3

Sources for GDP and Its Components

This chapter describes the process of identifying and assessing the data sources for compiling quarterly estimates of gross domestic product (GDP). It is not possible to identify a limited, standard set of sources that could be applied across all countries because of differences in the production structure of economic activities and the degree of sophistication of the data collection systems. Therefore, this chapter highlights examples of acceptable data sources that are used to compile estimates of quarterly GDP in various countries and some of the factors that need to be taken into account when considering these sources.

Introduction

3.1 Ideally, the same data sources used for the annual estimates of GDP should be used for the quarterly estimates. However, this may not be possible because the data are not available on a quarterly basis, and even if they are, the higher frequency data may be less accurate and reliable. Compilers therefore must choose among a range of alternative data sources, with varying degrees of accuracy and reliability, and hence suitability. This chapter addresses issues that are specific, or are of greater importance, to quarterly GDP compilation relative to annual GDP compilation. Therefore, it will not provide a broad description of sources because, in general, the same principles for designing sources and methods apply to both annual and quarterly GDP.

3.2 The chapter first presents an overview of the data sources and issues relating to the compilation of quarterly GDP. These issues may apply to more than one component of GDP. The remainder of the chapter covers issues relating to the components of the production, expenditure, and income approaches to measuring GDP. The production approach is presented by type of indicator. A presentation by type of economic activity would be repetitive because some issues are relevant across various types of economic activity and a presentation arranged by output and intermediate

consumption would not show the links among the compilation of these items.

3.3 The expenditure and income approaches are discussed by component because the indicators used to derive the estimates for each component tend to be more specific to that component. Some indicators may be used in more than one approach because of the relationships between the components or activities. One example is the use of the same construction indicators for construction in the production approach and for gross fixed capital formation on dwellings, buildings, and other structures in the expenditure approach. In these cases, specific issues for such indicators are discussed under the heading of expenditure. Even if expenditure or income data are incomplete, it may still be possible to derive a useful split of GDP by type of expenditure or income, as noted in paragraph 3.80.

Overview of Data Sources
General Issues

3.4 Quarterly GDP data sources are generally more limited in detail and coverage than those available for the annual estimates. Quarterly GDP data sources are also expected to be timelier than the data for the annual estimates, a factor that could affect data availability and may increase data collection costs. As a result, GDP compilation may rely on indicators that best capture the movements in the target variable in the past and in the future. Therefore, the basic principle in selecting and developing sources is to obtain indicators that best reflect the economic activity being measured. In some cases, source data are available in a form ready for use in compiling quarterly GDP with little or no adjustment. In other cases, the source data may differ substantially from the ideal and will need to be adjusted. These adjustments may typically be established for one or a few main benchmark years for which additional data sources—such as the results of more comprehensive and detailed

surveys or censuses—may be available. In these cases, the annual and quarterly time series are anchored to these main benchmark years and the regular source data are used as indicators to update the benchmark estimates (extrapolation or, equivalently, forward carrying of the benchmark adjustments). As the annual GDP provide the benchmarks for quarterly GDP, they should be the starting point in selecting and developing quarterly sources. In some cases, the same sources that are used for the annual estimates or for the benchmark estimates may also be available on a quarterly basis. The most common among these are merchandise trade statistics and accounts of government operations.

The Choice of a Suitable Indicator

3.5 The choice of a suitable indicator is based on the assumption that it is able to reflect the changes in the target variable. However, these indicators should be reviewed on a regular basis because the economic conditions (production relationships or price relationships of the variable) may have changed over time. For example, the use of the number of visitors as an indicator of accommodation should take into account that over time (and even based on the quarter), the length of stay per visitor and the ratio of visitors using paid accommodation is likely to vary.

3.6 The indicator being chosen may either be a primary item of a data collection system or a by-product of the system. For example, the number of employees in a given industry would be a primary item of a survey of employment but a by-product of a business income tax system. If the indicator is a by-product, then factors such as the sampling procedures, representativeness, and classification systems could affect accuracy because the by-product would have been collected using survey procedures and data collection systems that were not specifically designed to collect these data.

3.7 The suitability of an indicator must first be assessed qualitatively by examining the similarities and differences with the target variable in terms of scope, definitions, frequency, coverage, and so forth. There is a range of possibilities for the closeness of the indicator and the target variable. The most desirable indicators differ only slightly from those used in the annual GDP, for example, by being based on a sound sample but with less detailed data. Less satisfactory are indicators that cover only a part of the total, such as the key products or a subset of producers in an industry. Even less satisfactory are indicators that measure a variable related to the process or population of the target variable, but less directly, such as labor inputs as an indicator of the output of services.

3.8 Indicators that apply past trends or measure a variable that is connected to the target variable only by a behavioral relationship or statistical correlation should be avoided because the underlying relationships can be expected to be less stable than is the case of an indicator with a direct intrinsic relationship to the target variable.

3.9 The indicator and the assumptions behind its use can also be assessed quantitatively by comparing the rate of change in the annual sum of the quarterly indicator with growth rates in the corresponding annual GDP estimate. Equivalently, the ratio of the annual benchmark to the sum of the quarterly indicators for the four quarters shows the relationship between the two series as a single figure, which in this manual is called the benchmark–indicator ratio.

3.10 A stable benchmark–indicator ratio shows that the indicator represents the movements in the target variable well. Changes in the ratio may point to problems and help identify ways to improve the indicator in the future. The benchmark–indicator ratio does not necessarily have to oscillate around one, as differences between the levels of the annual estimate and the quarterly indicator can easily be solved by multiplication. For example, a quarterly indicator in the form of an index can readily be converted to a monetary value. This lack of emphasis on levels is an important difference in focus between quarterly GDP and annual GDP compilation: while establishing correct levels is essential in annual GDP compilation, levels in quarterly GDP can be derived from the annual GDP. The essential task in quarterly GDP is to obtain the data sources that provide the best indication of quarterly movements.

3.11 Even with careful selection of the most suitable indicators and improvements to data sources, benchmark–indicator ratios will vary over time, because indicators are generally not fully representative of the target variable. It is possible to identify multiple indicators for one target variable or to decompose that

one variable into various subcomponents, with each subcomponent having a separate indicator.

3.12 Multiple indicators may be available for the same item either in terms of being alternative indicators of the overall activity or representing different aspects of the activity under consideration. For example, air transport indicators may include total passenger movements, sales of aviation fuel, or visitor arrivals by air. In this case, the indicator that is most representative in terms of concept and best tracks annual movements should be adopted. In some cases, the indicators may represent different parts of the item. In cases where the indicators represent different aspects of the activity, the best solution is to split the annual data into each component and benchmark each indicator and component separately. If this is not possible, the components should be added or weighted together to form a single indicator before benchmarking.

Surveys of Businesses and Households[1]

3.13 This section addresses issues relating to the collection of data for statistical purposes and therefore covers issues relating to both sample surveys and censuses.

3.14 The timeliness of surveys for compiling quarterly GDP is a common challenge because of the limited time available for data collection processing. In this regard, surveys of businesses may be limited to covering large enterprises and establishments in some major activities. A common problem for surveys of businesses is the outdated nature of the survey frame because of delays in including new businesses and deleting nonoperating (dead or dormant) businesses as well as reclassifying the businesses that change economic activity. This problem is more serious for quarterly GDP than for annual GDP because of the more limited collection time for the quarterly source data and because the information needed to update the survey frames may be more limited on a quarterly basis. The continuing process of births and deaths of establishments and enterprises occurs for all activities but may be more prominent in those with a large number of small-scale, short-lived establishments, such as retail and personal services. Births and deaths of establishments and enterprises are important factors in

changes in the overall trends. In fact, an increase in the number of producing units is usually an indicator of growth in output. Further, as the structure of the economy changes or as new products become more popular, it is possible to see a growth in producers engaged in a given kind of activity and a decline in others.

3.15 Moreover, new businesses are particularly likely to have higher rates of growth and high levels of capital formation (particularly in the start-up quarter), as well as being more likely to be established during economic upturns. Closed businesses are included in the scope of surveys but may be misclassified as nonresponse. Because of these factors, quarterly business surveys should be designed to reflect changes in the population of businesses or they will tend to understate growth for a booming economy and understate declines for an economy in recession.

3.16 In many countries, the business register may be based on enterprises rather than establishments, as the former may be the legal requirement for registration. However, the latter is preferred if the compiler is to derive an accurate breakdown of economic activity.

3.17 For survey results to reflect changes in the population, the following considerations need to be taken into account when designing surveys of business:

- The register needs to be updated on a continuous basis to ensure complete coverage of the entire population of businesses in the frame. New businesses should be incorporated in the survey as soon as they start, either by drawing supplementary samples of new businesses or redrawing the sample for the whole population.

- Deceased business units should be distinguished from nonresponding units. The contribution of deceased businesses to their industry should be recorded as nil; for nonresponding businesses, values should be estimated.

- For each economic activity, the original sample and the supplementary samples should be stratified by size (preferably revenues or sales instead of number of employees), location, age, and other dimensions that may explain major variations in the level and growth rates of the target variable for each business for which corresponding population-wide information is available in

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[1] A specific discussion on the use of data from household income and expenditure surveys is included in paragraphs 3.83–3.84.

the frame. Different stratification principles may have to be used for new and continuing businesses in cases where the available population-wide information differs for the two subgroups.

- Many surveys collect information on a range of variables. Statistical agencies adopt this approach to reduce response burden and the cost of data collection. Survey design and sample selection is usually determined by the primary variables being covered in the survey often to the detriment of the other variables. In this regard, the accuracy and reliability of secondary variables should be considered against the primary objectives of the survey.

3.18 The problem of survey nonresponse may be more acute for quarterly surveys because of the time constraints posed by having to complete the survey in a shorter period compared to an annual survey. Survey nonresponse should be monitored closely because differences between respondents and non-respondents could lead to bias in the estimates for the population. There are various factors that the statistical agency may consider to mitigate nonresponse and achieve an acceptable response rate. For quarterly data collection, it may be useful to focus on the following:

- complexity of the questionnaire (it is necessary to focus on that level of detail for quarterly data),
- questionnaire follow-up and data collection methods,
- respondent burden, and
- survey timing.

3.19 Monthly or quarterly labor force surveys can be an important data source for quarterly GDP, particularly in cases where there may be undercoverage of business surveys. If new businesses cannot be incorporated in the survey as soon as they start or there is a large informal economy, household labor force surveys may provide information that can be used to adjust incomplete coverage of business surveys. However, the coverage, timeliness, and frequency of the labor force survey could be a challenge.

3.20 The comparison of labor force and business survey results could give adjustment factors for undercoverage in business surveys and to cover the nonobserved economy. The adjustments, or grossing-up

procedures, should be conducted at a detailed industry level with stratification by dimensions that explain variations in the ratio between the target variable and the grossing-up factor. Infrequent changes in survey frames or other changes in survey methodology can lead to distortions in the time-series qualities of the quarterly GDP. Movements in the indicator will be misleading if caused by changes in survey methods or coverage, rather than underlying economic events. Therefore, it is essential to determine and isolate the causes of the movements. It may be possible to identify and separate the effects of changes in sampling frame and methods from changes due to economic events.

Administrative Data

3.21 Administrative data are records that are compiled by government agencies or other organizations for administration, regulation, and monitoring, and not specifically for statistical purposes. However, in some cases, the needs of statistics compilers may be taken into account when the information gathering system is being developed. Administrative data are relatively cheaper to obtain compared with survey data—since they do not require specific collection protocols—and may be more timely. As a result, administrative data may be more widely used in quarterly GDP than in annual GDP compilation. However, there may be limitations in the data sources that may undermine their suitability for national accounts compilation in terms of the consistency of definitions, coverage, scope, timing differences, and so forth. Timing differences, in particular, may constitute a major drawback to using administrative data in estimating quarterly GDP, because these differences may be magnified in the quarterly context. For example, an administrative system that collects data every two weeks could result in some quarters having six two-week periods and others having seven. Taxation records—in particular, value-added tax (VAT) data— and merchandise trade statistics collected through customs records represent the two most widely used forms of administrative data. Quarterly income tax records for large enterprises and quarterly income and financial statements of the enterprises that list shares in the stock exchange, if available, may be useful to compile quarterly GDP and quarterly sectoral accounts.

Value-Added Tax Data

3.22 Tax collection systems represent an important type of administrative data for national accounts compilation. These systems are established to monitor income taxes, VATs, sales taxes, or other product taxes. VAT systems have gained in prominence as a source of data for national accounts as more and more countries have implemented VAT over the past two decades. These systems cover a broad range of goods and services that are sold by both producers and distributors, and they collect monthly and quarterly data as part of the tax collection process.

3.23 However, as with other administrative data sources, tax systems are not designed to meet statistical objectives. Therefore, there may be inconsistencies between framework used by the tax authorities to collect the information and the conceptual framework of the national accounts. These inconsistencies may result from the classification of units, the coverage of units at each point in time, the classification of transactions, the residency criteria used for transactions, and the time of recording of transactions. For example, the VAT system may most likely record transactions on a cash basis, whereas national accounts transactions should be recorded on an accrual basis. Further, VAT information may be presented on the basis of the legal entity, which may be engaged in various types of economic activity, rather than on the basis of type of activity. Therefore, the requisite level of detail may be lacking. VAT data for the legal entity could be supplemented by a survey of multi-industry enterprises. If such a survey is not possible, data by industry of enterprise could be used as an indicator of data by industry of establishment. There may also need to be extensive communication with the tax collection authorities to understand the data, to produce tabulations in a form suitable for national accounts compilation, and to make adjustments to tax forms and procedures to better meet statistical objectives. Other product tax systems may also provide data on the underlying flows of taxable products, such as alcohol and petroleum.

3.24 In using VAT data to estimate value added by type of economic activity, it should be noted that the data do not take into account changes in inventories because the data cover sales (not output) and purchases (not intermediate consumption). Also, purchases of goods and services that are deductible for VAT usually include both capital formation and intermediate consumption. For national accounts indicators, it is highly desirable to separate these two components. Otherwise, the purchases data would not be usable as an indicator of intermediate consumption as gross fixed capital formation is usually large, lumpy, or both.

International Merchandise Trade Statistics

3.25 International Merchandise Trade Statistics (IMTS) represent one form of administrative data that includes specific requirements for statistical purposes. The guidelines used to compile the IMTS are outlined in the United Nations' *International Merchandise Trade Statistics: Concepts and Definitions 2010* (*IMTS 2010*). These statistics are relatively cheap to compile, comprehensive, and timely; therefore, they are particularly useful in countries with weak data sources. The IMTS could be used for a range of compilation purposes; for example, imports statistics may be used to derive commodity flow estimates and exports may be used to estimate production of some key industries. If imports data are used, the usefulness of the data is enhanced when domestic production of the goods under consideration is low. Likewise, if exports data are used, the usefulness is enhanced if domestic consumption of the goods under consideration is low.

3.26 One major drawback of using the IMTS is that the dataset lacks the requisite product detail that will allow the differentiation of products by quality, and in some cases, end use. Merchandise trade statistics are classified according to *product groups* and not according to specific products.[2,3] Therefore, it is not always possible to get accurate, reliable product price information based on the quantity and value information in the merchandise trade statistics. The quantity and value information produce unit values, which reflect the value of a group of products. In addition, merchandise trade statistics may be prone to

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[2] For example, in terms of quality, the commodity group HS3-87059 (*Special purp. motor vehicles, other than those principally designed for the transport of persons/goods, n.e.s. in 87.05*) may include vehicles of varying make, model, and hence quality.
[3] For example, in terms of end use, the commodity group HS3-170199 (*Cane/beet sugar & chemically pure sucrose, in solid form, not containing added flavoring/coloring matter)* does not specify whether the goods will be used as intermediate inputs or final consumption.

classification errors, incorrect values, and incorrect quantity measures.

3.27 The IMTS also pose numerous timing issues for compilers. The data are recorded when the goods cross the customs frontier (entered in the records of the customs) and not when they are produced or used in production. Therefore, it is not possible to separate imports entering inventories from imports for other uses (intermediate consumption, final consumption, capital goods, etc.). Thus, if imports data are used to estimate the supply of goods in production or for consumption based on commodity flow methods, then some of the goods used to estimate supply may actually be entering inventories. Likewise, if exports data for a given period are used to estimate domestic production in that period, then it is likely that some of the goods may be inventories produced in a previous period and some of the goods produced in the current period may be exported in a following period.

3.28 Major products, such as ships and aircraft, may be excluded from the IMTS. Information on these imports may be obtained through government registration or licensing records or through supplementary surveys of airline and shipping companies. The balance of payments compilers may also compile data on imports and exports not recorded by customs, including goods under merchanting.

3.29 The IMTS include goods for processing that enter or leave the economy without a change of ownership. These goods should be excluded from the imports and exports statistics. The balance of payments compilers may undertake the necessary adjustments (see compilation guide on balance of payments; IMF 2014).

Other Data Sources

3.30 Compilers may also consult industry associations, industry experts, or the leading enterprises in a specific industry to derive quarterly indicators, if survey or administrative data are not available or are inadequate. Ideally, there should be only a few gaps that represent a small proportion of the total. Compilers should make every effort to fill the data gaps to ensure comprehensiveness of the measurement of economic activity; however, the use of information obtained through these consultations should be temporary and the data gaps should be closed as soon as is feasible using more conventional data sources.

3.31 If no quarterly indicators are available from the consultations, compilers may consider some additional alternatives. Some of the alternatives include the following:

- a related item as an indicator,
- a range of other items as an indicator,
- the overall economy (excluding the target components) as an indicator, or
- mathematical methods based on distribution of annual data and extrapolation of past annual trends.

The suitability of these methods is discussed in Chapter 10.

3.32 In choosing among alternatives, past patterns in the annual data for that variable can be used as a guide. If a series is volatile and related to the economic cycle, growth rates of the rest of the economy could be a suitable indicator. If the annual series does not relate to fluctuations in the rest of the economy, a growth rate based on past trends may be suitable. Extrapolation on the basis of past trends is generally not desirable, as it tends to hide the actual data on current trends. If there is no suitable indicator, a simple method that is transparent may be more appropriate than something that is time consuming and complicated but not necessarily any better.

GDP by Type of Economic Activity
General Issues

3.33 Estimates of GDP by type of economic activity show the contribution of each activity to economic growth and therefore provide a useful perspective on economic performance. In many countries, these estimates may be based on more reliable source data and more rigorous compilation procedures compared to the expenditure and income approaches. Therefore, estimates by type of economic activity may be considered to be the most accurate and therefore the official quarterly GDP estimates in these countries.

3.34 The general principles for deriving current price and volume estimates are the same for quarterly and annual GDP. The production approach involves calculating output and intermediate consumption, and deriving value added as the difference.

3.35 Observed data on both output and intermediate consumption at current prices may be available quarterly in some cases; in these cases, the double indicator method for value added can be used. For example, in some countries, government-owned enterprises may dominate or have a monopoly in some industries such as petroleum, air transport, electricity, water, or telecommunications and the units may be able to provide the detailed data required.

3.36 However, the data required for the production approach may be incomplete on a quarterly basis. Because compiling the production accounts at current prices and in volume terms requires detailed accounting information on output and inputs current expenses, the required data may not be available quarterly or may not be collected with the timeliness needed to compile quarterly GDP estimates. The missing data must then be estimated by using another series as an indicator. Most often, output data are available, while data on intermediate consumption are not. In cases where data on intermediate consumption are not available, data on some key components of intermediate consumption (e.g., fuel for transportation services), labor inputs, or capital inputs may be available as indicators of intermediate consumption, assuming a fixed relationship. Likewise, if no data on intermediate inputs are available, then the estimation process could assume a fixed relationship between output and value added.

3.37 Relationships between inputs and outputs may change as a result of technological changes, differences in the seasonal patterns of outputs and inputs, or variations in capacity utilization caused by changes in the business cycle. The impact of technological change may not be significant in the short term and can be handled through the benchmarking process if they happen gradually over a longer period. As discussed in Chapter 6, it is preferable to use benchmarking rather than fixed ratios. The reliance on fixed coefficients is particularly unsatisfactory for calculations at current prices because of the additional factor of changes in relative prices.

3.38 In some countries, value added is derived directly, without explicitly calculating output and intermediate consumption. This practice is undesirable for several reasons. Since value added is not directly observable, this method encourages the use of inappropriate calculation methods. Further, it is not consistent with the *2008 SNA* presentation of the production account or with supply and use tables, and does not support comparison of quarterly estimates with subsequent annual output data. As an example, compiling the full production account by type of economic activity makes explicit the assumptions about input–output (IO) ratios that might otherwise be implicit or ignored. An assumption of fixed IO ratios at both current prices and in volume terms might be highlighted in implausible implicit price deflator movements, or deflating value added by an output price index might result in unacceptable changes in IO ratios.

3.39 Deflating value added by output price indices assumes that prices of inputs and output change by the same proportions. Relative prices may be quite volatile because of various factors that may cause the price of inputs to deviate from the price of the output. For example, units engaged in road or air transport may not be able to transfer sudden changes in the price fuels to the output as these changes occur, and this could lead to deviations between output and intermediate consumption over a short period.

3.40 The preferred method of deriving value added in volume terms is similar to deriving value added at current prices—as the difference between output in volume terms and intermediate consumption in volume terms. Thus, the current values of output and intermediate consumption are each deflated by appropriate price indices. This method, double deflation, while conceptually sound, requires a large amount of data that may not be available on a quarterly basis and in a timely manner. Double deflation may also be prone to measurement errors of both output and intermediate consumption.[4]

3.41 As a result, compilers may opt to use a single indicator method. One widely used method is to extrapolate value added based on the volume index of output. Another, but less satisfactory single indicator method is to extrapolate value added using a volume index of inputs. These may be total inputs, intermediate inputs, or one major input, such as fuel or labor. However, it may be difficult to derive a volume index of total inputs or intermediate inputs for quarterly

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[4]On the merits of using double deflation techniques in the national accounts, see Alexander and others (2017).

data, and one major input may be used. The use of volume indices for inputs may be more common or necessary for nonmarket activities where information on output volumes may not be available.

3.42 If data on intermediate consumption at current prices are not available, one option is to first derive an estimate of intermediate consumption in volume terms using output in volume terms as an indicator. This method assumes a stable relationship between output and intermediate consumption. Intermediate consumption at current prices is then derived by reflating the volume estimate using price indices that reflect the product composition of intermediate inputs in volume terms. A composite price index of intermediate consumption may be constructed by weighting the relevant price index components of published indices such as the consumer price index (CPI), producer price index (PPI), and import price index. A use table (see Chapter 9) for a recent year would provide weights to derive industry-specific intermediate consumption deflators (or reflators). A more detailed level of reflation is preferable as it allows the effect of changes in the composition of output to be captured in the estimates.

Basic Prices and Producer Prices

3.43 The *2008 SNA* uses two kinds of prices to measure output. The preferred method is basic prices, but producer prices may be used if basic prices are not available. Both are actual transactions prices that can be directly observed and therefore recorded. Basic prices exclude taxes on products the producer receives from the purchaser and passes on to the government, but include subsidies received by the producer to lower prices. It measures the amount retained by the producer. Producer prices include taxes on products and are reduced on account of subsidies. It is therefore the price that the producer invoices the purchaser. Neither basic nor producer prices include amounts receivable in respect of VAT or similar deductible taxes invoiced on the output sold.

Market Output, Output for Own Use, and Nonmarket Output

3.44 The *2008 SNA* makes a fundamental distinction between market and nonmarket outputs. This distinction is important to determine how output is valued and therefore the data sources and techniques to be

used in valuation. The classification of the activity of an enterprise as market or nonmarket output should not change from one quarter to the next. Therefore, the quarterly national accounts (QNA) compilation process should follow the classification of the annual national accounts in that regard.

Sources for Industries

3.45 Commonly used types of source data for the production approach on a quarterly basis include current price data from accounting records (through surveys) and administrative systems, quantity indicators, labor and other input measures, and price indices. Most commonly, deflation will be used to derive volume measures, and due to problems that are discussed below, deflation is preferable to direct measures of volumes. In other cases, there may be volume and price indicators only or current price value and volume indicators only. Annex 3.1 provides an overview of the value and volume indicators most commonly used for the production approach.

Current Price Data on Outputs and Inputs

3.46 To derive the value of output for goods-producing industries, the value of sales together with opening and closing values of inventories of finished goods and work-in-progress[5] are required. The simplest indicators cover only total sales of goods produced by the enterprise. Other revenue, such as sales of goods not produced by the factory, repairs, or rental services, might also be collected in total or separately. Data on inventories used in calculations should have the effects of holding gains/losses excluded.

3.47 Some countries may collect data on the value of construction through surveys of construction. If only the total value of a project is available, then the total value should be allocated over the expected life of the project. Compilers may allocate the value of the project equally in each period based on the assumption that the volume of work is distributed evenly over the life of the project. However, this also assumes that there is no inflation over the period. A preferred approach is to discount future income associated with the project. The *2008 SNA* paragraph 20.63 provides some details of how this approach may be applied.

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[5] Output = sales + changes in inventories of finished goods and work-in-progress (excluding any revaluation effects).

3.48 An alternative approach is to collect data on the value of work done during the quarter. Collecting these kinds of data avoids the difficulties of making assumptions about the allocation of a total value for a whole project to particular quarters. However, the feasibility is limited by the availability of data, as construction enterprises are often small scale and work done may be hard to separate into quarters. Progress payments for work done may be an acceptable approximation if interviews suggest that they approximate the value of work put in place. (Construction indicators are discussed in paragraphs 3.111–133.)

3.49 Sales data are commonly used as quarterly indicators for the output of wholesale and retail trade. Sales data could be obtained from a survey of wholesalers and retailers or through tax records. Output at current prices is defined as the trader's margin: that is, sales less the cost of goods sold.

3.50 Government agencies and public corporations may be useful sources of information for the activities that they undertake, regulate, or tax. General government undertakes public administration, defense, and community services, and would be the primary source of information for these activities. In some countries, public corporations may be heavily engaged in or may have monopoly control over some activities, such as air transport, electricity, water, and so forth. Government agencies may be a useful source of information through their regulatory responsibilities of activities such as financial services, insurance, health, and gambling.

Quantities of Outputs and Inputs

3.51 The concepts of quantity measures and volume measures should be distinguished. Quantity data are expressed in terms of physical units and can only be expressed for a homogeneous product. Volume data are presented in terms of volume indices or values expressed at the prices of a common period; these data differ from the quantity data because quality changes are accounted for and because the measures can be meaningfully aggregated.

3.52 Quantities are easy to define for the goods-producing industries: for example, liters of petrol and kilos of flour. In some cases, businesses can supply quantity data more readily than they can supply financial information on a quarterly basis. The businesses may not compile quarterly accounts, or the data may take longer to compile than simply collecting numbers that do not require processing or valuation. Quantity indicators can be multiplied by price indices or average prices for the quarter to obtain current price indicators. Such estimates avoid the inventory valuation issues that arise for current price values that have been derived from data that include inventories measured at historic cost.

3.53 The limitations of quantity data are significant, and quantity data are not economically meaningful if products are heterogeneous or subject to quality change. The usefulness of quantity data is limited by the homogeneity of the products. For basic commodities, such as wheat and base metals, there is often relatively little variation in quality over time, particularly if data are broken down by grades of quality, so quantity indicators may be suitable. However, many products vary considerably in quality. For such goods, deflated current price data should be used. This situation applies to a large number of manufactured goods and to some agricultural and mining products. The more narrowly such products are defined, the more the estimates will be able to reflect the actual volume of output. For example, if cars are treated as a single product, changes in the mix of output toward larger cars or cars with more accessories (better quality) will not affect the number of cars, but should be treated as an increase in the volume of output. There are many products for which quantities are poor indicators or for which output is not readily quantifiable, such as clothing, medicines, and services. One way of dealing with the problems of heterogeneity of products is to collect extra detail, although it may not be practical owing to greater collection costs, respondent burden, and delay in tabulation.

3.54 Quantity indicators are usually developed on a case-by-case approach for each type of economic activity, rather than as a unified system. The following cases are considered:

- *Agriculture:* Government agencies (ministries of agriculture and government agricultural produce marketing agencies) may closely monitor the production of key agricultural commodities. Ideally, the data should be obtained at the farm, but quantity data may also be obtained at points of the distribution chain in cases where there

are (i) a few producers, (ii) if the products/crops are produced primarily for export, or (iii) if the products are used as primary inputs for another industry. However, there will most likely be a difference in the quantity produced at the farm and quantity measured along the supply chain due to wastage/spoilage, timing differences, consumption, informal sales, and other factors. In measuring value added for agriculture, the compiler should recognize that there may be a timing difference between the period of harvest and allocation of output. Conceptual issues associated with work-in-progress and the timing of agricultural production are dealt with in Chapter 11.

- *Mining and quarrying:* In absence of quantity data, compilers in some countries may use the information on rent on the extraction of subsoil assets owned by governments (usually referred to as royalties) or severance taxes on the extraction of minerals from private lands. These payments are usually based on the quantity extracted and provide an estimate of the quantity of production. However, if the government accounts are compiled on a cash basis, it would not be possible to determine in which period the quantity was produced. In that case, additional information, such as the documents presented by the mining companies to support the payments, may provide some information as to when production took place.

- *Construction:* Floor area built distinguished by type of building. (Indicators for construction are discussed further under gross fixed capital formation on construction in the expenditure approach.)

- *Accommodation and food service activities:* Number of visitors may be an acceptable indicator in countries where foreign visitors constitute a significant proportion of the number of persons staying in paid accommodation. Some countries conduct regular (monthly or quarterly) surveys of visitor expenditure. Therefore, additional information from these surveys, such as average daily expenditure of visitors and average length of stay, may be used to fine-tune the estimates. In other cases, hotel tax revenue (hotel occupancy tax, hotel and restaurant service charge, and VAT on accommodation service) may provide some useful information.

- *Transportation and storage:* Number of passengers carried/embarked/disembarked, tons of freight or ton-kilometers, and numbers of licensed taxis or new vehicles registered. To the extent that prices, and therefore the volume of service, reflect distance, data with a kilometer dimension are better indicators. For example, metric ton-kilometers would be a better indicator of the volume of freight than a measure of metric tons that did not take into account differences in distances carried.

- *Information and communication:* Number of telephones in service or number of telephone calls (both landline and cellular). Indicators should be closely monitored over time because of the changing nature of this activity. The ratio of mobile phones to (fixed) landlines is continuing to grow in many countries; therefore, if landlines are used as an indicator, then the relative growth of this activity due to mobile phones will not be captured.

- *Real-estate activity (ownership of dwellings):* Numbers of dwellings, preferably broken down by location, size, and type of dwelling and with adjustments for new dwellings and alterations and quality change. (Sources and methods are covered later in more detail in the discussion of indicators for household consumption of rental services.)

- *Professional, scientific, and technical services:* Numbers of wills, court cases, and divorces for lawyers; numbers of registered land transfers for real-estate agents; and numbers of deaths for undertakers.

- *Public administration:* Licenses issued and court cases processed. Because these indicators are partial and do not reflect quality well, they are used to only a limited extent. Other services such as numbers of tickets sold by theaters and other forms of entertainment as well as numbers of vehicle repairs are indicators too. Government employment is also used for estimating the volume of public administration services.

3.55 The potential range of sources is very wide and these indicators are not usually part of a comprehensive system of indicators. As a result, there are typically many gaps and data often need to be obtained from different agencies. Some potential indicators

may be unpublished, but could be obtained by making a request to the relevant agency.

Labor Input Measures

3.56 Measures of labor input are sometimes used as indicators of the volume of output of service industries. The assumption behind the use of this method is that employment is directly related to output and value added in volume terms. Labor is a major input to the service industries, and compensation of employees plus mixed income typically constitute very high proportions of value added. Labor and income per capita data are used to complete the coverage of economic activities by accounting for the non-observed economy. The number of hours worked is preferable to the number of employees as an indicator of labor input. For a given number of employees, total hours worked takes into account changes in standard weekly working hours, hours of overtime, and changes in the specific numbers of hours worked by individuals. Total output would be affected by these changes, whereas the total number of employees will not.

3.57 However, hours worked is still an imperfect measure of labor input. Ideally, labor input measures would take into account different types of labor (e.g., disaggregating by occupation or skill level) weighted by their different rates of remuneration. The total value of wages and salaries divided by a wage and salary index would give an indicator that also takes into account such compositional effects, but it would need to be supplemented by a measure for self-employed labor. It is preferable that actual hours worked be covered, rather than paid hours which include sick leave, vacations, and public holidays but exclude unpaid work. The labor input measure should include working proprietors and the self-employed as well as employees.

3.58 Comprehensive monthly or quarterly data on employment by industry may be available in many countries, from specific surveys or as a by-product of a payroll or social security tax system. However, the classification by economic activity used by the administrative source may not be consistent or sufficiently detailed for compiling QNA estimates.

3.59 Labor input is not an ideal volume measure because the relationship between labor and output is variable. The relationship between labor input and output also changes as a result of changes in capital intensity and total factor productivity.

3.60 In the case of the nonmarket activities of general government and nonprofit institutions serving households (NPISHs), current price output is measured on the basis of the cost of inputs. It is preferable that the output volume measure take into account the services provided by the government or nonprofit institution, if measurable. It is common, however, to use input indicators, such as labor and purchases of goods and services, if suitable volume measures are not available.

3.61 As with other sources, calculations at a greater level of detail will usually improve the estimates as the relationship between output and labor varies widely across industries and even within broad industry groups. For example, photographic activities and legal activities may both be in the same category, "*Professional, scientific, and technical services*," but the value of output per hour or employee of a photography business may be much less than that of a law firm. Accordingly, an indicator that separates the two activities will better reflect changes in output.

Indirect Indicators

3.62 Where direct measures are not available, a diverse range of indirect indicators may be considered. It is sometimes possible to identify a downstream or upstream activity that can be used as a basis to generate indicators. For example, the supply of building materials can be used as an indicator of construction activity. An indicator for wholesale and retail could be obtained from the supply of goods that are distributed by wholesalers and retailers. Although it would be conceptually preferable to obtain data on sales and purchases from the establishments and the margins received, data on the supply of goods may be more readily available and easier to estimate. This is because there are relatively fewer data sources on the supply of goods (imports and domestic producers) compared to the large number of mainly small-scale wholesalers and retailers. (Data on sales of goods to consumers are discussed later in this chapter in the context of GDP by expenditure category.) The distribution activity of specialist importers or expensive goods that can be identified should be measured separately. As the estimation procedures rely on an assumption of fixed markups (i.e., the margin as a percentage of the price),

the method will give better results if calculated at a greater level of product detail to take into account the combined effect of changes in the product mix with varying markups of different products.

3.63 If data on road freight transport activities are inadequate, it may be possible to derive an indicator based on the supply of goods that are usually transported, or at least the major components. Indicators for other supporting industries may also be derived from the output of the industries served, such as services to agriculture, mining, and transport.

3.64 Population is sometimes used as an indicator in cases where a more specific indicator is not available, such as subsistence agriculture, owner-occupied dwellings, and some personal services. The indicators should be adjusted for long-term trends. For example, population could be used to represent dwelling services, but adjustments should be used to account for trends in the quality of dwellings and persons per household. Adjustments for divergence in long-term trends between the population indicator and the annual estimates can be incorporated through the benchmarking process.

3.65 All of the methods discussed in this section assume ratios based on the benchmark data. Such ratios are more likely to be stable in volume terms, so it is generally better to make the assumption in volume terms and then reflate to current prices. Also, in all of these cases, if the benchmark data are more detailed, the quarterly estimates will tend to be better if the calculations are done at a detailed level.

Price Indicators

3.66 If a current price value is available for an item, a volume measure can be obtained by deflating with a price index. Alternatively, if a volume measure is available, a current price measure can be obtained by reflating with a price index. Countries generally compile four major price indices: CPIs, PPIs, export price indices, and import price indices. Each index measures prices of transactions at different stages; therefore, these aspects need to be taken into account when deciding on which index should be used as a deflator. CPIs measure purchasers' prices, PPIs measures basic prices, export price indices measures export prices (usually free-on-board prices, or FOB), and import price indices measure import prices (usually

cost-insurance-and-freight prices, or CIF). These indices may not always be appropriate deflators and sometimes suitable deflators will need to be derived. This may be done by either decomposing a major index (e.g., using components of the CPI) or obtaining supplementary price information.

3.67 In some cases, a specific index may need to be developed because the main indices are not compiled, not timely, or inadequate (outdated weights, poor coverage, or incorrect price basis). For example, compilers may develop a price index of agricultural products using information collected from ministries of agriculture and other government bodies that regulate or monitor agricultural production. The source data may have to be adjusted to derive basic prices because the prices may be purchasers' prices collected at the point of sale (produce market) and not from the producer. For some professional services, such as lawyers, architects, and engineers, the professional associations may have information on the fees, which could be used to construct an index.

3.68 Where no direct data are available, prices of one or more similar or closely related products or industries that have a tendency to move in the same way may be suitable. For example, if electricity is produced from imported fuel, then the price of electricity may be tracked by the price of fuel.[6]

3.69 It may be necessary to produce output deflators or reflators based on the costs of inputs, for example, weighting together wage indices or information on wage rates with the prices of major intermediate inputs. Because this technique does not account for operating surplus, it is unsatisfactory to the extent that profitability varies. However, to the extent that profitability and productivity are taken into account in annual data, the benchmarking process will incorporate the annual variations.

3.70 Wholesale and retail present special difficulties in identifying the price dimension. The difficulty arises because the output of this activity—a service—is the trade margin. The service component is combined with the prices of the good and the quality aspects are difficult to measure. Deflating the margin directly should be avoided. A volume indicator of the

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[6]We must also be cognizant of the various factors that could affect the price of the product such as government action in the form of price controls, taxes, and subsidies.

margin service can be made from the volume of goods bought or sold using an assumption of a stable volume of the distribution service per unit of goods: that is, no quality change in the service. The suitability of the assumption is improved by compiling at a greater level of detail, as markups differ among products and between outlet types. The price indices of the goods should not be used as a proxy deflator or reflator of margins because margins have different cost structures and can vary differently than goods prices.

3.71 Financial intermediation services indirectly measured (FISIM) is a margin and so is not readily observable. One approach for quarterly GDP estimation is to use the deflated values of loans and deposits as a volume indicator of the service provided, in conjunction with the annual benchmarks. The value of loans and deposits should be deflated by a price index representing the general price level (e.g., the implicit GDP deflator excluding FISIM or the CPI). Ideally, this method should be applied at a disaggregated level, with a detailed breakdown of assets and liabilities by type, because the interest margins vary, reflecting the fact that the value of service provided varies for different categories. Interest margin changes are price effects and do not affect the volume of loans, so these changes will be shown as a price effect. The direct deflation of the value of FISIM by a general price index or by input prices for financial services is not a suitable alternative. These deflators do not measure the price of FISIM and ignore interest margin changes. Thus, changes in profitability of financial institutions would be incorrectly shown as a volume change. In cases where independent current price and volume measures for output are obtained, the corresponding implicit price deflator should be checked for plausibility.

3.72 Another more sophisticated approach is to deflate the monthly stocks of deposits and loans in its various components using the average of the stock at the end of the previous month (opening balance) and the stock of the following month (closing balance), the monthly weighted average reference rates (SNA rate: interbank interest rate, central bank interest rate, and average implicit effective interest rates of deposits and loans), and the interest rates for the base year (fixed-base year) or for the previous year (chain-linked series). The purchasing power of the monthly average stock of loans and deposits in national currency is estimated by deflating the overall stocks' last day of the previous month and the last day of the following month by the average CPI with the appropriate rebasing (base year or previous year).

3.73 The monthly average CPI of the two adjacent months is to be used in order to deflate the stock at last day of the month since the CPI reflects the average prices (midpoint of the month) of the month and the stocks should be valued at average prices of the previous year or of the base year. Loans and deposits in foreign currency is deflated monthly by a price index that integrates the changes in the exchange rate and inflation of the countries with which the country in question undertakes transactions of loans and deposits. Then, the deflated stocks are multiplied by the SNA interest rate and by the effective interest rates on loans and on deposits of the base or previous year, and FISIM results from the difference of both amounts (effective interest for loans at constant prices minus SNA interest for loans at constant prices, plus SNA interest for deposits minus effective interest on deposit at constant prices).

3.74 Intermediate consumption usually has no specific aggregate deflators, so it is necessary to build the deflators from components of other price indices for the relevant products. Note that even when a fixed coefficient method has been used to derive volume measures for a given type of economic activity, it is desirable to reflate intermediate consumption and output separately and is undesirable to use the fixed coefficient method at current prices.

3.75 Some countries compile indices for selected categories of services, although an overall index of services production may not be available. The coverage and definitions used in the index should be assessed to determine whether the index is consistent with the requirements of QNA compilation. The compiler must therefore weigh these factors against the cost and practicality of compiling separate indices to derive volume estimates of services.

Industrial Production Indices

3.76 Some countries may compile a monthly or quarterly industrial production index (IPI). The index is expected to cover the following ISIC Rev. 4 categories: Section B (mining and quarrying), Section C

(manufacturing), Section D (electricity, gas, steam, and air conditioning supply), and Section E (water collection, treatment, and supply; sewerage; waste collection; and remediation activities). However, there may be gaps in coverage and not all activities will be covered in all cases. Countries use a range of methods to derive volume indicators of economic activity when compiling the IPI, such as deflated values, quantity measures, or selected inputs. In some cases, the IPI may use a mix of methods, such as quantities for homogeneous goods and deflation for others.

3.77 It is preferable to compile quarterly GDP estimates from the IPI source data or from IPI components at a disaggregated level, rather than from the total IPI. The more detailed compilation would facilitate the resolving of differences in coverage and concepts between the IPI and quarterly GDP. Benchmarking, structural assumptions, and reflation tend to be better when carried out at a greater level of detail. The national accounts measure of output requires weights to reflect output at basic prices or producers' prices, while in practice the IPI may use other weights or valuations. The IPI may have gaps in coverage that may need supplementary sources: for example, particular industries and goods that are not easily quantified. The base years may also differ. Published IPIs are sometimes adjusted for variations in the number of working days, rendering them unsuitable as quarterly indicators. For compilation of nonseasonally adjusted quarterly GDP, the data should reflect the actual activity in each quarter, before adjustments for working days or other calendar and seasonal effects.

3.78 If different methods are used in the IPI and quarterly GDP, then it would be useful if the quarterly GDP sources and methods documentation clearly states the differences. These differences should be explained (e.g., weights, coverage, and valuation) and quantified, if possible.

GDP by Category of Expenditure
General Issues

3.79 GDP by type of expenditure shows the final demand for goods and services. This approach does not rely as much on fixed ratios as the quarterly production estimates. Nevertheless, there are some issues relating to timing, valuation, and coverage of source data that are equally as important and should be considered. Some of these issues are as follows:

- *Time of recording*[7]: Timing differences are a much more important issue in quarterly data than in annual data because these differences are much more pronounced in higher frequency data. Government and international trade are typically well covered by quarterly data, but the time of recording of data is often inconsistent with the national accounts requirements.

  - Government data are often recorded on a cash basis, although accrual adjustments are sometimes made for particular, identifiable items. Accrual accounting is becoming more common in government accounts.

  - IMTS are recorded when the goods pass through the customs frontier of the reporting country and not when they are consumed as intermediate consumption or final consumption. The balance of payments compiler may make some adjustments to the IMTS data to account for change of ownership of the goods between residents and nonresidents; however, these adjustments are still not adequate for national accounts purposes. The balance of payments statistics are concerned with when the goods are acquired (when change of ownership occurs) and not when they are used in production. Thus, goods may be acquired and enter inventories and not used as intermediate inputs during the quarter under consideration.

- If the estimation process depends on data from surveys of enterprises, then the expenditure estimates may be more strongly influenced by coverage problems in the business register. This influence arises because of the high proportion of retailing and consumer services output that goes to household consumption and the high proportion of building output that goes to capital formation. These activities often have high proportions of smaller, shorter-lived, less formal businesses.

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[7]The issue of time of recording for government finance statistics and merchandise trade statistics is also important for the GDP estimates by type of economic activity. This issue is addressed here because both represent significant components of GDP by expenditure category.

- Changes in inventories have serious valuation problems. These problems also occur in production and income approach estimates, although they may be partly avoided by use of quantities of output in the production estimates.

3.80 Although the expenditure data may have serious gaps, it may still be possible to derive a useful split of GDP by type of expenditure. Compilers in many countries face difficulty in developing reasonably reliable estimates of household consumption expenditure and changes in inventories. Therefore, in some cases, either or both of these components may be presented as a residual—the difference between the sum of the available estimated components and total GDP by type of economic activity. This is not an accurate approach to estimate household consumption expenditure and changes in inventories; nevertheless, the size and change in the residual from one period to the next could provide a useful check on the accuracy of the estimates. For example, a substantial decline in household final consumption expenditure (when measured as a residual) may suggest that one or more of the estimated components of expenditure on GDP may be overstated.

Data Sources
Household Final Consumption Expenditure
Value Indicators

3.81 Household final consumption expenditure is usually the largest category of GDP by expenditure. The main sources of data on household consumption expenditure are surveys of retailers and service providers, household expenditure surveys, imports of consumer goods, domestic production of consumer goods, and VAT systems. Compilers may use a single data source or a combination of the sources, but the compilation procedures would determine the data sources that are used.

3.82 Surveys of retailers and providers of other consumer services are common sources for data on household consumption at current prices. The retailers and service providers may be specialized (e.g. motor vehicle sales), but supermarkets and large stores sell a wide range of goods, so that collecting product breakdowns for these stores is desirable. As noted previously, a detailed breakdown by product improves the quality of the deflation. If product

mixes are stable, satisfactory quarterly data by product can be estimated by using total sales of a retail industry as an indicator for the benchmark values of sales by product. Some countries conduct continuous household expenditure surveys. However, it is more common for countries to conduct these surveys at multiyear intervals. If the results are processed on a timely basis by quarter, they could be useful indicators for quarterly GDP. For surveys conducted at multiyear intervals, the data are usually combined with other data from business surveys—such as surveys of retail sales—to extrapolate the benchmark period. However, the increase in online retail—and the increasing sales to households by nonresident online retailers—poses a special challenge for data collection on household consumption based on the suppliers.

3.83 Household expenditure survey data may have some shortcomings. Reporting quality and omissions of small or sensitive items may be a problem in household surveys, depending on the behavior of respondents. For example, expenditure on alcohol and tobacco may be understated, requiring adjustments to be made on the basis of other information such as merchandise trade statistics, retail sales, and tax records. In cases where the smuggling of alcohol and tobacco may be a major issue, adjustments may be made based on information from law enforcement. The errors caused by the problem of recall of purchases, which is common in household income and expenditure surveys, could be magnified in the quarterly GDP. The purchases of consumer durables, which are usually large and infrequent, may be allocated to the incorrect quarter.

3.84 Household surveys provide good coverage of own-account production of goods, purchases from informal sector activity, and purchases of services, which are all difficult to cover or not covered by surveys of establishments. In this regard, they may be useful in developing countries in preference to business surveys. In developed economies with relatively smaller informal sectors, business surveys may be used because of issues such as collection cost, delay, and reporting quality of quarterly household expenditure data.

3.85 A VAT or sales tax system may provide data on sales by type of enterprise. Such a tax system may also

divide sales into different product categories if different tax rates are applied. It is necessary to identify which sales are indicators of household consumption: for example, sales by retailers and consumer services. The systems used to collect other taxes, such as taxes on alcohol or tobacco, may also be a potential source of information.

3.86 In addition to broad sources such as retail sales, VAT systems, and household surveys, there are a range of specific indicators for components of household consumption. The sources of specific indicators include specialized statistical surveys, major supplying enterprises, and regulators. Where there are a small number of large suppliers of a particular item but no currently published data, the information can sometimes be collected specifically for quarterly GDP. Examples could include sales to residences of electricity and gas, as well as some components of transport, communication, and gambling.

3.87 Expenditure estimates may have to be adjusted to take account of expenditure by residents abroad and expenditure by nonresidents in the domestic economy. If the information is derived from a household income and expenditure survey, then expenditure by residents abroad may have been included in the estimates. However, if the information is derived from retail sales, then adjustments would be required. The balance of payments statistics record these expenditures in the travel account as travel credits (expenditures by nonresidents in the domestic economy) and travel debits (expenditures by residents abroad).

3.88 Commodity flow methods can be used in cases where there are good data on the supply of products. Total supply to the domestic market at purchasers' prices for a product can be derived as follows:

- domestic output at basic prices,
- *less* exports,
- *plus* imports,
- *less* changes in inventories,
- *plus* taxes on products,
- *less* subsidies on products, and
- *plus* trade and transport margins.

3.89 This method would provide the most reliable estimates if calculated at the most detailed product level, which would facilitate the exclusion of goods identified as intermediate goods (such as raw materials to be used in manufacturing) and capital goods. It is recognized that some of these products may have dual purposes as consumer goods and intermediate/capital goods. Thus, reasonable ratios should be applied to identify the consumer goods. Likewise, some products that may be identified as consumer goods may also have multiple purposes as intermediate goods or capital goods and reasonable adjustments should be made. For example, a motor vehicle purchased by a household for use as household transportation would be classified as a consumer product. The same make and model of vehicle, if purchased by an enterprise, would be classified as capital goods. In some countries, the merchandise trade statistics may classify the imports according to the importer and based on the importer, the compiler may be able to determine whether some products that have a dual purpose will be used in production or are available for household consumption.

3.90 The commodity flow method can be particularly useful for goods because goods are often supplied by a relatively small number of producers and importers, and data on the supply of the goods are easier to collect than data on sales at the retail level. Where a significant part of retailing is informal, surveys of retailers are likely to have incomplete coverage, so the commodity flow method could provide more suitable indicators than a survey of retailers.

Volume Indicators

3.91 Data on consumption of dwelling services can be estimated by extrapolation on the basis of the number of dwellings. If construction data do not allow estimates of the net increase in the number of dwellings, population could be used as a proxy (preferably adjusted for any trends in the average number of persons per dwelling). Because of differences in the average rental per dwelling, the quality of the estimation would be improved by doing separate calculations by location and for different dwelling types (e.g., house/apartment or number of bedrooms). It would also be desirable to put in an adjustment factor to account for any shortcomings in this method (e.g., for long-term changes in the size and quality of dwellings). These factors should be accounted for annually so that their effects can be incorporated in the quarterly GDP by the benchmarking process. Because the stock of

dwellings is large and changes slowly, acceptable estimates can be derived for dwelling services, even in the absence of quarterly volume indicators. The methods used should be consistent with those used in the production estimates.

3.92 Indicators for some services, such as insurance, education, and health, may be obtained as a by-product of government regulation. In addition, motor vehicle regulation may provide indicators for the volume of vehicle purchases. The components to be included are household purchases of cars and other light vehicles, both new and secondhand, from businesses and governments.

3.93 Administrative data may help fill other gaps. For example, units engaged in providing financial services, medical health activities, and gaming activities (e.g., casinos, lotteries, and fantasy sports betting) are often highly regulated. As a result, indicators may be published or available from the regulatory authorities. Other administrative data can be used as indirect indicators. For example, numbers of court cases and wills in probate are potential indicators for legal services, numbers of deaths for funeral services, and total numbers of vehicles and numbers of road accidents for vehicle repairs. In each case, a direct survey would usually be better but may not be justifiable on a quarterly basis because of the data collection cost and the relatively small size of the activity.

3.94 Consumption from the own production of agriculture can be quite important in some countries. Depending on the method of estimation used, estimates of agricultural output may include own production, so there may be no need to identify the consumption separately. However, the methods used to derive household consumption may not distinguish between household consumption from own production and consumption of agricultural products acquired from other producers. The methods should be consistent with those used in the production estimates. The estimates may be based on household consumption of domestic production of agricultural output using information from household consumption surveys, food consumption (calorie intake) surveys, or poverty surveys. These methods do not provide adequate volume indicators; therefore, in the absence of quarterly surveys of subsistence production, population trends may be an acceptable indicator.

Price Indicators

3.95 The components of the CPI are appropriate deflators for household consumption. Deflation should be carried out at a detailed level to ensure that each component is deflated by the price index that most closely matches its actual composition. For example, it would be better to deflate each *Classification of Individual Consumption According to Purpose* (COICOP) class of food separately to account for different price movements. National accounts compilers should work closely with price statisticians to have consistent classifications and coverage of all required components. There may be gaps where a component of expenditure is not covered by a matching CPI item. An example is insurance services, which are measured as margins in the national accounts but which may be measured as total premiums in the CPI or, in some cases, may be excluded from the CPI altogether.

3.96 For expenditure by residents abroad, some compilers have used as deflators the CPIs of the main countries visited by residents, adjusted for exchange rate changes. However, the expenditure patterns of travelers (whether residents visiting abroad or visitors to the compiling economy) are different from that of residents. Therefore, the use of the overall CPI may provide biased estimates. For example, housing carries a significant weight in the CPI of many countries; however, this item is not expected to be a component of expenditure of visitors. If available, it would be preferable to obtain specific indices for the most relevant components of expenditure by visitors: for example, paid accommodation, transport, purchased meals, or any particularly important categories of goods. Likewise, expenditure of nonresidents could be deflated by the domestic CPI items that relate to the major components of tourist expenditures, such as paid accommodation, transport, meals, and so on.

Government Final Consumption Expenditure
Value Indicators

3.97 Government accounting data are often available on a monthly or quarterly basis. Even if not published, the data may be available on request. Data for the central government are generally readily available. In some cases, lack of data or delays may require estimation for state, provincial, or local government. In the absence of comprehensive data, consideration can be

given to alternative indicators that relate to the actual level of activity in the quarter, such as the following:

- a sample collection for local governments,
- wages paid by the governments concerned (preferably excluding those involved in own-account capital formation such as road building),
- expenditure data classified or not by economic type,
- central government payments where these are the major source of funds, or
- budget estimates (before forecasts are used, the track record should be checked to see whether they are reliable).

3.98 As noted previously, for many countries, the government accounts are prepared on a cash basis, whereas economic statistics should be compiled on an accrual basis. Government cash payments can be large and lumpy, and the timing of these payments may be subject to political or administrative considerations. Differences between the cash basis used and the accrual basis required by the *2008 SNA* could cause errors and discrepancies in the estimates. These errors are the same for both quarterly and annual GDP, but the impact on quarterly GDP is likely to be larger. A particular instance of a distortion caused by cash recording is where government employees are paid every two weeks. While some quarters will have six paydays, others will have seven, causing fluctuations in the quarterly data that would not be a serious issue in annual data. Also, in many cases, government contractors are paid in full after the work is completed and there may be a considerable lag between the completion of the work and the finalization of payments. To the extent that such timing problems can be identified, adjustments that are supported by evidence can be used to get closer to an accrual basis.

3.99 The links to the production estimates for general government should be noted and monitored. If inconsistent methods or data are used, errors in the residual item or discrepancies will occur. The scope of government final consumption expenditure and government output differ, in that government final consumption expenditure is equal to the following:

- general government output,
- *less* own-account capital formation included in output,

- *less* any sales of goods and services at economically significant and economically insignificant prices,
- *plus* purchases from market producers for delivery to households free or at economically insignificant prices, and
- *less* changes in inventories of finished goods and work-in-progress.

Although the same indicators can often be used for both production and expenditure, the factors causing differences between them need to be taken into account, especially if they are changing proportions of the total.

Volume Indicators

3.100 In a few cases, it may be possible to obtain quantity measures for output of government services. For example, numbers of students at government schools, numbers of operations or bed nights for patients in public hospitals, and numbers of benefit recipients served by a government social assistance office may be available. However, these indicators fail to take into account important quality aspects. Further, there are many other activities of government where output is difficult to quantify, such as public safety and policymaking.

3.101 In the absence of suitable output volume indicators, an indicator based on labor inputs may be used, such as the number of employees or hours worked. Because government consumption is a labor-intensive service, this is a more acceptable assumption than it would be for other expenditure components. In addition to the limitations of labor input measures for measuring production, measuring consumption is more difficult because of work contracted out to the private sector, capital work on own account, and the offsetting effect of charges for some services. Structural changes in the proportions of staff engaged in capital work, the proportions of output recovered through charges, or the proportion of work outsourced could be significant on a quarterly basis.

Price Indicators

3.102 Although current price value-added measures for government are clearly defined as being based on costs, the price and volume dimensions are less clearly defined and have several alternatives. Prices

are usually not directly observable. One option is to derive independent value and volume measures so that the price dimension is obtained indirectly. Alternatively, a deflator could be obtained as a weighted average of input costs. The usual input costs are wage indices or pay scales of civil servants and military staff, combined with relevant components of price indices reflecting typical input costs such as rents, electricity, stationery, and repairs.

3.103 Methods based on input costs have the shortcoming that they do not account for productivity changes. Of course, these measurement problems are the same for annual and quarterly estimates. For the QNA compiler, the simplest solution is usually to adopt the annual method and allow the benchmarking techniques to incorporate any adjustment factors.

Final Consumption Expenditure of Nonprofit Institutions Serving Households
Value Indicators

3.104 Much of the discussion on measurement of government consumption also applies to NPISHs. Like general government, their output and consumption of nonmarket services at current prices are measured at cost. However, quarterly accounting data are less available than for general government although data for some larger institutions may be published or available on request. Governments may be a good source of indicators if they monitor, regulate, or provide transfers to charities, private schools, and similar institutions. Otherwise, since NPISHs are mainly involved in services, wages and salaries paid may be an acceptable substitute. Balance of payments data on transfers to nongovernment institutions may be an important indicator in countries where foreign aid is a major source of funding for NPISHs.

Volume Indicators

3.105 Labor input measures may be suitable indicators. If data are unavailable and the NPISHs sector has been shown to be economically stable in annual data, past trends may be an acceptable volume indicator. The method for the expenditure estimates should be consistent with that for the equivalent production estimates.

Price Indicators

3.106 The methods are similar to those used for general government consumption, where output at current prices is also defined as the sum of costs. A weighted average of input costs may be used for consumption by NPISHs so that the deflator corresponds with the composition of the current price value measured from input costs. Items could include wages, rents, repairs, stationery, and electricity.

Gross Fixed Capital Formation
General Value Indicators

3.107 The *2008 SNA* classifies gross fixed capital formation by type of asset. For many countries, largest components are buildings (dwellings and other buildings and structures), and machinery and equipment. It also includes weapons systems, cultivated biological resources, and intellectual property products. Research and development, irrespective of whether or not it is successful, is considered gross fixed capital formation. Costs associated with the purchase of fixed and other assets are also included, such as transfer costs (including real-estate agents' commissions, legal fees, and taxes on real-estate purchases), architects' fees, and installation costs. In addition to purchases, own-account production of capital can be important in some cases, including construction, computer software, and legal work.

3.108 Annual and quarterly business surveys of capital expenditure are the conceptually preferred sources of data on capital formation, excluding dwellings. However, capital formation surveys are particularly expensive and difficult to conduct on a quarterly basis for the following reasons:

a. Such surveys are very sensitive to coverage problems in the business register because new enterprises, which may not yet even be in operation, are particularly likely to have higher rates of capital formation than established businesses.

b. The potential population is almost every enterprise in the economy, and there will be a large number of enterprises having little or no capital formation in any particular quarter. As a consequence, the sample frame needs frequent updating and the samples have to be relatively large.

c. Product splits are also more difficult to obtain than from the supply side.

d. Another issue that may be the source of some difficulty in estimation is that the *2008 SNA* includes work done on contract as capital formation of the final purchaser at the time it is done, while only progress payments will be known to the purchaser. If possible, it would be desirable to compare data from the alternative indicators for construction and equipment noted in this section.

3.109 VAT returns may not separate capital and intermediate purchases but where a VAT system requires capital and intermediate purchases to be split, a useful indicator of capital formation can be obtained. However, the VAT system lacks a product split and excludes work on own account. The lumpiness of capital formation may assist in identifying enterprises undertaking capital formation during the period and provide the basis for generating a split at the level of individual enterprise.

3.110 Commodity flow methods may provide an estimate of the gross acquisition of fixed assets; however, the compiler would have to obtain data on disposals from another source. For the total economy, the disposals would constitute assets acquired by nonresidents. The exports statistics would therefore constitute a useful source of information. Quarterly income tax records and quarterly financial statements of enterprises may also be useful sources.

Components of Gross Fixed Capital Formation

Buildings (Including Dwellings) and Other Structures

Value Indicators

3.111 Gross fixed capital formation on buildings and other structures includes the value of output of construction activity, including own-account construction as a secondary activity, and the cost of ownership transfer on the acquisition of the asset. It excludes the value of maintenance and repair.

3.112 Construction is often difficult to measure because of the large number of small-scale contractors, own-account work, and work done without permits. Further, many of the contractors remain in business

for a relatively short period; therefore, it is difficult to get an accurate count of how many may be in operation during a given period. The supply of building materials, on the other hand, can often be obtained from imports statistics and a relatively small number of producers of construction materials and quarries (with adjustments for exports and imports, if applicable). To the extent that there is a stable relationship between building material inputs and output, this is a suitable indicator that can be obtained with relatively little cost or compilation time. The quality of the assumption deteriorates if there are changes in any of the mix of types of building, techniques of building, productivity, and inventories of building materials. If changes in these factors are known to be occurring, it may be desirable to explore more complex methods (e.g., a calculation that takes into account the different products used by different types of construction or collection of data on inventories).

3.113 The estimation of gross fixed capital formation on buildings and other structures raises a number of special measurement issues and problems, such as the following:

- *Large numbers of small enterprises:* Construction is typically carried out by numerous enterprises that are often small and informal. Therefore, data collection and obtaining sufficient coverage of these enterprises may be particularly difficult.

- *Projects with long gestation periods:* The length of construction projects gives rise to the issue of the allocation of output to the relevant quarters and hence the estimation of work-in-progress. This issue is addressed further in Chapter 11.

- *Subcontracting:* Work is often arranged by a prime contractor with a number of specialized subcontractors, which means that several enterprises may be involved in the same project, giving rise to the possibility of double counting or omissions.

- *Speculative construction:* Where the work is undertaken by a developer with no final buyer, the price is not known at the time that the work is done. In addition, land costs are included in the price, and holding gains and operating surplus are mixed together (*SNA 2008*, para. 6.140).

- *Construction exports and imports:* Construction undertaken by resident contractors/enterprises

(and not a branch office) in another economy (exports of construction) should be included in the estimates. Information on this activity may be available from the surveys of construction companies; however, these estimates will not be captured through commodity flow methods. Likewise construction imports may not be captured through the business survey and the compilers should be careful to exclude these estimates from the commodity flow estimates. Information on construction exports and imports may be obtained from the balance of payments compilers. However, some construction projects undertaken by a resident contractor overseas may give rise to a branch. This may be the case for major projects (such as bridges, dams, and power stations) that take a year or more to complete and that are managed through a local site office (branch) in that economy (*BPM6* para. 4.27 and para. 4.29). This output is considered part of the output of the economy where the branch is located. Activities undertaken by a branch of a resident enterprise is not considered part of the output of that enterprise.

3.114 These problems apply to the corresponding estimates for construction industry by the production approach as well. They also apply to annual data, but quarterly data are more sensitive to the slowness or high cost of data collection and more subject to difficulty allocating the value of long-term projects to quarters.

3.115 Gross fixed capital formation on buildings and other structures can be measured using various data sources or a combination of the following:

- supply of building materials,
- issue of government permits for particular projects,
- data reported by construction businesses,
- data reported by construction-purchasing businesses, and
- data reported by households engaged in own-account construction.

3.116 In many countries, construction requires permits from local or regional governments, and the permit system can be used as a source for estimates of construction in the national accounts. The permit system may cover only larger projects or urban areas, while in other cases it may cover all except minor construction work. Permits usually show the type of construction, value, size, proposed start and end dates, and the name and address of the owner or builder. If the data are in volume terms only (e.g., floor area—number of square feet or meters) or the value data are of poor quality, then an average price per unit is also necessary to derive current price values. Data in this form need to be allocated to the relevant period, usually with information from builders, regulatory authorities, or engineers in order to obtain average construction times for each building type.

3.117 It is also necessary to make adjustments, to the extent practical, to account for projects that do not go ahead (realization ratio), biases in builders' estimation of their costs, the effect of holding gains included in prices, and the proportion of projects that are carried out without a permit. Government decisions, other official channels, or newspapers may be used to identify large-scale projects that may not be captured through the permits process. These may include the construction of airport terminals, power plants, water treatment facilities, and so forth. These projects should be considered separately because the input–output structure is likely to be different. Information on the cost and inputs may be obtained from the relevant government department or the contractors.

3.118 One drawback of this approach is that the timing indicated in the permit may not match the timing of the project because there may be delays in project execution. In some countries, the unit undertaking the construction is expected to report on the expected date of construction if there is a change. However, this stipulation may not exist in all countries.

3.119 The approval process can also be used to identify construction projects that could then provide the frame for a sample survey. Direct information about the project, such as the value of work done each quarter and changes from the original proposal in the cost or size or starting/ending dates, can be collected in such a survey. Using survey information prevents the need for making the kind of assumptions that have to be made when permit data are used directly. The survey method is conceptually much closer to statistical requirements, but it is more expensive and time consuming to perform. The usefulness of the survey is

also limited by the degree of sophistication of builders' accounting records about the value of work done in the period. In practice, the value of work done may have to be represented by progress payments.

3.120 The *2008 SNA* notes that when a contract of sale is agreed in advance for the construction of buildings and structures, spreading over several periods, the output produced each period is treated as being sold to the purchaser at the end of each period: that is, as a sale rather than work-in-progress. In effect, the output produced by the construction contractor is treated as being sold to the purchaser in stages as the latter takes legal possession of the output. It is therefore recorded as gross fixed capital formation by the purchaser and not as work-in-progress by the producer. However, in the absence of a sale contract, the incomplete output produced each period is recorded as work-in-progress of the producer. Construction undertaken without a contract of sale raises special issues regarding valuation and timing. For practical purposes, it may be recorded as gross fixed capital formation rather than work-in-progress. For example, if a commodity flow method is used to estimate construction, it would not be possible to identify how much is undertaken with a contract for sale and how much without.

3.121 Ultimately, the net effect on GDP of the different treatment of contract and speculative construction should be nil, since they cause offsetting differences in gross fixed capital formation and changes in inventories. However, if it is decided to include unsold construction work in gross fixed capital formation, there is a valuation issue in that the estimated price may differ from the realized price. If unsold construction work is shown as changes in inventories, there needs to be a valuation adjustment to make the withdrawal from inventories consistent with the gross fixed capital formation. When the contract calls for progress payments, the value of the output may often be approximated by the value of stage payments made each period.

3.122 Construction in rural areas in developing countries may sometimes be carried out by households on their own account and made with their own labor, outside the scope of official permits. A household survey may provide information on the numbers of households involved and the cost of

materials. These results would need to be adjusted to an estimated market price by taking the equivalent market prices (if such a market exists) or a shadow price based on costs (including labor). Usually, these indicators would only be available for a benchmark period and not on a quarterly basis. The building material approach captures some of this activity to the extent that a significant proportion of materials is produced by factories, although some materials may be made by the household. In the absence of other data, the size of the rural population could be used as a quarterly indicator for this type of construction.

3.123 It is desirable to obtain data on gross fixed capital formation of construction by type of asset, both for economic analysis and for improving deflation. Data by the industry and institutional sector of the purchaser are also useful for analysts. The estimates based on building materials give little or no breakdown, while other estimation methods can give more. In some cases, the general government sector data could be obtained from the government finance statistics, allowing the nongovernment component to be derived as a residual. Because residuals magnify the effects of errors, implausible values of the residuals may point to data problems.

3.124 Both the estimates of gross fixed capital formation and output will often be derived from the same data sources. However, the estimates will differ because the following items are treated differently:

- repairs (part of output; however major repairs and renovation are treated as fixed capital formation);
- secondary activity (secondary construction by establishments outside the construction industry is part of capital formation, while establishments may have secondary activity in producing other goods and services);
- speculative construction (output and inventories of the industry when the work is put in place); and
- associated expenses, such as nonconstruction goods included in a structure and architectural, legal, and approval fees (which are not part of construction output, but are fixed capital formation), or the effect of any product taxes and subsidies.

Volume Indicators

3.125 Data on the supply of building materials may be the most readily available construction volume indicator. Whereas the number of builders may be large and their activities dispersed, building materials are often produced and supplied by a relatively small number of large factories, quarries, and sellers. Data on exports and imports of building materials are also generally available and may be important for some kinds of building materials in some countries. Therefore, measures of the total supply of building materials or selected major building materials to the domestic market can be obtained as output plus imports less exports. Preferably, trade, tax, and transport markups would be taken into account, to the extent that they have changed or that differential markups affected the weights of different components. A lag factor may be included to take into account the time it takes for materials to get from the factory (local production) and customs frontier (imports) until they are incorporated in construction work.

3.126 This method provides comprehensive coverage of construction as it also covers informal activity in construction. The limitation of this indicator is that it assumes a stable relationship between building materials and output. The assumptions may not be stable because different kinds of construction work use different materials and have different materials-to-output ratios. Thus, when the mix of construction projects changes, the materials-to-output ratio would also change. For example, the construction of a water dam or other major public sector project would alter this ratio and this effect could be quite pronounced in smaller economies. In that case, it may be useful to consider the large projects separately.

3.127 Building permit systems may provide volume indicators such as floor area. However, there is an interval between the permit's approval and the start of construction. This interval is not always known and if estimated for a given period, may fluctuate over time due to changes in demand for construction, supply of materials, and seasons.

Price Indicators

3.128 Because each construction project differs, compiling a price of construction presents special difficulties.

Three alternative methods that are used to derive construction price indices are

- model specifications,
- hedonic techniques, and
- input costs.

3.129 One method of obtaining output prices is to collect or derive hypothetical prices for construction output. House builders may have standard models of houses that are offered. Although options and individual circumstances mean that the model is not implemented in every case, it can still form the basis of the builder's pricing, and it would be relatively easy to obtain quotations from the builder for the standard model on a consistent basis. However, standard models are usually only found for dwellings, where a mass market exists, but not for other types of construction. Another approach to model specification is to divide construction into a number of particular tasks: for example, painting a certain area of wall, laying a certain height and type of brick, and cost per hour of electrical work. A weighted total of each of these components could be used to represent overall prices for a particular type of construction. A possible shortcoming is that the most difficult jobs might be omitted, such as the prime contractor's organizational work and unique, large-scale engineering tasks. Construction is usually highly cyclical, with margins cut or increased in line with conditions. Because the prices are hypothetical, the statistician needs to be careful if list prices are being reduced by discounts or bargaining during a recession or if more is charged during a busy period to cover overtime costs.

3.130 Some countries have explored the use of hedonic techniques to measure prices of one-off goods. In addition to collecting the prices of a range of buildings, these countries also collect data on characteristics of the building that affect the price (such as floor area, height, fittings, materials, and location). A regression model is then developed to identify the effect of each characteristic on the price. This allows the prices of the different kinds of buildings to be converted to a standard basis and, hence, allows a price index to be derived. This method requires a great deal of work in data collection and analysis of data. A limitation is that characteristics may be too numerous or abstract to be quantified, so the model

would only explain a limited part of the price variation. Also, the coefficients of the model may not be stable over time.

3.131 Input cost measures are based on the prices of construction materials and labor. These should include building materials (from a producer price index) and wages (preferably specifically for occupations employed in construction). An adjustment could also be made for changes in markups to account for builders' operating surplus and mixed income, if indicators were available, because these represent a major part of the price and could be quite variable. Data on intermediate consumption by product supplied to the construction industry would be required for a benchmark period. Use tables could present these data or they could be obtained directly from surveys of construction enterprises. Otherwise, it would be necessary to seek expert advice or a sample of bills of quantities for building projects. Data on employment in construction by type of employee (occupation groups) would also be useful for weighting the labor cost part of the index. Because of different input structures, it would be desirable to compile separate indices for different types of building and construction (i.e., houses, apartments, offices, shops, etc.).

3.132 Generally, it is desirable to avoid using input costs to represent output prices, because input costs ignore changes in productivity and profitability. However, the input cost method avoids the difficulties of obtaining an output price index for heterogeneous products. Many types of construction are one-off, and even where the same model is used in different places, differences in soil type, slope, or options mean that it is not possible to find exactly comparable observations. Finding actual buildings that are representative and consistently priced is close to impossible.

3.133 In practice, countries may often use a mix of different pricing measures for the different types of construction. In situations where independent volume and value indicators are available, it is beneficial to derive an implicit price per unit to check that the result is plausible. Erratic results may mean that one of the indicators is unsuitable (e.g., the implicit deflator may fluctuate because of quality changes that were not taken into account in floor area data used as a volume indicator).

Machinery and Equipment

Value Indicators

3.134 The five sources for measuring equipment, reflecting the stages along the distribution process, are the following:

a. survey data on supply of machinery and equipment,

b. survey data on purchases by enterprises,

c. VAT data on purchases,

d. registration and licensing of transport equipment, and

e. imports statistics.

3.135 The supply of machinery and equipment may be estimated using the commodity flow method. The supply of goods should exclude goods purchased by households and exports of domestic production. It may be difficult, but an adjustment should also be made for goods entering inventories and goods leaving inventories and acquired by enterprises. Relevant taxes, trade margins, transport margins, and installation costs should also be applied to the supply of domestic production and imports. In addition, adjustments should be made for disposals through sales to nonresidents (considered exports) and sales to households (considered fixed capital formation of household as producers or household final consumption expenditure).

3.136 Data from the supply side provide totals and splits by asset type, but not estimates by industry or institutional sector of use, which are of analytical interest. Like construction, government finance data could be used to obtain government capital formation of equipment, and then a private total could be calculated as a residual.

3.137 Transactions in secondhand goods present some additional issues. Some sources may only provide data on new products. Data on some secondhand components—such as government asset sales, goods sold or purchased internationally, or vehicles—may be available. Data in some cases may not need to be collected if the transactions are small, stable, or occur within a single component.

Price Indicators

3.138 Machinery and equipment is a heterogeneous group, so quantities are meaningless and indicators

based on quantity should be avoided. Data derived from a survey of equipment purchases are at purchasers' prices. Components of the PPI and import price index could be weighted and used as a proxy. However, PPIs are derived at basic prices and exclude margins and some taxes. It would be desirable to make adjustments if trade, transport, and tax margins were known to be unstable. The most likely instance is taxes, where information on tax rates to adjust basic/producer prices for taxes on products including VAT would generally be available. Similarly, import price indices are typically measured at the point of arrival in the country rather than the point of final purchase, and thus exclude domestic trade, transport, and tax margins.

3.139 If the equipment data had been derived from the supply side, the current values for domestically produced goods would have been reported at basic or producers' prices. If so, the best method would be to develop volume indicators by deflating the supply values of domestically produced equipment by the relevant PPI component. As the value and price measures would be consistent, it would be expected to be a superior volume indicator to one derived from value and price measures that were based at inconsistent pricing points.

3.140 Imports are a major component of capital formation in many countries. Import unit values would be expected to be poor indicators of prices. If no import price index is available for some or all types of equipment, a solution may be to take advantage of the producer price or export price indices of the main equipment-supplying countries. These should be obtained at a detailed level so that the components can be weighted to reflect the composition of imported equipment in the importing country. The data should also be adjusted for exchange rate movements and lagged to account for shipping times, if the lag is substantial and if it is possible to identify the lag period. It is possible in practice that the effect of exchange rate changes is lagged or smoothed by forward exchange cover and by squeezing or expansion of margins. Further, because of changes in exchange rates and international specialization in types of equipment, prices of imported and domestically produced equipment may behave differently.

Intellectual Property Products
General Issues

3.141 The *2008 SNA* has introduced a new category of gross fixed capital formation that comprises many of the items under the previous category of intangible assets. The measurement of intellectual property products raises a range of conceptual issues such as the identification of originals, transactions in licenses versus transactions in copies, and licenses to use versus licenses to reproduce. In most cases, these conceptual issues determine whether the transaction is considered capital formation or (intermediate or household) consumption. The effect of incorrect inclusion or classification of these transactions would be magnified in the quarterly accounts.

Value Indicators

3.142 The estimates could be made on the supply side or the demand side, but the approach used would depend in part of the category of intellectual property products being considered.[8]

3.143 *Research and development and mineral exploration and evaluation:* In many cases, the enterprises engaged in these activities would be limited and known. If significant, a survey could be considered. For example, in countries where mineral exploration is important, a specific survey on the topic would be justified. The value data may be derived through quarterly or annual surveys that request information on the intentions of the enterprises during the upcoming quarters. Administrative data may also provide some useful information in terms of permits and licenses for research or mineral exploration.

3.144 *Computer software and databases:* Although all businesses may use software and databases, only a few may acquire these items as gross fixed capital formation. A demand side approach is further complicated by the fact that capital expenditure on this category may be lumpy and may not occur in every quarter. Quarterly surveys may therefore focus on the large enterprises. Supply data on domestic production may be easy to collect because of the

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[8]The *Handbook on Deriving Capital Measures for Intellectual Property Products* (OECD 2010) provides detailed guidance on deriving value and volume estimates of intellectual property products.

relatively smaller number of businesses involved, but data on imports would be much more difficult and inaccurate. Software transferred on physical media constitutes only a proportion of total software and the value of the software may not be accurately recorded in the merchandise trade statistics. In addition, not all software acquired by businesses is to be considered gross fixed capital formation—some of it may be intermediate consumption. Likewise, a substantial proportion of computer software is for household consumption. Some computer software/applications and databases may be produced on own-account by enterprises for their own use. Quarterly income tax records and quarterly income and financial statements are useful sources of this kind of expenditure.

3.145 *Entertainment, literary, or artistic originals:* These activities may not be very important in some economies but where they are, the information could be collected through quarterly or annual surveys.

Price Indicators

3.146 The *2008 SNA* notes that intellectual property products are not well covered by available price indices partly because they may be produced for own use and may not have comparable observed market prices, and partly because they tend to be heterogeneous products. Originals and copies each present their own unique challenges and should be considered separately. The *Producer Price Index Manual: Theory and Practice* provides a summary of techniques that could be used to derive price indicators for unique products like intellectual property product originals. However, it should be noted that quarterly transactions in originals of intellectual property product may not be very common.

Cost of Ownership Transfer

3.147 The cost of the ownership transfer refers to all costs relating to the acquisition or disposal of an asset. For produced assets, the cost of ownership transfer is included in the value of the asset. For nonproduced assets, the cost of ownership transfer is shown separately in gross fixed capital formation. It includes all professional charges and commissions (lawyers, architects, surveyors, and engineers), trade and transport margins invoiced to the purchaser, taxes payable on the acquisition or disposal, delivery and installation charges, and terminal costs.[9]

3.148 Architectural and approval costs are related to construction activity, so construction indicators could be used as indirect indicators if more direct data are not available. However, as some of these expenses precede construction work, their timing is different. As a consequence, the timing pattern built into construction estimates may have to be adjusted.

3.149 Real-estate transfer costs consist of items such as lawyers' fees, real-estate agents' commissions, land title transfer taxes, loan application fees and other setup costs for finance, and inspection fees. These costs relate both to new construction and to purchases of land and existing buildings (including dwellings). If these land dealings are registered with a government agency, it may be possible to obtain a quarterly indicator from this source. Data on financing of land and building purchases is a poorer indicator; an even worse indicator is the value of new construction. For real-estate transfer expenses, numbers of transfers registered with the relevant government agency may be used as a volume indicator. To take into account compositional changes, it would be better to classify by type of property (e.g., houses, apartments, shops, and complexes) and other variables that may affect the cost (e.g., by state or province if charges are different). In some cases, it may be necessary to derive a current price measure from the volume measure, which would require information about transfer tax rates, real-estate commission rates, lawyers' fees, and so on.

Changes in Inventories
General Issues

3.150 Inventories are defined as goods and some services[10] that have been produced or imported but have not yet been used for consumption, fixed capital formation, or export. This delay between supply of the product and its use brings about valuation issues.

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[9] Terminal costs are incurred at the end of the life of the asset to render the structure safe or to restore the environment. Terminal costs could be significant in the case of nuclear power plants and landfills.

[10] Inventories of services include work-in-progress on complex products such as films, computer programs, and architectural drawings that may take more than one period to complete.

Inventories appear explicitly only in the expenditure estimates. They must, however, be taken into account in both the production estimates (both output and intermediate consumption) and income estimates (operating surplus and mixed income). The valuation issues also arise in the other approaches, except where output or input measures are expressed in quantity terms for production estimates.

3.151 Inventories consist of materials and supplies, work-in-progress, finished goods, goods for resale, and military inventories. These components of inventories differ according to their stage and role in the production process. Materials and supplies are products that a unit holds with the intention of using it in production.

3.152 Work-in-progress is output that is not sufficiently processed to be in a state in which it is normally transferred to another institutional unit. It is especially important for activities where the time needed to complete a given unit of output spans more than one quarter and could exist for both goods and services. It must be recorded for any output that is not completed at the end of the period and although it is not complete, this output is transferrable to another institutional unit. It can span a wide range of products including crops, livestock for slaughter, ships, aircraft, computer software, and films.

3.153 Finished goods are part of output and are of the same form as their consumed equivalents. Work-in-progress is also part of output, but is harder to quantify than finished goods because the product is incomplete. Inventories of goods for resale—that is, goods held for the purpose of wholesaling and retailing—are neither part of output nor future intermediate consumption of the holder. Net increases in inventories of goods for resale need to be deducted from purchases of goods for resale to derive cost of goods sold and, hence, wholesale and retail margins, which are defined as the value of goods sold less the cost of goods sold. The separation of different components is important because they include different products and, therefore, the price indices to be used in deflation will also differ.

3.154 In practice, attention can be confined to those components of inventories that are of significant size. Inventories of work-in-progress may be very important for agriculture depending on the types of crops produced. However, the compiler may wish to focus on the crops produced on a commercial basis because of the practical issues associated with attempting to estimate work-in-progress for subsistence agriculture. Quarterly surveys may focus on large enterprises engaged in mining, manufacturing, and distribution.

3.155 Although changes in inventories may be a small component of GDP, they can swing substantially from strongly positive to strongly negative. Consequently, this small component can be a major factor in GDP movements. In the quarterly data, the average absolute quarterly contribution to growth can be large, often being one of the major quarterly growth factors. Over the long term, the contribution of changes in inventories to GDP growth tends to be small, because some of the quarterly volatility will cancel itself out over the year. The importance of inventories follows from its nature as a swing variable in the economy. It represents the difference between total demand (the sum of the other components of GDP by expenditure category) and total supply. An increase in inventories would represent supply that was not used during the period, while a reduction would show the amount of demand that was met from previous supply. Without these data, the expenditure estimates would show demand, not production. Data on changes in inventories are also important for analysis, because the gap between demand and supply can be an indication of future trends. For example, a decrease in inventories suggests that demand exceeds supply and output or imports will need to increase just to keep pace with the existing level of demand.

3.156 Changes in inventories present particular difficulties in terms of valuation. Businesses use several different varieties of historic cost, none of which match national accounting valuation concepts. Measurement practice also varies, from complete physical stocktakes to samples and estimates. The valuation problems are sometimes ignored but are significant, as can be illustrated with some simple but conservative assumptions: if inventories are stable, the total holdings of inventories of inputs and outputs are equivalent to three months of output, and if value added is half of output, then 1 percent of price change in inventories will amount to a valuation effect of 2 percent of quarterly value added. Thus, even quite low rates of inflation can cause a significant overstatement of

the level of value added, and this effect will be concentrated in the major inventory-holding industries. Similarly, a small increase in the rate of inflation will overstate the growth of GDP.

3.157 It is not desirable to estimate changes in inventories as a fixed ratio of another component of expenditure on GDP because inventories do not have a fixed, stable relationship with any of the other components.

Value Indicators

3.158 A number of issues arise concerning data on inventories. Some businesses may have computerized inventory controls, others have full physical stocktaking at less frequent intervals with sampling or indicator methods for more frequent measures, and some small enterprises may not measure inventories on a quarterly basis at all. The values of inventories may also be a particularly sensitive commercial issue. Valuation effects can generally be better calculated with higher frequency data. This is because higher frequency data reduce the possibility of uneven price and volume movements within the period. As a consequence, the annual sum of the quarterly valuation adjustments may be superior to annually calculated ones, unless there is some other compelling difference, such as differences in coverage or detail. Similarly, if monthly data are available, the calculation should generally be done on a monthly basis for use in quarterly estimates. These factors all need to be assessed in light of each country's conditions.

3.159 Some countries derive changes in inventories in GDP by expenditure as a residual. The residual method could be used quarterly even if the annual measures were obtained directly. This method is only feasible if there is a complete measure of GDP from the production approach and estimates are available for all other expenditure categories. However, because inventories should also be included in estimates of output and intermediate consumption, the measurement problems still need to be dealt with, even though quantity data that sidestep these valuation issues can sometimes be used. Derived as a residual, changes in inventories would also include the net effect of errors and omissions. In that light, compilers should review it carefully for signs of any errors that could be dealt with directly. As well, users

should be advised to use caution in interpreting the estimate of changes of inventories, which should be labeled as being "changes in inventories plus net errors and omissions" to emphasize the limitations. If direct data on changes in inventories are not available, a few questions could be added to the business/economic survey to determine the direction/sign of the changes in inventories: accumulation or decumulation of stocks of inputs, finished goods and goods for resale, as well as the intensity (strong, medium, or minor during the quarter). This qualitative information will be very useful to assess the residual estimates on changes on inventories.

3.160 One method that should not be used is to accept changes in inventories at book values as reported by enterprises without adjustment. Business accounting practices typically use historic costs, which result in the inclusion of holding gains in the value of changes in inventories. Quarterly income tax records and quarterly income and financial statements are useful sources of data on inventories.

3.161 *Valuation of work-in-progress:* For nonagricultural products with a production cycle of one year or less, the *2008 SNA* notes that the value of the additions to work-in-progress may be approximated by calculating the proportion of the total production costs incurred in that period and applying that ratio to the basic price realized by the finished product. This method assumes that prices and costs remain stable during the period of production. Thus, the value of the output of the finished product is distributed over the accounting periods in which it was produced in proportion to the costs incurred in each period. However, this method may not be satisfactory for agricultural products because a disproportionate share of the costs may be incurred during the sowing season with little, if any, costs being incurred until harvest.

3.162 Prorating the output to the physical growth of the crop may be considered a possibility, but in cases where there is serious risk of climatic damage just before the crop is harvested, this may give over-optimistic indications of probable output. Pragmatic distributions over quarters based on experience may have to be used, or where multi-cropping is the norm, to allow the whole output of each crop to be counted in the period when it is harvested.

Volume Indicators

3.163 Inventory data may be available in quantity terms for some products held by some enterprises. Because inventories include almost every type of goods (as well as a few kinds of services) and firms typically use a range of products (especially their inputs), this solution cannot be implemented comprehensively. However, it may be available for some of the major components of inventories, such as major agricultural commodities, oil, or some minerals (these goods have the most volatile prices and inventory holdings may be large). With quantity data, valuation problems can be sidestepped by directly revaluing the change in the quantity over the period by the base year average prices (volume measures) and average prices of the period (current price measures). The result will be an estimate of the value of the physical change in inventories. At current prices, this is only an approximation of the *2008 SNA* concept, which also includes adjustments for all valuation changes that occur between the time of production and the time of final expenditure. The two concepts will be the same if price changes and transactions are spread evenly over the quarter.

Price Indicators

3.164 Price indicators used may be based on the composition of the inventories, making use of CPIs, PPIs, trade prices, and average prices for specific commodities. The opening and closing levels of inventories (never the change in inventories) should always be deflated. If inventories are usually valued at historic cost, prices of several preceding periods may be relevant.

Valuables

3.165 Valuables cover a wide range of products that may be held for their intrinsic value, such as precious metals and stones, antiques, and other art objects among others. Surveys of enterprises are likely to provide most accurate data on the value of these transactions. Supply side methods are likely to understate the value of these items and this method of estimation should be avoided in this case. Merchandise trade statistics may record only the production value and not the market value of the items that are considered valuables. For example, for rare coins held for their intrinsic value, the merchandise trade statistics would only record the value of the stamped metal.

3.166 Many statistical agencies do not develop price indicators for valuables because of the inherent difficulty of deriving such indicators and the relative size of this component of GDP. Quarterly income tax records and quarterly income and financial statements are useful sources of inventories.

Exports and Imports of Goods and Services

Value Indicators

3.167 The concepts and definitions in the sixth edition of the *Balance of Payments and International Investment Position Manual* (*BPM6*) are consistent with that of the *2008 SNA*. Therefore, if the balance of payments statistics are compiled according to the *BPM6*, then no further adjustments to the value estimates may be required as the merchandise trade data should have been adjusted to *BPM6* basis. The main source of data on exports and imports of goods is the IMTS compiled through special report forms completed by importers and exporters. Some countries may also compile data on imports and exports through surveys of enterprises engaged in foreign trade or through international transactions reporting systems. Services data are typically derived from specific surveys, administrative systems, and international transactions reporting systems.

Price Indicators for Goods

3.168 Customs and other trade data systems usually collect quantity information (e.g., kilos and liters) and some countries compile unit volume and unit value indices directly from the information included on customs declarations. The unit values and volumes at the most detailed level of classification are combined to derive aggregate indices using weights from the value data.[11] These indices possess various weaknesses that make them unsuitable for use as price and volume indicators. Trade statistics—even at the most comprehensive level—are compiled by product group and not individual products. Thus, a given group will include products of varying specifications and quality. Unit

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[11] The *Export and Import Price Index Manual: Theory and Practice* (ILO and others 2009) presents a more comprehensive assessment of the errors and bias in the use of unit value indices.

values are derived by dividing the value of imports or exports for a given product group by the quantity for that group. The result is that the index may be affected by changes in the mix of products comprising that specific product group, making it difficult to isolate the underlying price changes from changes in quality. For example, the specific trade classification, group of motor vehicles for the transport of persons would include motor vehicles with varying accessories that could result in substantial differences in the price. This anomaly will affect the reliability of the volume estimates of trade or intermediate inputs that may be derived using these statistics.

3.169 Unit value indices may be used for some homogenous products such as oil and gas or where quality variations may be minimal or no measurable for deriving price indices, such as some primary commodities.

3.170 Some countries compile import and export price indices using price quotes of exports and imports. These quotes are collected from businesses in the same way as the PPI. Import and export price indices do not possess the same weaknesses as unit value indices and provide more accurate measures of prices and volumes.

3.171 Components of these indices can also be used to deflate the current price value data at the most detailed level to derive volume measures. The price indicators should be consistent with any adjustments for transfer pricing in the value data.

3.172 A price index is a better way of dealing with heterogeneous products than is a unit value index. The price index approach of identifying products with fixed specifications and transaction conditions for each product allows price effects to be isolated. However, developing and maintaining a trade price index system could be costly and has the disadvantages of high respondent burden. Also, the actual transaction prices that make up trade may be affected by factors such as the mix of prices from contracts made at different times and the effects of foreign exchange hedging. These effects may not be easy to capture in a price index.

3.173 In some cases, neither unit value indices nor price indices may be available. In these cases, a solution may be to use price indices from other countries.
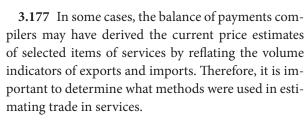
In the case of imports, the export price indices of the main supplying countries can be used. If export prices are not available for some supplying countries, a producer price index may be an acceptable substitute, although factory gate prices are less relevant than export prices. Preferably, the indices would be obtained at a fairly detailed level so that different imported products could be deflated separately to reflect the actual composition of trade, rather than the fixed composition used in the indices of the supplying country or countries. It would also be desirable to obtain price index data from several of the main supplying countries, in order to take into account different composition and price pressures. The price indices should be adjusted for exchange rate movements between the currencies of the supplying countries and the importing country. If the source of the trade is remote, it may be desirable to allow a lag to account for shipping times (e.g., if shipping takes two months, the January export price represents the March import price).

3.174 For exports, the components of the PPI relevant for exports of goods may be used. For minerals and major agricultural commodities, world prices may be used to derive an index.

3.175 Imports are deducted from total expenditure to derive domestic output. In other words, the imported component of each type of final expenditure and intermediate consumption is excluded from total expenditure to derive the expenditure on domestic output. It is therefore highly desirable that the deflation of imports and the imported components in the corresponding other expenditure categories be as consistent as possible, so as not to create inconsistencies that lead to errors in total GDP. For example, different deflation methods for imported capital equipment in capital formation and imports could generate differences in data that would affect GDP.

Price Indicators for Services

3.176 Price or volume indicators may be available for various types of exports and imports of services, although overall indices for international trade in services may not be available. The indicators for exports of services may be similar to that used to estimate value added by type of activity; however, in some cases, such as travel, new indicators may be required.

3.177 In some cases, the balance of payments compilers may have derived the current price estimates of selected items of services by reflating the volume indicators of exports and imports. Therefore, it is important to determine what methods were used in estimating trade in services.

3.178 In other cases, other price indices may be relevant. Hotels and transport components of the consumer price index may be relevant to travel service exports, while prices of hotels and transport in the main destination countries may be relevant to travel service imports (adjusted for exchange rate movements). Price indices and implicit price deflators from particular industries in GDP by the production approach (exports) or from the supplying country (imports) may be useful. In the case of FISIM, the deflated value of loans and deposits may be used, as discussed under the production approach.

GDP by Income Category

General Issues

3.179 The income approach is not as widely used as the two other approaches for estimating quarterly GDP, partly because the required data, which may be derived on an enterprise level, may not be readily available on a quarterly basis as the relevant financial records may only be compiled annually. In addition, income components do not have price and volume dimensions and GDP by the income approach may only be estimated at current prices. GDP by income category represents the items of the generation of income accounts; therefore, it is possible to present the accounts by institutional sector. The estimates according to the income approach comprise the components of compensation of employees, operating surplus, mixed income, and taxes less subsidies on production and imports.

3.180 Income data provide a useful perspective on the distribution of income from GDP: for example, looking at compensation of employees and operating surplus as a proportion of value added for the nonfinancial corporations sector. The income approach requires that, at a minimum, businesses have quarterly data on, depreciation, and net interest payable, so that the availability of data on business incomes determines whether independent quarterly income estimates are developed. The data could be particularly important in analyzing issues such as rates of return and profitability. The income approach is potentially useful as an alternative measure of GDP if the other approaches have serious data problems: for example, if IO ratios in production data are known to be changing rapidly with the business cycle.

3.181 Benchmark data for the income approach can be compiled in two ways. The income estimates can be compiled in the same way as value added in the production approach—that is, from goods and services produced less goods and services used—with the additional step of using expense data to split value added among compensation of employees, net taxes on production, and the residual, namely, operating surplus/mixed income. As for the production approach, getting this information is not usually feasible in a quarterly context. Alternatively, income estimates can be built up from the primary income components. This method is viable in some countries on a quarterly basis using profits, interest, and depreciation as indicators.

3.182 In the absence of an independent estimate of GDP from the income side, an income split can usually be derived with one category as a residual. Such data are as analytically useful as the full approach. Operating surplus/mixed income is always the residual in countries that use this method, because it is the most difficult component to measure.

Value Indicators

Compensation of Employees

3.183 Compensation of employees has two main components: (a) wages and salaries in cash or in kind and (b) social contributions payable by employers. The major indicators may be derived from the following sources:

- administrative data from income tax, payroll tax, or social security;
- business surveys of employment; and
- household income and expenditure surveys.

Where government regulates employment, clear definitions of employment and data are usually readily

available. The data may refer to total compensation of employees paid or received, but an industry or institutional sector split may also be available.

3.184 Pension fund contributions and other social contributions paid by employers are also included in the definition of compensation of employees. However, pension payments received by households are not compensation of employees, although these payments may be recorded as such in cases where government accounts are compiled on a cash basis. Data on social insurance programs administered by the government may be readily available, but data are less likely to be available for private programs, where they would need to be collected by surveys or derived indirectly based on the information on wages and salaries.

3.185 Wages and salaries in kind cover goods and services provided to the employees without charge or at reduced prices. It also includes the value of interest foregone when employers provide loans to employees at reduced or zero interest rates, as well as employee stock options. In terms of goods and services, it may not always be possible to distinguish between wages and salaries in kind and intermediate consumption. Ideally, quarterly source data should also cover these items. If some items are not available, and especially if these items are small and stable, use of the available items to indicate the unavailable ones will be quite acceptable (i.e., an implicit ratio adjustment through benchmarking the quarterly data to annual data that include these items). However, the larger or more volatile they are, the stronger the case for collecting additional data to record them separately.

Operating Surplus

3.186 An indicator that approximates gross operating surplus can be derived by adding operating profits, net interest payable, and depreciation. These kinds of business accounting data can potentially be collected directly from businesses by surveys.

3.187 Profits data should be collected with definitions as close as practical to national accounts concepts. Operating profit in the business accounts is closer to the national accounts concept than some bottom-line profit measures, to the extent that it

excludes one-off items such as capital gains, foreign exchange gains and losses, and insurance claims. It should also exclude income from the operation of other enterprises: that is, profits received as dividends from subsidiaries and holdings of shares. The *2008 SNA* does not consider provisions for bad debts as being transactions, so these should be added back. In a quarterly context, some adjustments may need to be made implicitly through benchmarking an incomplete quarterly indicator to the more comprehensive annual data. Business accounting measures of profits include the effect of price changes from inventories, which should be excluded in national accounts measures. (The adjustment would be the same as the corresponding adjustments made to the production and expenditure estimates: i.e., the inventory valuation adjustment.)

3.188 Net interest accrued and depreciation should also be added back to profits to get closer to gross operating surplus. It would, therefore, be worth collecting data on these items at the same time as profits, because the relationship of operating surplus to profits is likely to be much less stable than the relationship of operating surplus to profits plus net interest and depreciation. Expense data from detailed annual or benchmark surveys would allow the identification of other expenses that are not intermediate consumption, compensation of employees, or taxes on production. Similarly, detailed income data would allow the exclusion of any items that were not from production. If these factors are small and stable, an implicit ratio adjustment through the benchmarking process may be suitable. Otherwise, consideration may need to be given to collecting the data quarterly.

3.189 Large enterprises often calculate their incomes on a quarterly or even monthly basis, and publicly listed companies are often required to release quarterly or half-yearly information. Similarly, data may be available for government enterprises and market producers within general government. Privately held corporations and unincorporated enterprises may be less inclined to produce detailed quarterly accounts.

3.190 Many small enterprises do not have quarterly accounts, particularly in developing countries. In these

cases, their operating surplus cannot be collected, but it may be derived by estimating their output, intermediate consumption, and compensation of employees. The same indicators used for estimating value added under the production approach could be used and estimates of their wages and net taxes on production deducted.

Mixed Income

3.191 Mixed income covers compensation of employees, consumption of fixed capital, and the return on investment in cases where these cannot be identified separately. Thus, mixed income would be recorded for unincorporated enterprises in the household sector that do not compile separate financial statements. Estimates of mixed income may be derived from household income surveys or other information on the sales and revenue of these unincorporated enterprises.

3.192 In the case of ownership of dwellings, the sources for estimating output and value added can be used with the addition of data on property taxes paid and compensation of employees. To the extent that the same indicators are used in the income and production approaches, they become less independent and more integrated.

Taxes and Subsidies on Products, Production, and Imports

3.193 Data on total taxes on imports, VATs, other taxes and subsidies on products, and other taxes and subsidies on production are usually available from a government finance statistics system. Although government finance statistics systems are generally among the most accurate and timely data sources, the data can suffer from problems of time of recording, as noted in paragraph 3.23. The quarterly GDP compiler may be able to adjust some of the cash-based data to approximate the accrual basis. In some cases, state, provincial, or local government data may not be available for the most recent quarters. If this is the case, it would be necessary to make estimates. For large components, the estimate should be based on actual data on trends in the tax base and changes in tax rates, while simpler methods could be used on small items.

Volume and Price Indicators

3.194 The income approach is oriented to current price data only because prices of some income components are not observable. It is possible to measure labor inputs in volume terms and make estimates of net taxes on products at base year rates, but there is no meaningful price or volume dimension to operating surplus/mixed income and other taxes on production.

3.195 A few countries derive GDP by the income approach in volume terms by deflating by the implicit price deflator for GDP from the production or expenditure-based estimates. Only if the income-based GDP figure differs from the other approach will this give a different GDP, and it will differ from the other approach by the same percentage as at current prices. This treatment is valid only for total GDP and is not valid for splits by type of income. Deflating income components by a generalized price index, such as the CPI or the implicit GDP deflator by the production/expenditure approaches, is a measure of purchasing power (called "real" income in the *2008 SNA*) that should not be confused with volume measures of product.

Summary of Key Recommendations

General Data Sources

- *Use indicators that most closely match the definition, classification, and coverage of the target variable. Indicators that apply past trends or measure a variable that is connected to the target variable only by a behavioral relationship or statistical correlation should be avoided.*

- *Incorporate new businesses in the survey as soon as they start, either by drawing supplementary samples of new businesses or redrawing the sample for the whole population.*

- *Distinguish deceased business units from nonresponding units. The contribution of deceased businesses to their industry should be recorded as nil; for nonresponding businesses, values should be estimated.*

- *Consider the accuracy and reliability of secondary variables against the primary objectives of the survey when deciding on the suitability of data sources. Survey design and sample selection is usually determined by the primary variables being covered in the survey, sometimes to the detriment of the other variables.*

- *Undertake adjustments or grossing-up procedures at a detailed level with stratification by dimensions that explain variations in the ratio between target variables and grossing-up factors.*

- *Monitor indicators closely so that changes in the structure of the economic activity could be identified in a timely manner.*

Price and Volume Measures

- *Avoid using unit value indices of imports and exports in quarterly GDP compilation. The use of these indices may result in volatility in the estimates because they measure value changes for a group of products. Therefore, the indices may capture the effects of quality changes (e.g., caused by changes in the product mix) as well as price changes.*

- *Compile volume estimates at the most detailed level possible. For example, deflate household consumption expenditure using the components of the CPI, rather than the overall CPI.*

Labor Input Measures

- *Use hours worked instead of the number of employees as a measure of labor input. Include unpaid work in actual hours worked but exclude paid hours for sick leave, vacations, and public holidays. The labor input measure should also include working proprietors and the self-employed as well as employees.*

Data for Commodity Flow Methods

- *Classify imports and domestic production consistently to ensure that goods are allocated to the respective end use (consumption, intermediate inputs, and capital goods) and to avoid double counting and over/under estimation. Estimates of goods used for construction/gross fixed capital formation should exclude consumption goods and raw materials that will be used in manufacturing.*

- *Adjust the supply of goods for inventory changes, where possible. If no adjustments are made, then the estimation process will imply that the goods are used as inputs, fixed capital formation, or final consumption as soon as they are supplied.*

Annex 3.1 QNA—Overview of Data Sources for Output and Intermediate Consumption by Type of Activity

ISIC Rev. 4			Current Price Data[a]	Data on Quantity of Output	Labor Inputs[b]	Other Indicators/Data Sources
Sec.	Div.	Description				
A	01–02	Agriculture and forestry	X	X		Population and household consumption.
	03	Fishing	X	X		Fishing permits, household consumption, and exports.
B	05–09	Mining and quarrying	X	X		Industrial production index, exports, mineral exploration permits, rents, and severance taxes.
C	10–33	Manufacturing	X	X		Industrial production index and exports.
D	35	Electricity, gas, steam, and air-conditioning supply	X	X		Number of new electricity connections, and fuel consumption (intermediate inputs) assumes a stable relationship between fuel inputs and outputs.
E	36–39	Water supply	X	X		Number of new water connections.
F	41–43	Construction	X	X		Sales of new homes, supply of building materials, building permits issued, and square feet/meters of construction.
G	45–47	Wholesale and retail	X			Supply of goods for resale and imports of goods (excluding direct imports).
H	49–53	Transportation and storage	X			Passenger movements, freight handled (cargo loaded/unloaded), aircraft landings, and ship calls to port.
I	55	Accommodation	X			Number of visitors and number of bed nights.
	56	Food services	X			Beverage sales and index of accommodation.
J	58–63	Information and communication	X	X		Number of call and data units, number of telephone and cable connections, advertising rates/number of advertising slots, and minutes of calls.
K	64, 66	Financial services and auxiliary services	X			Loans and deposits, interest rates, number of transactions, number of ATM withdrawals, number of checks, number of cashier checks, and number of loans.

ISIC Rev. 4			Current Price Data[a]	Data on Quantity of Output	Labor Inputs[b]	Other Indicators/Data Sources
Sec.	Div.	Description				
K	65	Insurance and pensions	X			Number of insurance policies in force, deflated average stocks of reserves, number of pensioners, and deflated average stocks of pension liabilities.
L	68	Real-estate activities	X		X	Total (new and existing) home sales, commercial real-estate rentals, rental rates, and number of titles.
M	69–75	Professional, scientific, and technical services	X		X	Professional fee rates and number of divorces, cases, and deaths.
N	77-82	Administrative and support services	X		X	
O	84	Public administration and defence; compulsory social security	X		X	No. of employees No. of social security beneficiaries
P	85	Education	X		X	No. of students
Q	86-88	Human health and social work	X		X	No of hospital patients No. of hospital beds No. of appointments No. of surgeries
R	90-93	Arts, entertainment and recreation	X		X	No. of tickets to performing arts, theatres, events, parks.

[a] Current price data may be derived from surveys of units or administrative data sources.
[b] Labor inputs should be measured as hours worked (paid hours adjusted by paid time off and unpaid work). If hours worked are not available, then number of employees may be considered.

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