The information on revenues and expenses per transport unit (*e.g.* freight-tonne kilometre or taxi journey) can be collected from ad-hoc surveys. An estimate of total demand may be available for certain types of transportation. For example, freight data may be derived from foreign trade statistics.

5.61. Private communication services on a small-scale such as provision of e-mail, fax, and telephone services are becoming important in many countries. Registration records from government bodies or business associations may provide information on the number of business units.

5.62. It is useful to cross-check the output estimates of transportation and communication services against data on the use of such services, which can be obtained from household expenditure surveys, business statistics, government data, and balance of payments.

5.63. An estimate of transport margins can also be derived from the use table within a supply and use framework by applying estimated transport margin rates to various uses flows.

Business, professional, and technical services

5.64. Information on the numbers of professionals involved in providing various business, professional, and technical services may be obtained from licenses issued by regulatory bodies or from professional associations. Population censuses or household labour force surveys may also provide information on the number of persons engaged in these activities. Income tax data on the gross receipts

of units or professionals involved in these activities can also be used to determine output, with adjustments made for underreporting of incomes in tax declarations.

Education, health, and personal services

5.65. Data on private education, health, and personal services (where small-scale operators are often important) are not available in many countries. Several indicators may exist that can be used to prepare the estimates, to supplement the survey data, or to validate the estimates derived using a particular method. Various physical indicators of education and health services may be available from administrative sources. The number of establishments or professionals can be obtained from administrative registrations, issue of licenses, and professional associations. Population censuses or household labour force surveys may also provide information on the number of persons engaged in these activities. Similarly, tax records may provide a basis for output estimates. Household expenditure surveys often supply data on consumption of these services by households, but these surveys may not be comprehensive in this respect because they will not capture the use of these services that is covered through insurance schemes.

Domestic services

5.66. Domestic services are usually small-scale, although sometimes provided by enterprises. It may be possible to cover small-scale activities in this area through population censuses and household labour surveys, which often include data on the total number of persons employed in domestic services. Average income per employee may be estimated from small-scale ad-hoc surveys. It may also be possible to use household expenditure surveys to calculate average incomes of domestic employees.

Owner-occupied dwelling services

5.67. Estimates of the value of owner-occupied dwelling services cannot be based on direct observations since there are no market transactions for these services. A common procedure is to estimate the number of owner-occupied dwellings from housing or population censuses and to estimate the value of owner-occupied dwelling services from rents paid for comparable dwellings which may be derived from housing censuses or real estate agents.

5.68. An alternative method is imputation of rents by reference to *opportunity costs*. In this method, net value added is derived by applying some interest rate to the estimated value of the stock of owner-occupied dwellings. The consumption of fixed capital and intermediate consumption is then added to obtain the gross output of owner-occupied dwelling services. It should be noted that this method might cause erratic movements in production and consumption of these services due to the volatility of interest rates. Furthermore, in areas with a relatively undeveloped financial system, such as rural areas in developing countries, interest rates can be uncharacteristically high.

5.69. Estimates of owner-occupied dwelling services are usually prepared from benchmark estimates for a year for which detailed data are available, supplemented by other indicators such as price indices (*e.g.* rent index within the consumer price index) for later years. Construction statistics and statistics of building permits are often used to update the estimated stock of housing, particularly in the case of urban areas where building construction is regulated. Usually the benchmarks are prepared with an urban/rural or some other regional breakdown. The benchmark estimates should be updated periodically, and the indicators and assumptions used in the estimation should be reviewed regularly.

5.4. Production Approach: The Italian Approach

5.70. This section summarises the Italian Approach to GDP estimation by the production approach. It was developed by Istat during the 1980s to deal with the particular characteristics of the Italian economy. Whilst a hallmark of the approach is the use of labour input method, this is not its only distinguishing characteristic. It also involves a substantial correction for underreporting. It is more than

simply an application of labour input method. It is a complete approach to GDP estimation that has been designed for Italy but can be applied in any other country with similar features, namely:

- many small enterprises, which may be missing from, or misclassified in, the business register because they are unregistered or because of their high turnover rate;
- high volume of irregular, *i.e.*, unregistered, labour;
- considerable underreporting of production by enterprises; and
- strong labour force survey.

5.71. The Italian Approach is specifically designed to deal with the NOE, which is why it is being discussed here. The following outline has been extracted from detailed descriptions by Istat (1993) and Calzaroni (2000).

General approach for estimating GDP

5.72. Estimation procedures are divided into groups by economic activity according to the data available:

- branches for which estimates are based on quantity times price – including agriculture, energy and part of construction;
- branches for which estimates are based on expenditure data – part of construction, rents and private services for education, research, health, entertainment and leisure;
- branches for which estimates are based on costs and earnings directly from balance sheets – credit, insurance, some branches belonging to public enterprises;
- branches for which estimates are based on distributed incomes – non-market services;
- branches for which estimates are based on the labour input method.

5.73. Some such division is typical of estimation by production approach. What characterises the Italian Approach is that 70% of production is estimated using labour input method.

5.74. The procedure for estimating output, value added (and other national accounts aggregates) by branch of economic activity is summarised in the following formula:

$$Y = \sum_{i=1}^m \sum_{j=1}^J X_{ij} * U_{ij} + \sum_{i=m+1}^M Y_i$$

where: Y = overall estimate of the aggregate

i = indicator of the branch of economic activity

M = number of branches (101 in the case of Italy)

j = indicator of the size of the establishment

J = number of size groups (J = 8 for Italy: 1-5, 6-9, 10-19, 20-49, 50-99, 100-249, 250+)

X = average per capita value of the aggregate

U = fulltime equivalent employment

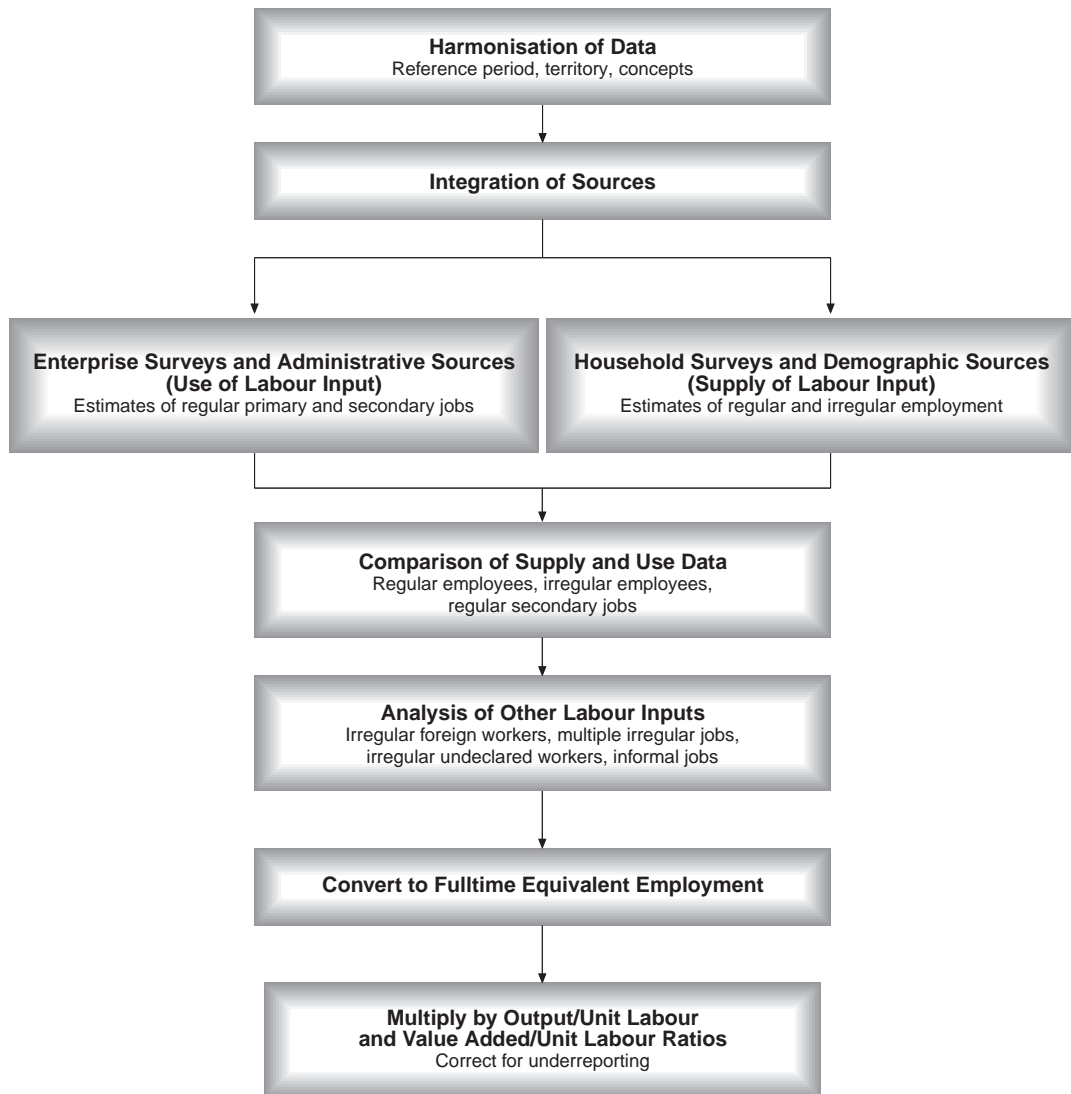
$\sum_{i=m+1}^M Y_i$ = part of the aggregate not estimated using labour input method

Application of labour input method

5.75. Estimation of GDP using the labour input method is along the lines described in Section 5.2.3. The steps are illustrated in Figure 5.1. The following paragraphs describe some particular features of the application in Italy.

- *Adjustment of incoming data.* This involves temporal and territorial harmonisation, and conceptual harmonisation to national accounts definitions.

Figure 5.1. Estimation of GDP by input of labour method (Italian approach)



- *Integration of enterprise data.* Labour input data are obtained through enterprise surveys and administrative sources. A comprehensive business register is lynchpin of the enterprise survey programme. The aim is to produce exhaustive estimates of the registered employment covering primary and secondary regular jobs.
- *Integration of household data.* This involves a micro-level comparison of records from the labour force survey and the annual population census. The objective is to obtain as precise an indication of employment status as possible. The same status according to both sources is a confirmation. In the case of conflicting status indicators, it is assumed that a person employed according to the labour force survey is actually employed, and that employed according to the census but not the labour force survey may be indicative of irregular employment. In the later case the conflicting information is resolved by assigning the person in question the status of a “donor” person within the database for which the employment status has been confirmed. The

donor is chosen on the basis of the minimum distance between the person and all possible donors, where distance is defined in terms of characteristics available in the original data sources.

- *Comparison of supply and use of labour inputs.* Comparisons of numbers of jobs are made at a detailed level of economic activity by region, separately for employees, self-employed and unpaid family workers. Three cases are distinguished:
 - regulars, for which the number of employed people equals the number of jobs;
 - fulltime irregulars, for which the number of employed people exceeds the number of jobs;
 - regulars with multiple jobs, for which the number of jobs exceeds the number of employed people.
- *Other components of labour input.* The household and enterprise survey sources account for about 90% of the total labour input. Other sources are used to estimate for the remainder. Expenditure side data are used to give estimates for irregular multiple jobs. Data from the Ministry of Internal Affairs provide data on non-resident foreign workers. Informal jobs are estimated through special purpose surveys.
- *Computation of full-time equivalent employment.* Jobs are converted to full-time equivalent employment. Two situations are distinguished:
 - where (regular or irregular) employment is on a less than full time basis, *e.g.* secondary and part-time jobs;
 - where employment is on a full-time basis but the quantity of work delivered is reduced, *e.g.* as a result of hours unworked due to lack of orders.
- *Compilation of output and value added.* Ratios of output per unit of labour input and value added per unit are estimated on the basis of annual surveys of enterprise budgets, with adjustments for underreporting as described below.

Adjustment for underreporting

5.76. Output and value added ratios are adjusted to compensate for underreporting of turnover. The hypothesis underlying such corrections is that the income of a self-employed worker of an enterprise should at least equal the average wage of the regular employees. The income of self-employed workers is obtained by taking the value added reported by the enterprise and subtracting the compensations of employees, the capital consumption and other components in accordance with the 1993 SNA. When income thus computed is less than the average wage of employees, it is adjusted upwards to be the same as the average wage. This adjustment carries through to the calculation of the ratios and hence to output and value added.

5.5. Production Approach: Compilation Issues

5.77. This section deals with some specific compilation issues involved in measuring the NOE through the production approach. As described in the Sections 5.2, 5.3 and 5.4, NOE adjustments are based on indirect indicators of production obtained from various data sources. The national accounts estimates (output, intermediate consumption, and value added) are calculated by means of certain ratios based on assumptions regarding the relationship between the variable to be estimated and the indicator. The indicators may refer to output or intermediate consumption or other inputs. Furthermore, they may be in volume terms (such as dwelling floor areas or number of full-time equivalent employment), or in current price values (such as exports or taxes). However, compilation of GDP by the production approach involves calculating output, intermediate consumption, and value added at current prices as well as in volume terms. Because of definitional relationships, data can be considered effectively complete if two items out of output, intermediate consumption, and value added are available; and if two items out of values, volumes, and prices are available. Therefore, even if an appropriate indicator of production can be obtained, the national accountants still have to use appropriate compilation

techniques to derive value added estimates both at current prices and in volume terms. The major compilation issues that have to be considered in this context are described in the following paragraphs.

Explicit calculation of all items of the production account

5.78. Explicit calculation of all items of the production account (output, intermediate consumption, and value added) is needed because attempting to estimate value added directly suffers from severe disadvantages. The most important disadvantage is that value added does not itself have observable volume and price dimensions, which makes it impossible to derive proper volume measures from current price data or *vice versa*. To get around this problem, output or input prices are often used to deflate current price value added or to inflate volume measures of value added. The implicit assumption of this procedure is that input and output prices develop in parallel, which is not always the case. The direct calculation of value added alone involves implicit assumptions about input/output ratios that cannot be verified. Also, applying a fixed input/output ratio to current value estimates may result in implicit deflators that are implausible. A further problem in estimating value added directly is that the estimates cannot be incorporated into a supply and use framework because such a framework requires separate data on supply (output) and use (intermediate consumption) as well as value added.

Supplementary information and fixed ratios

5.79. Where possible, attempts should be made to gather supplementary information to derive ratios for the current period (such as input/output ratios, ratios of output per self-employed person, and cost per square unit of dwelling construction). *ad hoc* supplementary data increase the efficiency of the existing sources. For example, output can be derived by commodity flow method and the value added/output ratio can be calculated from an *ad hoc* study. In cases where single indicators are used in combination with ratios from past periods, volume measures should be derived first. Using fixed ratios assumes unchanged technology, which seems reasonable for the medium-term. However, using fixed ratios with current price data implies the additional assumption of parallel price movements of input and output prices, which, as previously mentioned, is often not the case. Once volume measures have been estimated, current value estimates can be obtained through the use of price indices.

Techniques for deflation or inflation

5.80. Appropriate techniques should be used to derive volume measures from current values (deflation) and current values from volume measures (inflation). If indicators are available for both output and intermediate consumption, the double indicator method should be used to calculate the volume measure of value added (as the volume measure of output less the volume measure of intermediate consumption). As mentioned above, if a single indicator is used in combination with a fixed ratio it is always desirable to calculate explicitly the volume measures of output and intermediate consumption, and to multiply them separately with relevant price indicators to obtain current price values.

5.81. Attempts should be made to match indicators with the concepts. For example, for output of personal services, the consumer price index for these items is more appropriate than the overall consumer price index.

Single or composite indicators

5.82. A composite indicator of production combines several indicators, often inputs to production. For example, a composite indicator of construction output may include all major raw materials and labour inputs. In contrast a single indicator may be one major raw material (such as cement) or labour. The appropriate choice of indicators depends on the quality of the data and the correlation between the indicators and production. Composite indicators reduce the risk of bias that may result from use of a single indicator.

Benchmark estimates and regular compilations

5.83. Comprehensive and detailed data may be available only infrequently, for example at five or ten year intervals, or on an *ad hoc* basis. Similarly, data may only be available for certain types of non-observed production activities. Thus a combination of benchmarks and indicators is required in compiling the national accounts generally and in adjusting for non-observed activities in particular.

5.84. The benchmarks provide an estimate for a certain period as well as a basis (*i.e.*, benchmark levels and the ratios derived from them) for regular compilations. The assumptions for benchmark-indicator adjustments should be made explicit and their suitability reviewed regularly. One way of assessing an indicator is to gather information about its coverage and definitions and identify its major differences from the benchmark. If benchmarks for more than one year are available, the change shown by the indicator over the period can be compared with the change in the benchmark series over the same period. The difference is a measure of the indicator bias. This kind of review may suggest how the indicator could be improved.

5.85. The benchmark-indicator relationships may change over time due to several factors. When subsequent benchmarks show different benchmark/indicator ratios, the difference should be allocated over the period between benchmarks.

5.6. Expenditure Approach: Sources and Methods

5.86. The estimates of GDP by expenditure categories show the final demand for goods and services. Estimates of final expenditures on GDP are particularly useful for policy purposes, but in many countries the expenditure approach is less developed than the production approach. The main causes might be the traditional focus on production statistics and problems in the availability of expenditure source data. In many cases, independent estimates of GDP from the expenditure approach are not compiled. Instead, GDP by type of expenditure is estimated for available components such as gross fixed capital formation, government final consumption, exports and imports, while the missing items (for example, household final consumption and/or changes in inventories) are derived as residuals by subtracting the available components from the GDP estimate compiled from the production approach. Such practices attribute errors in the estimates for all other aggregates to the item(s) derived as a residual. Furthermore, such expenditure estimates can not provide an independent check on the production estimates.

5.87. Comprehensive basic data on expenditures are usually not available. Thus indirect compilation methods are used. They depend on the availability of source data, which vary between countries and within a country over time. Selection of the appropriate approach requires investigation of the various possible alternatives. This Handbook suggests that compilation methods that derive estimates at an aggregated level (such as household final consumption expenditure) as a residual should be avoided. Instead, the compilation should be based on detailed and specific adjustments using specific sources and known relationships. Such an approach also allows the full use of available data and an assessment of the plausibility of the methods and results. For example, derivation of household final consumption expenditure as a residual does not take advantage of several data sources, in particular production of goods and services primarily used for final consumption, imports and exports of consumer goods, and household production for own consumption. These are available in most countries and can be used to estimate components of household consumption expenditure.

5.88. This section identifies typical sources and methods that can be used to prepare exhaustive estimates of the expenditure categories of GDP. The expenditure categories are household final consumption expenditure, government final consumption expenditure, final consumption expenditure of non-profit institutions serving households, gross fixed capital formation, changes in inventories, acquisition less disposals of valuables, and exports and imports of goods and services. Within each of these categories, the presentation below describes sources and compilation methods for items that have data shortcomings.

5.6.1. Household Final Consumption Expenditure

5.89. A comprehensive estimate of household consumption requires a combination of different sources and methods that are best suited to measuring a certain set of consumer items. Households obtain consumer goods and services through various channels and means. No one single source can be considered adequate, and data on household consumption should be gathered from different sources. Multiple sources may be available for some expenditure items. Estimation procedures and adjustments depend on the nature and quality of data sources, and more than one method may be applicable. A set of categories of household consumption that is helpful in assessing and achieving comprehensive coverage is the following:

- purchases of goods and services;
- consumption of goods from own production;
- services of owner-occupied dwellings;
- services produced by paid domestic employees;
- goods and services received as income in kind;
- financial intermediation services;
- insurance and pension fund services; and
- payments for licenses and fees.

Data sources

5.90. The main sources of data are household expenditure surveys, retail trade statistics, production statistics, administrative data, reports of individual companies, socio-demographic data, and international trade statistics. (Annexes 3.4 and 3.5 provide typical lists.)

5.91. A household expenditure survey (HES) usually provides detailed information, facilitating a systematic classification of consumption expenditure using a classification such as the *Classification of Individual Consumption by Purpose* (COICOP). A HES can furnish data on many types of household consumption, typically including all the items listed above except financial intermediation and insurance and pension fund services. A HES measures the flow of goods and services at the time of purchase at purchaser's prices and this is consistent with the time of recording and the valuation required by the 1993 SNA. Furthermore, a HES may ensure a better coverage of purchases from small scale retailers and service providers than the data on sales collected directly from the sellers, because purchasers are less likely than sellers to understate expenditure. The HES may also provide information on payments for domestic servants, goods and services received as income in kind, and payments for licenses and fees.

5.92. A HES usually has certain limitations as a data source for comprehensive estimates of the household consumption expenditure. It may not cover the whole population, often excluding persons living in hospitals, prisons, and other institutions. HES sample sizes are usually relatively small, which may adversely affect the representativeness of items that are purchased by particular groups of the population or the population in particular geographic areas. Seasonally purchased items may not be properly covered. Data on items that are infrequently purchased (such as consumer durables) or that are socially sensitive (such as alcohol and tobacco) are also less reliable. Furthermore, some goods and services may be used for business purposes as well as for household consumption, and households owning unincorporated enterprises may not report items purchased for the different uses separately.

5.93. For consumption of goods from own production, a HES may have three major shortcomings:

- own account producers may not be adequately represented;
- production retained for own consumption may be difficult to separate from other uses; and
- valuation of output for own consumption may be inappropriate.

Also, imputed values of owner-occupied dwelling services and imputed services charges for casualty and life insurance can not readily be estimated by respondents to a HES. Thus they must be estimated by national accounts compilers using other data sources.

5.94. Retail trade data constitute an important source of information on household consumption, particularly for goods that are mainly distributed through retail channels. Many types of retail providers are fairly specialised but some stores sell a wide range of goods, which require additional information on product breakdowns. Retail trade data include sales to users other than households. Such products should be identified and should not be attributed to household consumption. On the other hand, households may acquire products directly from manufacturers, wholesalers, and farmers. Retail trade surveys may also suffer from undercoverage, particularly regarding small-scale trade by household unincorporated enterprises. In most cases, therefore, the retail trade statistics require adjustments based on information from other sources.

5.95. Retail turnover data are most appropriate when the product group in question is mainly distributed through retail trade, the retail trade survey has an adequate representation of the retail outlets, and there is a clear link between the commodity groups distinguished in trade data and other sources (such as a HES, production statistics, tax records, and international trade statistics). Linking the data on the commodity groups from various sources provides a basis for adjustment to the retail turnover data, if necessary.

5.96. Production statistics can be used to estimate household consumption of particular commodities that are mainly used for household consumption, provided comprehensive data on their production are available. Data on production of farm products consumed by the farm households may be available from agricultural surveys. Household production or income surveys may also provide data on production of goods (agricultural as well as non-agricultural) by households for their own consumption. If surveys ask for total production only, additional information is needed on the allocation of production between final consumption and other uses, *e.g.* intermediate consumption as seeds.

5.97. Surveys of enterprises providing consumer services can be used for estimating household consumption of these services. In such cases, the main difficulty may be the allocation of the total production between household consumption and other uses. Such allocation ratios may be derived by analysing uses of these services in production by industries and by government, or they may come from data on balance of payments, or from household expenditure survey data. For some services, particularly owner-occupied dwelling services and domestic services produced by paid employees, the consumption estimates should be identical to the output estimates from the production approach. Thus, household consumption can be taken directly from the output estimates (see Section 5.3).

5.98. For consumer goods that are usually exported and/or imported, the production statistics should be used in combination with international trade statistics, which are further discussed in Section 5.6.7.

5.99. Administrative data can be used in cases where a regulatory system provides indicators of household consumption. For example, government administrative records can provide information on excise or other special taxes on sales of tobacco and alcohol. Other examples of administrative data that can be used to estimate particular components of household expenditure are:

- number of private vehicle registrations (to estimate vehicle purchases);
- stock of vehicles (to estimate expenditure on car repairs);
- number of marriages or other social and vital events (to estimate expenditures on religious ceremonies and funerals);
- number of providers of certain services such as child care centres and retirement homes (to estimate expenditures on these services); and
- several indicators for health and education.

5.100. Government records provide information on fees and licenses, but additional information is needed to separate payments by households from payments by producers.

5.101. The accounts and records of major producers can be used where a small number of large producers supply the bulk of a particular item. Examples include sales to households of electricity, gas,

water, telecommunication, and postal services. Distribution of some goods (such as petroleum products, certain food products) may be regulated centrally, in which case the data from the regulatory bodies can be used. Data may not always refer to sales to households, and adjustments should be made using additional information. Reports of financial institutions, insurance companies, and pension funds are important sources for calculating consumption of financial and insurance services.

5.102. Socio-demographic data may also provide useful information for estimating particular items of household consumption. Nutrition statistics can be combined with data on population to derive food consumption. Statistics on living conditions and housing can provide several indicators of consumption such as ownership of dwellings, private vehicles, and access to facilities. Health and education statistics may also be useful for estimating consumption expenditures on these types of services.

Compilation methods

5.103. Selection of an appropriate compilation method depends on a particular data situation. Four types of compilation methods can be distinguished: direct observation methods; commodity flow methods; benchmark-to-indicator methods; and consumption indicator methods.

5.104. *Direct observation* methods use information on consumption obtained from households, the consumer units, through a HES. As explained above, the comprehensiveness and accuracy of estimates depend on the quality of HES data, and adjustments are needed in many cases.

5.105. *Commodity flow* methods use information about the supplies of goods and services from domestic production and imports, and information on the uses of these supplies in activities other than household consumption. Compilation methods that use retail trade turnover, production statistics, international trade statistics, and reports of producers/suppliers are variants of a commodity flow approach. The commodity flow methods give best results if a product is entirely or predominantly used for household consumption. Furthermore, the commodity flow methods require that:

- comprehensive data on supply are available;
- information on any uses other than household consumption is available or can be calculated;
- information on taxes and distribution margins can be estimated to convert values at supply point (basic prices, producers' prices, c.i.f. values) to values at purchasers' prices; and
- estimates can be made for direct purchases abroad by resident households and for direct purchases in the domestic market by non-resident households.

5.106. Because international trade statistics do not cover expenditures of residents abroad and of non-residents in the domestic economy, commodity flow methods result in estimates of household consumption expenditure in the domestic market. Therefore, purchases abroad by residents should be added and purchases in the domestic markets by non-residents should be deducted to calculate final consumption expenditure of resident households.

5.107. *Benchmark-to-indicator* methods imply that comprehensive and detailed estimates of household consumption expenditure (*benchmarks*) are made only at some intervals (say three or five years, or annually in the case of quarterly estimates) and the regular estimates are prepared using *indicators* to extrapolate the benchmark estimates. The benchmarks for an item or group of consumer products should be based on the most appropriate data source with adjustments as necessary to ensure comprehensive coverage. The indicators may be obtained from the sources described above and others. They can be in value terms (*e.g.* sales and excise taxes) or in volume terms (*e.g.* stock of cars, dwelling area, and number of households). The benchmark-indicator relationship should be reviewed regularly for assessing the suitability of the indicators. Subsequent benchmarks may indicate a shift in the benchmark-indicator ratios. These changes should be allocated over the period between benchmarks because they reflect changes that must have occurred over the period between the benchmarks. If no adjustment is made, it causes a step problem in the series by allocating the entire difference to a single period when the new data are introduced. When indicators are poor, the different estimates obtained using alternative indicators may be large. In such cases, the causes of indicator bias should be investigated and an indicator that reflects as closely as possible the

behaviour of the target variable should be used. (Bloem *et al.* (2001) provides more information on benchmark-indicator techniques.)

5.108. *Consumption indicator* methods use information that may be linked to household consumption of certain products. Examples include the use of administrative and socio-demographic data to estimate household consumption expenditure. For example, nutrition data can be used to estimate consumption of food products. Similarly, the numbers of students by grades may be an indicator for school fees and other educational expenses.

5.6.2. Government Final Consumption Expenditure

5.109. The estimates of output and final consumption expenditure of government are closely related and should be calculated in conjunction with each other. For conceptually correct estimates of government final consumption, separate estimates of output should be prepared for market output, fixed capital formation on own-account, and other non-market output produced by government.¹ Information is also needed on receipts from sales of non-market services and purchases by government of goods and services that are provided to households free or at prices that are not economically significant.

5.110. Data for preparing the estimates described in the previous paragraph are usually available from budget reports and other government accounts. There are, however, a number of issues that need to be examined before information obtained from these sources can be used for compilation purposes. These include:

- Data may be lacking for provincial or local government, extra-budgetary funds, and defence related expenses. In such cases, methods that rely on indicators relating to current activity levels could be used, for example, wages paid by government and central government payments (when they constitute a major source of funds).
- Data on consumption of fixed capital are usually not available from the government accounts. In this case the data should be calculated on the basis of the stock of fixed capital owned by the government valued at current prices.
- Government accounts are traditionally prepared on a cash basis, which may differ significantly from the accrual basis needed for national accounts. Therefore, additional data should be used to adjust data recorded on a cash basis to approximate accrual accounting.

5.6.3. Final Consumption Expenditure of NPISH

5.111. Data for larger NPISH may be available from their published reports as submitted to the tax or regulatory authorities. Government may be a good source of statistical indicators if it monitors, regulates, or provides funding. However, data may not be available for smaller organisations. A small-scale survey may be a good choice if registers or listings of NPISH are available as a survey frame. Data on foreign transfers to NPISH may also be an important indicator in countries where foreign aid is a major source of funding for NPISH.

5.6.4. Gross Fixed Capital Formation

5.112. The main approaches used for compiling capital formation are direct observation of capital expenditures and various indirect techniques relying on commodity flow analysis or other data on supply of, or demand for, capital goods.

5.113. Surveys of capital expenditure by enterprises is the preferred source for estimating capital formation. However, they are very sensitive to coverage problems. In particular, new enterprises, which may not yet be in production or recorded in the statistical office business register, are particularly likely

1. The government final consumption expenditure is equal to government non-market output (excluding own account fixed capital formation) less receipts from sales of non-market output plus purchases of goods and services provided to households free or at economically insignificant prices.

to have higher rates of capital formation than established businesses. On the other hand, many existing enterprises may have little or no capital formation in a given period.

5.114. Data on the acquisition of fixed assets are usually available for government, public corporations and large companies and for large investment projects funded from abroad. Such data may also be available for other types of producers from capital expenditure surveys or when information on fixed assets acquired is collected in production surveys. Data on acquisition of fixed assets and own account capital formation by small and household unincorporated enterprises are usually not available.

5.115. Where a value added tax system is in place that requires capital and current purchases to be split, this can provide a useful indicator. However, value added tax statistics often do not provide a breakdown by type of product and they usually exclude own account capital formation.

5.116. Commodity flow methods are widely used to derive total fixed capital formation. They yield a classification by type of assets, but not a classification by kind of activity or institutional sectors. They can be more easily used for machinery and equipment as data on their supply are readily available and their coverage is usually satisfactory. Adjustments to supply data should be made to include taxes, distribution margins, and installation costs. Deductions should be made for goods that are used for intermediate consumption (*e.g.* parts for repairs), household final consumption (*e.g.* computers, cars used by households), or inventories, and net sales of capital goods (*e.g.* enterprises selling second-hand cars to households or non-residents).

5.117. Commodity flow methods can also be used to estimate construction, in which case the estimates of capital formation are closely related to the output estimates for construction. (See Section 5.3.) The main differences between construction output and capital formation in construction for which adjustments should be made are the following:

- construction output includes current maintenance, which is not capital formation;
- speculative construction (construction for which a purchaser is not identified and that continues to belong to the builder) is part of construction output, which should be classified as inventories but not as fixed capital formation until it is finished and sold; and
- ownership transfer costs are part of capital formation.

5.118. In addition to construction and equipment (which constitute the largest share), gross fixed capital formation includes cultivated assets (such as livestock and trees), intangible fixed assets (such as mineral exploration, computer software, and literary, entertainment, and artistic originals), and additions to the value of non-produced assets (such as land reclamation). Indicators for these assets are less commonly available. They may include the following.

- For cultivated assets, livestock statistics and agricultural censuses/surveys can be used.
- For software, estimates can be made from the supply side (*i.e.*, manufacture of standard or off-the-shelf software plus in-house development of software by government and enterprises plus imports less exports), or from the demand side (*i.e.*, expenditure on software). Supply data have the advantage that a relatively smaller number of businesses are involved in manufacturing standard software but have the disadvantages that a substantial proportion of off-the-shelf software is for household consumption and that many enterprises and government departments develop their own software in-house. A further problem is that some software is sold in conjunction with hardware and this may lead to double counting.
- For mineral exploration, administrative requirements for mining exploration permits may provide useful indicators. However, there are timing differences between the granting of permission and when the actual exploration takes place.

5.119. As described above, the data on expenditures by purchasers on the acquisition of fixed assets usually have partial coverage. On the other hand, commodity flow methods can provide only a total estimate for a class of fixed assets. Special care is needed to avoid duplication and omissions when combining different sources and methods, which is the approach usually followed.

5.6.5. Changes in Inventories

5.120. All countries have difficulties in estimating changes in inventories and several countries derive their estimates mainly as the difference between GDP estimates derived from the production and expenditure sides. This is obviously unsatisfactory and can be seriously misleading at turning points in the business cycle when inventory changes may move rapidly from negative to positive and *vice versa*.

5.121. Enterprise surveys provide data on inventories for establishments covered in those surveys. Administrative data on stocks of inventories held by government agencies supplying or regulating the supply of important products are an additional source. Information on inventories can also be obtained from agricultural and livestock statistics, food and energy balances, and reports of marketing boards. Generally, it can be expected that the NOE does not contribute significantly to inventories. Inventories associated with the NOE are mostly related to agriculture, trade, and manufacturing, and are probably concentrated in a limited number of goods.

5.122. Changes in inventories present specific difficulties with respect to valuation. Commercial enterprises use several different valuation methods, most of which are not consistent with the current-cost valuation required for national accounts (1993 SNA: 6.57–83). Adjustments are required to remove holding gains/losses on inventories. Bloem et al (1996) provide a description of some methods. Estimates of changes in inventories should be consistent with the treatment of inventories for deriving gross output and intermediate consumption in the production account.

5.6.6. Acquisitions Less Disposals of Valuables

5.123. The 1993 SNA classifies valuables (such as jewellery, works of arts, antiques, precious stones and metals) as a separate category of capital expenditure. In many countries, purchase of valuables by households may be important. Estimates for valuables may be prepared using data from producers (production statistics), imports, retailers, or purchasers (household surveys).

5.6.7. Imports and Exports of Goods and Services

5.124. The international trade statistics constitute the main sources of data about imports and exports of goods. Usually data on merchandise exports and imports are compiled from customs declarations, but some countries use reports of enterprises specialising in international trade. Customs records do not cover services. An additional problem is that the timing of recording may not match the national accounts concept. In many countries the data suffer from undercoverage and estimates must be made for missing items. Direct imports by government, particularly military goods, and foreign aid in-kind may not be recorded. In some countries, smuggling is a serious problem. There might be a substantial amount of border trade, particularly in cattle, crops, and food and other consumer products. Exports and imports of oil and natural gas, especially by pipeline, may be outside the customs statistics. Gifts and parcel post are often below the threshold value for inclusion in the data. Details regarding the concepts and methodology for compiling international merchandise trade statistics are provided by United Nations (1998).

5.125. In many transition countries, *shuttle trade* has grown rapidly. Shuttle trade refers to imports and exports by individuals who travel to neighbouring countries to purchase goods for resale in street markets or small shops. Shuttle trade is often excluded from customs record. The best approach is to conduct surveys of shuttle traders. Some countries have used data from small samples of traders on the total numbers of shuttle trade journeys and the average values of goods imported or exported.

5.7. Supply and Use Framework

5.7.1. Introduction

5.126. Use of a supply and use framework as a statistical tool in compiling GDP estimates has been increasing in recent years. It provides a basis for comprehensive, systematic, and consistent

adjustments to obtain exhaustive measures of GDP, even if non-observed activities have been estimated using the adjustment methods described in the previous sections. In particular, it facilitates:

- identifying gaps and inconsistencies in the basic data sources;
- filling gaps by calculating estimates for missing supply or use as a residual;
- cross-checking and reconciling as well as improving the consistency, plausibility, and completeness of the estimates of supply and uses; and
- calculating estimates for periods for which less detailed and/or less reliable data are available by using coefficients and other information from benchmark tables.

5.127. The supply and use framework provides a detailed basis for analysing industries and products through a detailed and systematic breakdown of:

- the *goods and services account*, showing the total supply of goods and services (output and imports) and their use (intermediate consumption, final consumption, changes in inventories, gross fixed capital formation, acquisition less disposals of valuables, and exports);
- the *production account*, showing output, intermediate use of goods and services, and value added; and
- the *generation of income account*, showing value added and its component primary incomes generated in the process of production.

5.128. The supply and use tables show two types of balances:

- for each *industry*, output equals intermediate consumption plus value added; and
- for each *product*, total supply equals total use.

5.129. Supply and use tables can be seen as a comprehensive, systematic, and economy-wide application of the commodity flow method. Discrepancies between supply-use balances indicate missing items or other weaknesses. These discrepancies and the analysis of their causes lead to imputation of missing items or adjustments to items with poor estimates. These adjustment factors can also be used in the national accounts compilation during the period following the compilation of the latest supply and use tables. However, the effectiveness of such methods of estimation depends on the extent to which corrections can be and have been made to the source data for underreporting, non-response, and bias. Moreover, commodity flow methods do not capture aspects of economic activity that are not recorded in either supply or use. The 1993 SNA (Paragraphs 15.54-119) elaborates the concepts and methodology, and more details are presented in United Nations (1999).

5.7.2. Basic Structure of Supply and Use Framework

5.130. In order to produce supply and use tables the following eight building blocks are required.

- Definition of the products to be distinguished in the supply and use tables in terms of product classifications. The 1993 SNA recommends the Central Product Classification (CPC), but other classification systems, such as the Harmonised System (HS), may also be considered.
- A key linking the classifications used for domestic production statistics and international trade statistics and the product groups used in the supply and use table.
- A breakdown of total output or sales by product for most of the goods producing industries and, to the extent possible, for services as well.
- International trade statistics for goods and records for exports and imports for services. The latter usually come from balance of payments statistics and are at a high level of aggregation.
- Conversion keys between output from activities not covered by product statistics and the product groups used in the commodity flow system. This may often be necessary for service activities. The default option is to define service groups by ISIC classes.
- Estimates of the ratios of intermediate consumption to output for various industries. In some countries these data are collected in special surveys of production costs.

- Cost structure surveys giving the total intermediate consumption by product, ideally in at least as much detail as the product groups defined for the supply and use table. The minimum requirement is a survey on intermediate consumption for manufacturing industries for the benchmark year.
- Sources giving final household consumption expenditure, gross fixed capital formation, and changes in inventories by product groups. Preferably these should be available annually; failing this results from a household budget survey for a benchmark year are the minimum requirement.

5.131. In setting up a supply and use table by means of the commodity flow method, the third and fourth items are indispensable, since the whole idea is to combine domestic production statistics and imports in order to determine the total supply of each product available for domestic uses. Ideally, the other items mentioned should be available with comprehensive coverage annually, but in practice, some of these items may only be covered partially or at intervals of several years. The commodity flow method can also be used when basic statistical sources are scarce by exploiting benchmark information to estimate data for other years.

5.132. The introduction of supply and use tables and application of the commodity flow method should not be seen as a procedure that is applicable only when an abundance of data is available so that each cell in the tables can be directly filled. On the contrary, the supply and use framework is a method to make the maximum use of available information, no matter how limited it is. A very basic principle is to avoid the loss of any information that is potentially useful in compiling the national accounts.

5.133. The following two scenarios show the usefulness of a supply and use framework even if applied on a very limited scale.

Scenario one: mainly supply side data available

5.134. In most countries, it is possible to establish the supply for the domestic market (as domestic output *plus* imports *minus* exports) at a fairly detailed level, as international trade statistics are usually compiled at a detailed level and industrial output is also usually available at a rather detailed level. For services, it is usually necessary to accept a more aggregated classification, perhaps related to the ISIC Rev. 3 classification. In spite of these shortcomings, the establishment of fairly detailed statistics on the supply of products to the domestic market enables national accountants to make some sensible judgements about the uses of the products based on their type and other characteristics. The main distinction is between intermediate consumption and final uses, and, for final uses, the nature of the product often indicates whether it is for consumption or fixed capital formation. A rough exercise of this kind helps to identify major flaws and inconsistencies in the accounts, even though it does not take full account of finer details.

Scenario two: macro balancing except for a few major products

5.135. The goods and services account for the total economy can be seen as a highly aggregated supply and use table, containing just one product group and showing no breakdown of intermediate consumption by industry. If this is all that is initially available, one way to proceed is to apply the commodity flow method “top down” by separating out a single, well-defined product and assessing whether the existing detailed information for this product is consistent with the aggregated goods and services account. The product chosen should be one of major importance for the economy (energy products, grain, steel or metals, fish, cement, etc.), for which, because of its importance, detailed information may be available from several sources. This may have repercussions for the residual “aggregate product”, *i.e.*, all other products for which a more detailed supply-use balance cannot be derived. In the same way, it may be possible to separate the intermediate consumption for a strategic industry from the total. This breakdown on the supply and use side could be continued to embrace more products and industries. The strength of this partial approach is that it may reveal counterbalancing statistical discrepancies that were previously concealed.

5.136. The underlying message is that organising all available data into a supply and use framework makes it possible to combine information on the characteristics of the various products with the accounting rules of the system to fill in empty cells for which no direct information is available.

5.7.3. *Choice of Product, Industry, and Final Use Classifications*

5.137. The choice of product and industry classifications is a crucial step in setting up a supply and use system. Once these classifications are fixed, they determine the main characteristics of the system, and all data entering into the system have to be adjusted and classified accordingly. The main issues to be considered in this connection are:

- The supply and use tables cannot have a more detailed industrial breakdown than the basic statistics. The product grouping is usually decided by the level of detail existing in statistics on domestic output as international trade statistics typically have much greater detail. For services a special approach may be needed, as *product* statistics do not usually exist. Consequently service products may have to be defined in accordance with an *industrial* classification such as ISIC Rev 3.
- Aggregation means a loss of information and so the supply and use system should be as detailed as possible. Having more detail does not necessarily require substantial additional work. Some limitations which compilers had to face in the past due to limited capacity of computing capacity are no longer relevant.
- When defining the industries and product groups, certain technical properties should be taken into account, such as distinguishing separately products that have only one use, or one predominant use. For practical reasons and to meet users' need, it is advisable to choose an industrial classification at least as detailed as the ISIC two-digit level.
- Exports and imports can be shown with finer product detail than for domestic production. This can help in the process of balancing supply and uses.

5.138. In the choice of product classification and the level of detail, the classifications for which price indices are collected should also be taken into account. Price indices are required for product groups in the calculation of volume measures based on the balanced supply and use table. For final expenditures, exports usually appear in only one column and thus represent no classification problem. For analytical reasons as well as for compilation reasons, it may be desirable to have a sub-classification of exports. Gross fixed capital formation can be classified according to both the type of capital goods (indispensable) and according to the kind of activity of the producer acquiring the asset. Changes in inventories raise special problems in relation to estimates by detailed products. Usually the product specification for inventories is determined taking into account the assumptions about the product composition for either finished products or raw materials in the individual branches for which information about changes in inventories may exist.

5.7.4. *Entering the Data*

5.139. Defining the classifications determines the framework. Once the framework is determined, it is possible to enter all existing data into the tables. Data on supply and use of products that are available from international trade statistics and production statistics should be entered into the system at the maximum level of detail. Some sources provide complete or partial data on both supply and use of products. For example, supply and use of electricity, at least by main categories of use, may be available from producers or distributors of electricity. Detailed product classifications may provide the potential to fill in the cells for the supply and uses of certain products having a close link, or even a one-to-one correspondence, between product types and uses, although valuation of demand and supply may differ due to trade and transport margins and taxes and subsidies on products. For example, imports of aircraft will almost always be shown as fixed capital formation.

5.140. Obviously, not all cells in the supply and use tables can be completed directly using existing sources. Particularly when the system is first established, the greatest challenge is the establishment of

the initial input structures and the structure of final expenditures by product. Before these structures can be established, estimates have to be made for all the important totals and sub-totals, namely, total gross output and total intermediate input for all industries. Furthermore, estimates for all categories of final expenditures are needed. If national accounts statistics are compiled at a detailed level, most of these aggregates (many of which may have been estimated using indirect compilation methods presented in the previous sections), should be available. The initial estimates of supply and use tables do not necessarily need to show a balance between supply and use.

5.141. Preferably, as soon as the dimensions of the supply and use framework have been decided, a software system should be designed to conduct consistency checks.

5.7.5. *Balancing*

5.142. After all available data and estimates have been entered in the system, inconsistencies appear that need to be removed. This process is known as *balancing*. It is necessary to distinguish between the balancing for the *benchmark year* (for which the source data are usually more comprehensive) and for *current years* outside the benchmark year where less comprehensive data are available. Balancing the benchmark year requires more human resources and time than non-benchmark years because the benchmark year has to be built from the beginning whereas for the following years the point of departure is a balanced system for the preceding year. This is, in particular, the case for the use table. The supply table is more likely to be covered by current data.

5.143. Even though the system takes advantage of the fact that supply and use for each individual product group must balance, this does not necessarily imply that the way to proceed is to balance all products one by one. In fact, to follow such a procedure would make the balancing work overwhelming and impossible to handle in practice. The balancing procedures must simultaneously take into account many restrictions imposed on the system by other commodity balances and the initial estimates for the aggregates and sub-aggregates of the system. This is exactly what makes the balancing efficient, and, therefore, also underlines the need for a relatively complicated computerised balancing system. For non-benchmark years, balancing usually uses more implicit assumptions than for the benchmark year, based on relations established for the base year (such as input/output ratios). This does not, however, mean that these relations are also maintained in the results for the current years, only that they are taken as the point of departure and subsequently adjusted as needed to obtain balance for the current year.

5.144. It is usually possible and advisable to establish, a priori, balanced sub-systems for important products such as energy products, some agricultural products and minerals.

5.7.6. *Calculations of Volume Measures*

5.145. For the conversion of current price estimates to constant prices, the most detailed price information available from the consumer price index, the producer price index, and import and export price or unit value indices should be used. In practice, each product balance is associated with one or more price indices depending on whether there are price indices available for specific sources of supply or specific kinds of uses. Thus, imports are usually deflated separately using either proper price or unit value indices, while domestic output can be deflated with prices from the consumer or producer price indices.

5.146. A similar situation prevails for final uses such as household consumption and fixed capital formation. For the items in the product balance that cannot be associated with a separate price index, a residual price index can be calculated in such a way that the product group will also be balanced in volume terms. Ideally, compilation of supply and use tables at current prices should be done together with the compilation of supply and use tables in volume terms, because these two dimensions, combined with the price dimension, can provide useful plausibility checks on the data through the implicit growth rates.