GDP by production approach: A general introduction with emphasis on an integrated economic data collection framework

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This document is written as training materials for the compilation of GDP by the production approach. The document in the first part discusses basic valuation principle in national accounting and the links between it and business accounting. The second part discusses methods and practices in estimating value added by kind of economic activity. The third part discusses methods and practices in estimating final expenditures. The fourth part discusses an integrated strategy for economic data collection. Finally the fifth part discusses double deflation method. The appendix contains exercises that readers should go through to master the basic concepts and practices in national accounting.

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Methodological introduction

1.   Economically, the gross domestic product (GDP) can be defined as the total value of goods and services (counted without duplication) that are newly produced in the economy during an accounting period, generated net incomes to the economy and are available for domestic final uses or for exports.

2.   This definition, when operationalized, provides three approaches for compiling gross domestic products (GDP): the production approach, the income approach and the final expenditures approach.

A. Three approaches to measuring GDP

3.   The production approach, which is also called the output approach, measures GDP as the difference between value of output less the value of goods and services used in producing these outputs during an accounting period.

4.   The income approach measures GDP as the sum of the factor incomes generated to the economy.

5.   The expenditure approach measures the final uses of the produced output as the sum of final consumption, gross capital formation and exports less imports.

6.   Theoretically, these three approaches are identical but in practice, however, the measure of GDP derived using three approached may be different mainly on account of different data sources used for the measurement of the economic activities undertaken in an economy.

Table 0.1. Illustration of supply and use of goods and services in the economy

	Goods and services	Final expenditure (final consumption, gross capital formation, exports less imports)	**Total uses**
Cost of goods and services used in production	70	30	100
GDP as sum of value added	30		
Total output of goods and services	100		

7.   A simple example shown in table 0.1 illustrates the three approaches. The economy in the example produces an output of 100, which is then fully used as intermediate consumption (70) and final consumption (30) in the same accounting period.

a) **The production approach**: Looking at the economy as a production process (down the first column), the economy in producing an output of 100 generates newly additional value of 30, which is called value added in the economic literature. This value added (which in this simple form is equal to GDP) is obtained by deducting from the value of output the cost of goods and services used in the process of production (i.e.100-70=30). The cost of goods and services used in production (70) is called intermediate consumption or intermediate inputs in national accounting literature.

b) **The income approach:** GDP can also be obtained by the income approach, i.e. by adding together all types of factor incomes generated in the production process, such as:
- wages and salaries and bonuses and other compensation payable to employees;
- taxes on products and production payable to the government; and
- operating surplus for the producers.

The income approach thus requires the information on the components of valued added, which is not shown explicitly in the above example. The most difficult part of the calculation of GDP by the income approach is the estimation of operating surplus from the net income (i.e. profit) reported by businesses. Later it will be argued that this operating surplus can only be estimated for the enterprise, but not for the establishments belonging to the enterprise.[1] Value added derived using establishment as a statistical unit, however, reflects better homogeneous economic activities when they are classified by the International Standard Industrial Classification of All Economic Activities (ISIC) or a national classification system based on ISIC.

c) **The expenditure approach:** The last approach shows the sum of goods and services used for final consumption, gross capital formation, and exports minus imports (again details are not shown in the above example).

d) As stated earlier, the three approaches should in principle produce the same figure of GDP which is 30 in this example.

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[1] Suppose, a corporation has 3 locations of which two are the production sites where goods and services are produced and sold. The third site is the headquarter unit. Each of the three sites is an establishment. In this case, operating surplus can be derived from the profit of the corporation, but operating surplus of the three establishments cannot be derived separately from this profit.

B. Strategy to ensure consistency and reliability in GDP compilation

8.   In the final analysis, the compilation of GDP and its components will yield more reliable data when the three approaches are used simultaneously. In addition, it will provide more analytical information.

9.   Many countries anchor their official estimate of GDP derived through production approach. As such, compilation of value added and GDP by the production approach is the first priority due not only to the fact that, like other methods, it allows for the tracking of the overall performance of the whole economy, but also to another fact that it is the only approach that provides data for the analysis of the productivity of each economic activity and changes in the structure of the economy. In addition, it allows policy makers to analyze the performance of specific enterprises against the industry averages.

10.   However, the implementation of all the three approaches is necessary for the improvement in GDP measurement reliability because these approaches allow for the identification of gaps in existing data as each of the approaches must use different sets of data reflecting different aspects of economic life but at the end must arrive in principle at the same final figure for GDP.

C. Which approach is preferable?

11.   For any given year when all requisite data are available, any of the three approaches is equally good. However, when financial resources made available to statistical offices are limited, they have to make a choice on the kind of data to be collected which in turn, will decide the method to be used to measure GDP. As indicated earlier, the top priority is normally put on collecting production data mainly for the analytical benefits that value added by industries provide to analysts as previously explained.

12.   The expenditure approach requires complete data on final consumption of households (including non-profit institutions serving households (NPISHs)) for the benchmark year, and then more frequent surveys on retail trade to obtain indicators for extrapolating the components of final consumption to the most current annual and quarterly accounts. Estimating gross capital formation would require the combination of surveys on investment in fixed assets, outputs of a limited number of industries that

produce capital goods, and imports of machinery and equipments besides data on the own account capital formation. Data required for estimating other components of final expenditures such as final consumption of general government, exports and imports are normally readily available from administrative sources. The expenditure method is also adopted by many countries and considered quite reliable.

13.   The income approach is considered less reliable mainly because it is not easy to collect reliable information on compensation of employees, and on net income (or profits) needed for the estimation of operating surplus. The deflation of value added estimated using income approach, to arrive at GDP in constant prices is theoretically not possible due to the fact that there are no appropriate deflators for components of value added such as operating surplus or profits. As regards deriving the estimates of GDP at constant prices using the other two approaches it is possible to deflate directly goods and services produced and used in intermediate or final consumption.

D. Should the value added generated by both economic activities (i.e. industries) and institutional sectors be compiled?

14.   It is quite obvious that value added by industries is highly useful as explained in previous paragraphs. However, value added by institutional sectors is also useful for policy makers, for example for comparing value added per employee in a given industry in public corporations with that in the private corporations, and for understanding the role of each sector in terms of their contributions to GDP. The total economy comprises the following institutional sectors in the System of National Accounts (SNA):

  a) Non-financial corporations (divided into public, national private, and foreign controlled);
  b) Financial corporations (divided into public, national private, and foreign controlled);
  c) General government;
  d) Non-profit institutions serving households (NPISHs);
  e) Households.

Table 0.2. An abbreviated form of cross-classification of institutional sectors and industries (ISIC) compilation

		Industry 1 (ISIC 1)	…	Electricity (ISIC 35)	…	Industry N (ISIC N)	**Total economy**
Corporations (private)	Output			100			
	IC			70			
	Value added			30			
Corporations (public)	Output			40			
	IC			30			
	Value added			10			
Government	Output						
	IC						
	Value added						
Households and NPISHs	Output						
	IC						
	Value added						
Total economy	**Output**			**140**			
	IC			**100**			
	Value added			**40**			

Note: IC: Intermediate consumption

15.   The compilation of value added by institutional sectors, fortunately, requires only limited effort to identify every production unit (namely establishment) by types of industries with a specific ISIC code, and type of corporations (financial and non-financial cross-classified with public, national private, foreign controlled) or other institutional sectors. This will provide cross classification of value added by industry and by institutional sectors. Table 0.2 shows an example on the recording of the two establishment units producing electricity, of which one is private and the other is public. The convention is to add them up and record them at the level of total economy only, the other method recommended here is to record them separately and then add them up.

16.   For analysis over time, national accounts aggregates such as GDP, value added, gross capital formation, final consumption expenditure, etc. must be not only in current prices but also in constant prices. Values in current prices are for structural analysis, such as share of manufacturing value added in GDP or ratio of income taxes over GDP, etc. Values in constant prices are essential for analysis of growth rates over time. In addition, because in many cases the most up-to-date data that are available is in volume, such as electricity generated or gas consumed, the growth rates in volume are thus used to extrapolate values in constant prices. These values in constant prices are then converted to current prices using appropriate price indexes and are subject to a process of data reconciliation. Data come from various sources, but are mostly in current prices;

therefore the process of data reconciliation would require all data in current prices in order to obtain a consistent set of data for national accounts.

E. Compilation and extrapolation of GDP: a note on technique

17.   The detailed compilation of GDP would require full or almost full basic data on all aspects of production, income and expenditures of all economic activities and institutional sectors. Statisticians try to collect all basic economic data as exhaustively as possible for the benchmark (or base) year. All basic data collected from censuses (conducted every five or ten year frequency) and limited surveys on production costs must be used and confronted with one another to arrive at the best possible set of national accounts data for the base year. This process is however not only costly but also time consuming. As a consequence, for annual and quarterly accounts, in order to reduce the cost of data collection and simultaneously increase the timeliness in providing national accounts data such as GDP to users, many data items are extrapolated from the base year using a limited number of basic data sources collected through surveys.

18.   The procedure normally followed by national accountants is to use the value added/output ratios by economic activity obtained for the benchmark (or base) year to estimate value added and GDP for the current quarter or year given (a) only outputs (which must be deflated to base year prices) or (b) some indicators to project the trends on outputs, for example the retail sale of cements may be used as an indicator to estimate output of cement-based construction of household unincorporated enterprises.[2] Thus for estimating annual and quarterly GDP, only surveys on outputs or trends on outputs are needed. This method is the most convenient and therefore is adopted by almost all countries. The value added/output ratios are quite stable due to gradual changes in technology and therefore for a period of five years, GDP estimates using these ratios are considered reliable. Table 0.3, as an illustration, shows the US data from 1998 to 2007. Value added/output ratios of the US economy seem to be quite stable during the period. A rare maximum year-to-year percentage change, at -5%, happened only once between

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[2]   See method of extrapolation below:

Output (in constant prices of period 1)	O_1	…	O_t
Indicator (at time t must be either in physical quantity or in value at constant prices of period 1)	W_1	…	W_t

$$O_t = \left(\frac{O_1}{W_1}\right) * W_t$$

2004 and 2005, and only to manufacturing value added/output ratio. This is the time when manufacturing price indexes accelerated from 2% to 5% and higher afterwards.

Table 0.3. Value added / output ratios (in percentage) and constant GDP Index of the US economy from 1998-2007[3]

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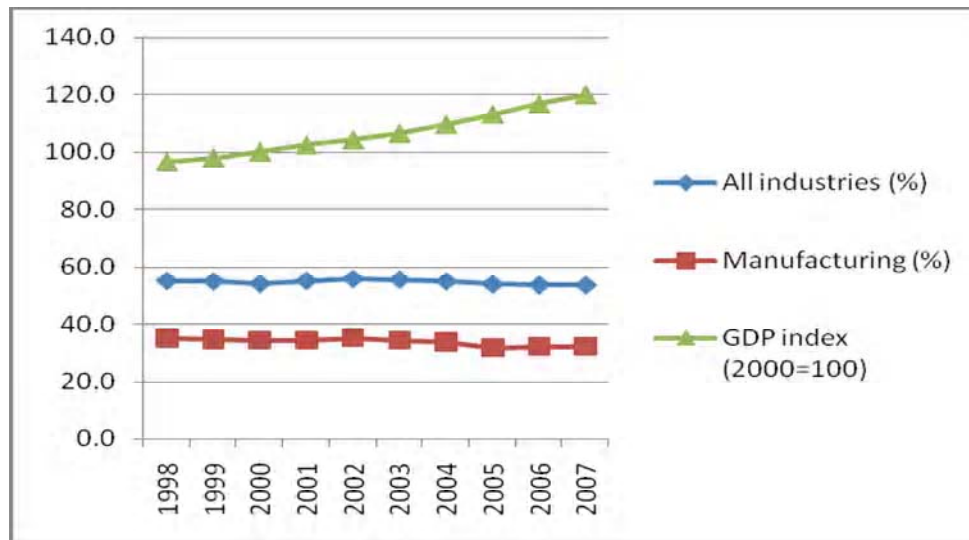
Table 0.4. Example on changes in input and value added ratios given changes in relative prices

	Base year production data	Base year ratios over output	Assumptions on input and output price indices for a more current year	Base year values updated to current prices	Updated ratios in current prices
	(1)	(2)	(3)	(4) = (1)*(3)/100	(5)
Gasoline	20	0.2	150	30.0	0.29
Other goods and services	40	0.4	103	41.2	0.39
Value added	40	0.4		[33.8]*	[0.32]*
Output	100	1.0	105	105.0	1.00

* The value in brackets in column 4 is derived as a residual (105-30-41.2). The value in brackets in column 5 is derived on the basis of the value in column 4.

19.   Given important changes in relative prices, the technique mentioned in the previous paragraph is less reliable when it is used to estimate value added and GDP in

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[3] **Source**: **GDP by Industry _VA_NAICS:** Value Added by Industry, Gross Output by Industry, Intermediate Inputs by Industry, the Components of Value Added by Industry, and Employment by Industry. See http://www.bea.gov/industry/gdpbyind_data.htm.

current prices. The example in table 0.4 illustrates the problem as well as the solution. The example assumes that even though the base year ratios (either of inputs and value added) did not quantitatively changed, the same ratios of inputs when being updated to current prices would not remain the same and therefore the value added ratios, calculated as residuals, also changed (see columns 4 and 5). One can conclude that estimates of value added in current prices will not be correct if input and value added ratios are not updated. To make this clearer, let us assume that in the current year, a $US 100 million worth of output is produced. Using the updated ratios, a value added of $US 32 million *in current prices* is estimated. However using the base year ratios, $US 40 million of value added *in base year prices* is estimated. This latter value at constant price, if updated to current prices using the output price index, will be 42, which is an over-estimation when compared to the more correct value.

20. The illustration in table 0.4 shows only the estimation of one industry by extrapolation technique. In general, the use of supply and use tables (SUT) as shown in table 0.1 but elaborated into many economic activities and products will provide a consistent framework for estimation. This technique is beyond the objective of this paper, but the essence of the technique is already manifested in the example in table 0.1, i.e. to ensure the equality of supply and use of goods and services, product by product in the economy. For example, the total use cannot be more than what is produced, which is a 100 in table 0.1.

F. Strategy to raise public awareness on GDP reliability

21. It may be argued the compilation of GDP is both a science and art. As a science, it is based on economic theory and concepts that are precise and consistent in the national accounting framework. As an art, compilers have to make judgments on the quality of the data relating to the supply and use of products and adjust data to make them reflect the fundamental concepts in the system. More than that, estimates have to be made to reflect flows that are only implicit in transactions, for example bank customers for most part do not pay explicitly for bank and financial services; however charges are implicit in the interest paid to or received from banks, and thus must be estimated. Due to this and statistical errors or even shortcomings in the data that can only be collected by sampling techniques, statistical errors in GDP are unavoidable. In addition, in order to meet the urgent needs of policy makers, flash or more current estimates are provided when the collected data has not been fully processed, thus the need for the revision of estimates.

22. **It is important to train users to understand the policy of revision of estimates.** The revision of data is a necessary outcome of the process of data compilation to satisfy users and policy makers in both objectives: (a) producing the most up-to-date

estimate of GDP when basic data are not fully available; and (b) producing the most accurate GDP possible. There is thus always a trade-off between timeliness and accuracy. Estimates will be less accurate when released early based on partial data and are more accurate when based on comprehensive data, which always become available with a time lag. For many countries, most monthly and quarterly indicators are only available for use in one or two months after the reference date, therefore in order to come up with flash estimates of quarterly GDP, a month or two after the reference date, many indicators must be extrapolated. As a consequence, the flash estimates are less reliable and must be revised when all the requisite data for the quarter are processed and become available for use. This first revision is normally called preliminary estimates. The second revision or final revision is needed when more elaborate and detailed annual data is available, which allows for the calibration of quarterly indicators and preliminary quarterly GDP to add up to the more reliable annual data (i.e. benchmarking quarterly data to annual data).

23.   **Statistical errors in GDP as shown in different compilation approaches also serve as an indicator for the need for data improvement**. There is no rule in deciding what the magnitude of statistical error is acceptable, but a rule of thumb is possible. In many economies, particularly in developed countries, a one or two percentage point change in GDP may indicate a turning point in the business cycle; in this case, a statistical error of one percent may be the maximum tolerable limit.   In other countries, particularly in developing countries, with higher rates of growth, a higher statistical error may be acceptable. The unidirectional statistical discrepancy may indicate presence of systematic bias in the GDP estimates.

24.   It is important to train users to understand the nature of statistical errors, which are the indicators of discrepancy given the current status of available data. The reduction of statistical errors would require more efforts and financial resources for improving the scope, coverage and quality of the source data.

25.   It is advisable to promote more usage of administrative data for which it is imperative that statistical offices work closely with other government agencies such as the Ministry of Finance, the tax authority, the central bank, etc. to develop administrative data forms to collect data that are readily conducive to the concepts of national accounting. The close links with these agencies would help statistical agencies get up-to-date data on taxes and government expenditures for example that help extrapolate up-to-date activities of industries and the government.

G. Focus of the document

26.   This document will focus on introducing the production approach according to the *System of National Accounts 2008* (2008 SNA), though the final demand approach is also

discussed. The production approach is in line with Milestone 1, which is recommended by the United Nations Statistical Commission as an important tool for tracking the performance of the economy and implementation of the SNA. Milestone 1 has two stages: The first stage is the compilation of GDP by value added only, i.e. the production of GDP. The second stage is the compilation of the use of GDP.

27. The first stage of Milestone 1 requires only the compilation of GDP in terms of value added by industry. This is the first priority for the following reasons:

   a) It is the easiest approach;
   b) It provides production data on all economic activities in the economy from agriculture, fishing, forestry to manufacturing, construction, trade, and services and thus allowing users to analyze the structure and productivity of the economy and its activities, and to monitor the performance of specific activities of their concerns;
   c) It provides the indexes for monitoring the production performance of different institutional sectors within the economy, such as state versus non-state corporations, non-financial versus financial corporations, the general government, the households and segments of the households;
   d) It provides finally the aggregate value of GDP for the monitoring of the performance of the total economy over time.

28. However, as argued before, the basic data requirement for economic analysis would also require the completion of the second stage, because GDP as the sum of value added alone would not:

   a) Allow for the affirmation of reliability as compared with the case when three approaches are simultaneously used so that errors may be identified and corrected; for example an output of some product may be underestimated given its total supply (including imports) is less than total uses of the product in the economy;
   b) Provide information on incomes generated; and
   c) Provide final expenditures, be they final consumption or gross capital formation, by different institutional sectors of the economy such as households, the government and corporations.

29. This information on income generated and final expenditures made by different institutional sectors in the economy is important for economists and policy makers to analyze the behavior of the economic agents (enterprises, government, and households) over the long run in the economy such as in the distribution of income, the choice for the uses income either for final consumption or investment in fixed assets.

30. This document is divided into five parts. The document in the first part discusses basic valuation principle in national accounting and the links between it and business accounting. The second part discusses methods and practices in estimating value added by kind of economic activity. The third part discusses methods and practices in

estimating final expenditures. Also included in the third part is the chapter on the utilization of the supply and use tables (SUT) to compile GDP by all three approaches: This in fact is the recommended approach to ensure consistency in estimating GDP in an integrated manner. The fourth part discusses an integrated strategy for economic data collection. The last part deals with deflation methods in order to obtain GDP and components of GDP in constant prices.

31.   The Annex at the end of this book contains solutions to exercises contained in the appendix at the end of chapters 1-3. Readers are encouraged to go through these exercises in order to master the basic concepts and practices in national accounting.

32.   The document borrows heavily on other handbooks written by the same author and already published by the United Nations. These include:

   a) *Handbook on National Accounts: A Practical Introduction* (ST/ESA/STAT/SER.F/85, 2004)[4] which covers fully the system of national accounting as an integrated framework;
   b) *Handbook on National Accounts: Links between business accounting an national accounting (*ST/ESA/STAT/SER.F/76, *2000);*[5]
   c) *Handbook on National Accounts: Accounting for Production: Sources and Methods (*ST/ESA/STAT/SER.F/39, *1986),* which was written on the basis of SNA1968;
   d) *Handbook on National Accounts: Input-Output Table Compilation and Analysis* (ST/ESA/STAT/SER.F/74, 1999).[6]

33.   Unlike the above-mentioned Handbooks which are based on the SNA1993 this document is conceptually based on the *System of National Accounts 2008* (2008 SNA)[7] and the *International Standard Industrial Classification of All Economic Activities* (ISIC) Rev. 4.[8]

H. Acknowledgment

34.   The author would like to express his thanks to Paul Cheung, Director of the United Nations Statistics Division (UNSD) who initiates the project*: Statistical Capacity Development in China and other Developing Countries in Asia* for which this document is an output. He also would like to thank Gulab Singh and Youlia Antonova from UNSD who reviewed and helped improve the writing of this document.

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[4] Readers can get free electronic copy on the UNSD website:
http://unstats.un.org/unsd/nationalaccount/handbooks.asp
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http://unstats.un.org/unsd/publication/SeriesF/SeriesF_76E.pdf
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[7] Currently available only in pre-edit version http://unstats.un.org/unsd/sna1993/snarev1.asp
[8] http://unstats.un.org/unsd/cr/registry/isic-4.asp

Part I
GDP, valuation system in national accounting and links with business accounting

Chapter 1. What is GDP?

1.1   Operationally, **GDP is defined by the production approach as the sum of gross value added during an accounting period plus taxes less subsidies on products and production.** Gross value added in turn is defined as output less intermediate consumption. In this paper, step-by-step, the concepts of output, intermediate consumption, and gross value added will be explained. Also explained is the reason why taxes less subsidies on products should be added to gross value added to obtain the estimate of GDP.

A. Output at basic prices

1.2   Output is the market value of goods and services receivable by producers of these goods and services.

1.3   The word *"receivable"* means the revenues retained by the producer after selling the product, i.e. after deducting the taxes on products collected by him on behalf of the government from the revenues paid by the purchaser. These revenues are the one recorded in the books of account and consequently in the income statement of the producer who would have to pay income taxes on the net income. Certainly the product taxes that the producer collects on behalf of the government are not his income on which he has to pay income taxes, and therefore should not be recorded in his income statement. On the other hand, subsidies on products, if any, receivable by producer from the government, must be added to the value received from the purchaser, as it makes up the full value receivable by the producer, partly from the purchaser, and partly from the government.

1.4   These revenues should not include additional transport costs paid separately by the purchaser to a third party for taking delivery of goods and services. In the case when the transport costs are inclusive in the sale value of the product, the full value should be recorded as "receivable"; this means that the producer sells two products to the purchaser: the product itself and the transport services.

1.5   These revenues receivable by the producer in lieu of goods and services are called output at basic prices. Basic prices reflect the actual revenues receivable by the producer and therefore the actual production costs incurred by the producer.

1.6   *"Market value"* means the actual transaction value receivable by the producer in the market. Rental, for example, should reflect the actual rental payable, even though it might be lower than the rental paid by most other purchasers in the market due to many

reasons, one of which is that the contract of transaction might have been signed well in advance of the time the actual transaction takes place. Value of crop at basic price should be the price receivable by the farmer at the farm gate.

1.7   In case of barter transactions, the output should be recorded at equivalent market prices of the product bartered, which means that the market price of the product of the same specification and quality.

1.8   In general, the output of a basic production unit (which is defined by the SNA as establishment and will be clearly defined later) produced for its own intermediate consumption is not treated as output in the 2008 SNA. For example, the electricity produced and used as intermediate consumption in the same establishment during the same accounting period by an electricity generation unit is not counted as output, only the net electricity generated for sale is counted as output. In a way, this avoids the possibility that output and sales recorded in business accounts deviate from the physical output. The 2008 SNA states that goods and services produced by an establishment and used for own final consumption, however, must be treated as outputs:

a) Housing services produced for own use by the owners of residential dwellings which are called owner-occupied dwelling services;

b) Goods that are kept in inventories, or own-account capital formation (own-construction of housing or machinery for instances), own-account software development, own account research and development;

c) All goods produced by households and household enterprises (which are called unincorporated enterprises by the SNA). For household unincorporated enterprises, the SNA 2008 goes even further, counting goods produced for both final consumption and intermediate consumption as outputs (SNA 2008, 6.32).

1.9   Losses or wastage in production and distribution will not be counted as output. For example electricity produced and lost in distribution is not part of output. Similarly part of the agricultural production lost during harvesting is not accounted for as production.

1.10   For most products, their values are measured directly.

B. Intermediate consumption

1.11   Intermediate consumption is the cost of all goods and services used up in the production of the output during the accounting period. Intermediate consumption, or also termed intermediate input, must be measured at purchasers' prices, i.e. the prices the purchaser actually pays for it. In countries with a value added tax (VAT) system, taxes on products assessed and paid by the producer on intermediate goods and services may be

reimbursed by the government, these deductable taxes must be excluded from the value of intermediate consumption.

1.12   Durable goods, such as saw, spade, knives, axes, hammers, screwdrivers, etc. which may be classified as capital goods since they are used as the tools of production over a number of years, may be included in intermediate consumption if their prices are below a certain level. The criterion is normally decided by statistical office or tax authorities, depending on the stage of economic development of the country.

1.13   Intermediate consumption excludes other production costs such as labor cost, financial costs and production taxes. The labor and financial costs and production taxes are costs to business firms but are treated in the SNA as incomes generated for the economy in the production process.

Given:

Output (excluding taxes less subsidies on products)	100	
Material costs (excluding deductible VAT)	30	Intermediate Consumption = 40
Service costs (excluding deductible VAT)	10	

Then:

	Output at basic prices	100
Less:	**Intermediate consumption at purchasers' prices**	40
Equal:	**Gross value added at basic prices**	60

C. Operational definition of gross value added and GDP

1.14   GDP is equal to the sum of gross value added at basic prices and taxes less subsidies on products. These taxes on products should include all taxes on products that are not deductible including sales taxes and import taxes.

Gross value added at basic prices = Output at basic prices – Intermediate consumption at purchasers' prices

GDP = Gross value added at basic prices + Taxes on products – Subsidies on products

Figure 1. Scheme of goods and services in circulation and valuation system

Figure 1.1. Actual circulation of goods and services

Value at basic prices	+	+	+	= Value at purchasers' prices paid by users
Output (goods) at basic prices	Trade margins	Transport margins	Taxes less subsidies on products	Output (goods) at purchasers' prices
Output (services) at basic prices			Taxes less subsidies on products	Output (services) at purchasers' prices
Output (exports) at basic prices	Trade margins	Transport margins	Taxes less subsidies on products	Output (exports) f.o.b. (price till at shipping/boarding area)
Imports f.o.b. at non-resident ports	Trade margins which may be supplied by residents and non-residents	Transport margins which may be supplied by residents and non-residents	Taxes less subsidies on products	Imports at purchasers' prices

- Trade and transport margins (including insurance) produced by residents are treated as domestic output (services) at basic prices.
- Trade and transport margins (including insurance) produced by non-residents are treated as imports f.o.b.

Include all non-deductible taxes less subsidies on products domestically produced or imported, through all stages of circulation

Figure 1.2. Supply of goods and services in circulation by the SNA

Output of goods and services in basic prices + Imports f.o.b. + Taxes less subsidies on products = Supply of goods and services at purchasers' prices

Note: In the identity in figure 1.2, trade and transport margins disappear because they are already part of output of services.

1.15 The identity is derived through the fundamental relationship between supply (resources) and demand (uses) of products in an economy. Supply of products in an economy is from own production and imports. Demand, on the other hand, is from intermediate consumption of producers, final consumption of households and government and, gross capital formation of all producers and exports. Households as producers are called unincorporated enterprises. A household can be an incorporated enterprise simply for the fact that it owns a house and therefore produces housing services for its own final consumption. As final consumers, households act simply as consumers. From the sources of supply to the demand of users, services can go directly but goods have to, most of the time, go through trading channels of wholesalers and retailers which generate revenues to them, which are called in the SNA trade margins, and also revenues to transport providers, which are called transport margins.

1.16 Trade and transport margins are services provided by traders and transporters to bring the goods from the producers to the users. (See figure 1 above). During this circulation process, taxes on products are assessed on the quantity or transactions values of the products. In some cases, the government may provide subsidies to the producers in order to reduce the purchasers' prices to the users.

1.17 From the point of view of the total economy, trade and transport margins are the output generated by the wholesalers, retailers and transporters. Thus, we can write the relationship in a general formula for the total economy where goods and services are grouped together as products, which also include trade and transport margins, as follows:

a) **Total supply of goods and services at purchasers' prices in the economy**
= Output of goods and services at basic prices (O) + taxes less subsidies on products (T) + imports of goods (M)

b) **Total demand of goods and services in purchasers' prices in the economy**
= Intermediate consumption at purchasers' prices (ID) + Final consumption expenditure of households and general government at purchasers' prices (C) + Gross capital formation at purchasers' prices of all resident producers (I) + exports c.i.f. (E)

1.18 Thus, as supply must equal demand, it has to be true that:

a) O + T + M = ID + C + I + E

Or

b) (O − ID) + T = C + I + E - M

c) (O − ID) is in fact gross value added at basic prices, while (O − ID) + T is GDP.

In short:

d) GDP = Gross value added at basic prices + Taxes less subsidies on products
= Final consumption in purchasers' prices + Gross capital formation at purchasers' prices + Exports f.o.b. – Imports f.o.b.

1.19   It is important to see from the above relationship that imports of goods and services must be valued as f.o.b. (free on board), that is, they must be valued at the delivery point at the port of the exporters. Trade margins, transport margins and insurance services to bring the goods to users if provided by resident producers will be treated as domestic output, and if provided by non-residents will be treated as imports of services. Exports are also valued at f.o.b., that is, at the price when goods are loaded on ships (not including freight and insurance).

1.20   From the analysis above, data that are used for national accounts compilation must be as follows:

a)   Output should be measured at basic prices. This actually reflects the way business records their revenues;
b) Intermediate consumption, final consumption, gross capital formation should be measured at purchasers' prices which reflect the actual costs to purchasers. These values should exclude all deductible value added taxes;
c) Exports as well as imports should be valued f.o.b.

1.21   In the case that output is measured at producers' prices, import duties need to be added to gross value added at producer prices to derive GDP.

GDP = Gross value added at producers' prices + import duties less subsidies on imports

1.22   This is not a preferred solution as changes in taxes may change value added/output ratios which are assumed to be constant in many analyses.

D. Components of gross value added

1.23   To complete this part, gross value added can be further enumerated as including:

a) **Compensation of employees:** Compensation of employees is the total remuneration in cash or in kind payable by employers to employees for the work done. Direct social transfers from employers to their employees or retired employees and their family such as payments for sickness, educational grants, pensions without setting up an independent fund are also imputed as compensation of employees;

b) **Other taxes less subsidies on production:** Other taxes less subsidies on production are taxes payable by employers to carry out production irrespective

of the amount of goods and services produced. They may be payable as license fees or on the ownership or use of land, buildings or other assets used in production or on the labor employed or on the compensation of employees paid. They are not taxes paid on values of sales or produced outputs, which are called taxes on products.

c) **Consumption of fixed capital:** Consumption of fixed capital is the cost of fixed assets used up in production in the accounting period. For example, given a fixed asset like a machine that has a finite life of 10 years, and assuming that its value decreases linearly over its life time, then the consumption of fixed capital of that capital, or the cost of using that capital in a year, is equal to one-tenth of the value of the machine (in this case, measured at the (constant) price when the machine was bought).

d) **Operating surplus**: **Gross operating surplus** is the residual obtained by deducting the components from (a) to (b) from value added. Thus, gross operating surplus includes interest payable to lenders of financial assets, or rent payable to rentiers of non-produced assets such as land, subsoil assets, patents, etc. **Net operating surplus** is equal to gross operating surplus minus consumption of fixed capital. Net operating surplus is the concept that truly reflects the return to capital in the economy, **but for many developing countries with limited information on fixed assets, the calculation of net operating surplus may not be feasible, thus gross operating surplus is the only alternative**.

1.24   For enterprises, gross operating surplus, must reflect the income to the producer engaging in the production activities of the enterprises before taxes on income are paid to the government, dividends paid to the enterprise share-owners and fictitious items imputed for accounting purposes like bad debt allowances. Operating surplus should exclude the following items that are considered by businesses as their incomes: incidental income gained on its financial investment such as dividends and interest received; capital gains due to price increases of its financial assets (such as stock, bonds and other securities) and non-financial assets (such as buildings and machineries), current transfers such as subsidies from government. **Gross operating surplus of an enterprise can be calculated directly as follows**:

a) + Additions to retained earnings
b) + Depreciation and depletion
c) + Bad debt provisions
d) + Property income payable
e) (-) Property income receivable
f) + Current transfers payable
g) (-) Current transfers receivable
h) (-) Gains (net of loss) on sales on fixed assets and securities

1.25   This income approach to operating surplus cannot be implemented at the establishment level since the items mentioned in the previous paragraph cannot be

allocated to the establishment. Thus, the income approach to operating surplus or GDP cannot provide value added by economic activity in case of multi-establishment enterprises.

1.26   **For the household unincorporated enterprises, the concept of mixed income, which include both consumption of fixed capital and operating surplus is used,** since these enterprises have no formal accounts and therefore assets used to produce services for own final consumption cannot be separated from those used for production. Mixed income for household unincorporated enterprises can only be derived as a residual as shown in para. 1.23. **Mixed income is equal to gross value added minus the sum of compensation of employees and other taxes less subsidies on production.**

E. Examples of GDP compiled by three different methods

Notes:

Australia: (1) Three approaches (output, final expenditure and income) are used in compilation; (2) GDP is compiled according to the SNA 1993; (3) Output and gross value added are measured by basic prices; As a consequence, taxes less subsidies on products must be added to gross value added at basic prices to obtain GDP; (4) Gross fixed capital formation is broken into detailed types of capital goods which are needed for compiling capital stocks; (5) No acquisition less disposal of valuables is compiled.

Malaysia: (1) Two approaches (output and final expenditure) are used; (2) GDP is compiled according to the SNA 1993, where FISIM (cost of financial intermediation) is distributed broadly to all users including final users; but not as intermediate consumption to any specific industry users. For this reason, there is a line of FISM in the output approach so that the full value of FISM used by industries is deducted from gross value added; (3) Output and value added are measured at basic prices.

Vietnam: (1) Two approaches (output and final expenditure) are used; (2) Vietnam applies SNA 1993; (3) Output and gross value added are measured at producer prices instead of basic prices; Thus, import duties are treated as part of trade margins and therefore there is no need for adding import duties to gross value added at producers' prices to obtain GDP.

Sources: OECD, UNSD, Vietnam

2007	Australia	Malaysia	Vietnam
	National currency	National currency	National currency
	Basic prices	Basic prices	Producers' prices
	SNA 1993	SNA 1993	SNA 1993
Transaction			
Gross domestic product (production approach)	**1132172**	**64186**	**1144014**
=Gross value added at basic prices, total activity	**1039829**	**65474**	**1144014**
Agriculture, hunting and forestry, fishing	26497	6570	232188
Industry, including energy	220333	28869.1	396063
of which: Manufacturing	108834	17952.2	244537
Construction	82139	1758.4	79617
Wholesale and retail trade, repairs, hotels and restaurants, transport	209603	8357.7	207055
Financial intermediation, real estate, renting and business activities	310240	8171.9	20752
Other service activities	191016	7514	208339
- FISIM		-1,885	
+Taxes less subsidies on products	92042	597	
+Statistical discrepancy	301		

2007	Australia	Malaysia	Vietnam
Gross domestic product (expenditure approach)	**1132172**	**64,186**	**1144014**
=Final consumption expenditure	**826921**	**37,102**	**79617**
Final consumption expenditure of households	626793	29,259	50769
Final consumption expenditure of non-profit institutions serving households	..	13	
Final consumption expenditure of general government	200129	7,830	156286
Individual consumption expenditure of general government	118931	3,003	
Collective consumption expenditure of general government	81197	4,827	
+Gross capital formation	**324746**	**14,080**	**111664**
Gross fixed capital formation	320052	13,914	244537
Dwellings	69337		
Other buildings and structures	114243		
Transport equipment	30957		
Other machinery and equipment	64638.4		
Cultivated assets	2400		
Intangible fixed assets (intellectual property)	19290		
Changes in inventories and acquisitions less disposals of valuables	4694		
Changes in inventories	4694	165	39862
Acquisitions less disposals of valuables	..	..	
+External balance of goods and services	**-19921**	**13,005**	**20752**
Exports of goods and services	234862	70,716	878473
Exports of goods	183543	60,592	
Exports of services	51319	10,124	
-Imports of goods and services	-254783	-57,711	-1032158
Imports of goods	-204820	-47,824	
Imports of services	-49963	-9,887	
+Statistical discrepancy	425	0	94565
Gross domestic product (income approach)	1132172		
=Compensation of employees	539020		
+Gross operating surplus and gross mixed income	471179		
+Taxes less subsidies on production and imports	121672		
+Statistical discrepancy	301		

Appendix 1:
Exercise on supply and uses of goods and services

Questions 1.1

Use the following two tables (which are simplified supply and use tables in national accounting) for analysis.

Table 1.1 shows the output at basic prices from each industry (or economic activity) in the economy. It also shows the supply from imports. **The total supply at purchasers' prices** is equal to the sum of domestic production, plus imports, plus trade and transport margins, plus taxes less subsidies on products.

Table 1.2 shows the uses of goods and services in production (intermediate consumption), in exports, final consumption expenditure and gross capital formation. The total uses are also in purchasers' prices.

The total uses and the total supply must equal in the economy.

   a) Why trade and transport margins (which are the output of trade and transport industries) are zero?
   b) Reformulate the two tables into one like table 0.1 in the chapter on methodological introduction.
   c) Derive total value added at basic prices and GDP from (b).

Table 1.1. The supply table: outputs are at basic prices

	Industry 1	Industry 2	Imports c.i.f. (Total f.o.b.)	Trade and transport margins	Taxes less subsidies on products	Total supply at purchasers' prices
Output at basic prices	100	210	33	0	15	358

Table 1.2. The use table: uses are at purchasers' prices

	Industry 1	Industry 2	Exports (f.o.b.)	Final consumption expenditure	Gross capital formation	Total uses at purchasers' prices
Intermediate consumption	40	110	70	118	20	358
Value added	60	100				
Output at basic prices	100	210				

Note: Use the following table for getting the answers.

		Industry	Final demand (final consumption + gross capital formation+ exports – imports)	Output at purchasers' prices
1	Intermediate consumption			
2	Value added at basic prices			
3	Output at basic prices			
4	Taxes on products less subsidies			
5	GDP or value added at purchasers' prices			
6	Output at purchasers' prices			

Questions 1.2

Given the following information, extrapolate to obtain output in constant and current prices for the years following 2005 (review the introduction):

	2005	2006	2007	2008	2009
Output in current prices	110	-	-	-	-
Price index	100	103	105	100	101
Output indicators in current prices	100	120	130	130	125

Questions 1.3

Balance the supply and use of rice in the example below. In the case the total supply is not equal to the total uses (or resources), suggest the best way to balance them.

Production	Million tons	Price per ton in $US
Total	1.5	
Own consumption	0.8	
Marketed output	0.7	
Price per ton at rural market		200
Imports, c.i.f.	0.4	204
Exports, f.o.b.	0.1	220
Increase in government stock	0.1	
Trade and transport margins per ton		20
Consumption tax per ton		2
Consumption by industry	0.2	

Chapter 2. National accounting and business accounting: a view towards data collection and adjustment to conform to national accounts concepts

A. Some basic definitions in business accounting and national accounting

2.1   Output, intermediate consumption, final expenditures (that include final consumption, gross capital formation and net exports – i.e. exports minus imports) are the basic national accounts concepts. The measurement of these concepts is based on the data, particularly from formal business accounts, that are kept by business and must be collected and used by national accountants to compile national accounts therefore it is important to discuss briefly the concepts used by business accountants before discussing the actual compilation of these concepts in national accounting.

2.2   **Sales/revenues/values of shipment.** Output in national accounts is an abstract concept that most of the time cannot be directly measured. For business owners and accountants, the relevant concepts are sales (or revenues, sometimes called values of shipments in manufacturing industries) and the cost to generate these revenues. Products that are produced may not be sold immediately but put in inventories and sold later. Output must therefore be derived from sales adjusted for changes in inventories of finished and semi-finished goods. This will be elaborated later.

2.3   **Cost of sales (or cost of goods sold**). Cost of sales is not the cost of goods and services used in output production. This is because purchases of materials may not be immediately used in production but put in inventories. National accountants are required to derive **intermediate consumption** which includes only the **costs of goods and services** (not including labor costs, capital costs and taxes on the production itself such as license fees, etc.) incurred in the production of the output derived.

2.4   For most business, a given level of inventories is always necessary to allow business to respond quickly to demand without losing customers. Thus the tracking of sales and inventories are both important. Over accumulation of inventories signals a difficulty in sales and thus a necessary slowdown in production, while an unexpected reduction in inventories signals necessary increase in production to meet higher demand. To assist the tracking of industrial production and the compilation of national accounts, the correct measurement of output and inventories is important. As a consequence, the questionnaires must be formulated in such a way that producers can respond properly in the languages they are familiar with.

Table 2.1.1. A typical income statement in business accounting

		X COMPANY			
		Statement of income for the year ended 31 December 20xx			
	(a)	Sales, net of discounts, returns, VAT and sales taxes			850
-	(b)	Cost of goods sold			-586
=	(c)	**Gross profit**			264
-	(d)	Operating expenses			-222
		Selling expenses		115	
		General expenses		107	
=	(e)	**Operating income**			42
+	(f)	Other income			9
-	(g)	Other expenses			-15
=	(i)	**Net income from continuing operations**			36
-	(k)	Taxes on income			-12
=	(l)	**Net income from continuing operations**			24
+/-	(m)	Discontinued operations of segment			0
		Income from discontinued operations, net of taxes			0
		Loss on disposal of segment, net of tax savings			0
		Extraordinary gains or loss, net of taxes			0
+/-	(o)	Cumulative effect of change in accounting principle			0
=	(p)	**Net income**			24
-	(q)	Charitable contributions			-2
-	(r)	Dividends payable			-12
=	(s)	Retained earnings			10

Costs as part of intermediate consumption in these different segments must be identified for national accounting purpose.

Note: This example is taken from Vu Quang Viet, Compilation of national accounts from business accounts: non-financial corporations, in chapter III in *Links between Business Accounting and National Accountings* (United Nations, ST/ESA/STAT/SER.F/76).

2.5   Table 2.1.1 shows a typical income statement prepared by business accountants to record sales, other incomes and operating cost and other costs. **Cost of goods sold** may contain two components: **cost of goods manufactured** (representing the activity of a manufacturer, and **cost of goods bought for resale** (representing the activity of a trader). **Operating expenses** include costs of goods and services, capital costs such as

depreciation, labor costs and others. **Other income** may include interest received, and other income from sideline activities like property rental, services provided; similarly other expenses may include interest payable, etc. **Net income from discontinuing operations** (i.e. discontinued operations of segment) shows the total income net of costs in a segment of business that the business will discontinue or already discontinued. This separation is for the purpose of business analysis. For national accounting, the incomes and the costs in this segment must be elaborated and classified properly in order to measure all production activities in the reporting accounting period.

2.6   Table 2.1.2 shows the relationship between cost of goods manufactured and cost of goods sold. For national accountants, raw materials used in manufacturing make up a part of intermediate consumption. If raw materials purchased are reported, they have to be converted to raw materials used in manufacturing.

Table 2.1.2. Cost of goods sold by manufacturing corporations

	Inventory of finished goods at the beginning of the period		70
Plus	**Cost of goods manufactured**		592
	Raw materials used in manufacturing	153	
Plus	Direct labour in manufacturing	360	
Plus	Manufacturing overhead cost (materials, services, depreciation and labour)	81	
Plus	Goods in process beginning inventory	21	
Less	Goods in process ending inventory	-23	
Less	Inventory of finished goods at the end of the period		-76
Equal	**Cost of goods sold**		586

2.7   Important for the computing of output and intermediate consumption by using data from the income statement used in business accounting is the proper identification of items that can be considered output or intermediate consumption. Thus the following distinctions described below and in table 2.1.3 are essential:

a) **Transactions of goods and services**. These can be incomes in the forms of sales/revenues or payments/purchases of goods and services that result from production. As sales and revenues received (such as sales of goods, receipts for rental of buildings and equipments), they reflect receipts for the goods and services produced. As payments for goods and services purchased, they reflect intermediate or final consumption expenditures on goods and services.

b) **Property income** is income accrued to owners of financial assets or natural resources. It is the income generated from production but transferred to the

owners of capital by its users (i.e. producers) in payment for the privilege of using it. Only services charged by the intermediaries for their role in intermediating the financial capital from the owners to the users are treated by the SNA as output of the intermediaries or intermediate consumption of users. These service charges are first calculated for the whole economy as the output of the financial intermediaries and then distributed to the users in proportion to the interest received and paid. Net interest expenses/receipts (after service charges are excluded), dividends are not purchases/sales of goods and services; they are property income.

c) **Current transfers** are transactions without receiving goods and services or capital in return as a counterpart in the same accounting period; they also should not be capital transfers.[9] Current transfers are incomes redistributed from value added. Net life and non-life premiums (after deducting insurance service charges) and claims are current transfers. Also included in current transfers are taxes/subsidies on income, other taxes/subsidies on production, charitable contributions. These may be incomes from business point of view, but they are not output (or incomes from production) from the national accounting point of view. Therefore, they are not part of sales or revenues used in calculating output or intermediate consumption. The extra box in table 2.1.1 shows the need to identify only goods and services in various categories of expenses. The same process must apply to various categories of incomes to identify only transactions of goods and services.

d) **Capital transfers** are, similar to current transfers, also unrequited transactions but are linked to the acquisition and disposal of a fixed or financial asset. Examples of capital transfers are investment grants in terms of machineries or cash to purchase machineries or to construct a bridge; inheritance and inheritance taxes; capital taxes which are irregular and infrequent taxes on assets and wealth; cancellation of debts by mutual agreement, or major payment of damages not covered by insurances, etc.

e) **Capital gains and losses** (also called holding gains and losses) are results of a change in the prices of fixed assets, non-produced assets and securities that are held. These are treated by business accountants as incomes but they are treated by the SNA as changes in the balance sheets, and not as incomes because they are not results of production. Capital gains and losses are not transactions but other flows.

2.8   It will be clear later that only sales and incomes that are transactions of goods and services will be used in calculating output and intermediate consumption for all activities,

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[9] Capital transfers are transfers that are of capital in nature, such as provision of capital goods free of charge, provision of income with the purpose of purchasing capital goods, irregular taxes on wealth and capital, etc.

with the exception of agriculture, financial intermediation and non-market activities whose outputs are calculated by different methods.

Table 2.1.3. Examples in types of transactions and other flows and their uses in SNA compilation

	Transactions in goods and services		Current transfers		Capital transfers	Other flows in revaluation asset accounts
	Output	Intermediate/final consumption/gross capital formation	Property income	Other current transfers		
Sales of goods and services	X					
Purchases of goods and services		X				
Purchases of goods for resale	X					
Rent collected from renting of building	X	X				
Net interest payments and receipts*			X			
Net insurance premiums and claims*				X		
Dividends			X			
Rental of fixed assets	X	X				
Rents on land, royalties on natural resources			X			
Contribution to charity				X		
Net gains and loss in gambling				X		
Foreign aid on investment					X	
Debt cancellation					X	
Taxes on capital gains or on assets transferred between institutional units (i.e. inherence taxes)					X	
Taxes on sales of assets				X		
Holding gains and losses on assets (fixed as well as financial) due to change in prices						X

Note: "Net" means that estimated service charges have already been deducted from interest receipts or payments and from insurance premiums.

B. Introduction to national accounts aggregated beyond GDP

2.9   It is not the intention of this document to introduce the full integrated accounting system of the SNA, however it is important to emphasize that the understanding and proper classifications of transactions as either property income, current or capital transfers as discussed in section A are crucial in the measurement of important aggregates other than GDP in national accounts such as gross national income, gross disposable income, gross saving and net lending (+)/ net borrowing (-).

2.10   GDP is product that is newly created during an accounting period. This is then distributed as income to labor and owners of other production factors such as fixed and financial assets. Gross national income (GNI) is the income resulting after such a distribution:

> GNI = GDP + (Compensation of employees + Property income from the rest of the world) – (Compensation of employees + Property income to the rest of the world)

2.11   However, not all of GNI is available for final uses domestically since some of it is transferred to other countries as current transfers, for example money sent to support dependents living in another country. At the same time, the country may receive similar current transfers from abroad. Taking current transfers into account leads to the concept of gross national disposable income:

> Gross national disposable income = GNI + Current transfers from the rest of the world – Current transfers to the rest of the world

2.12   Gross national disposable income is the income available for consumption and saving. Thus, deducting final consumption expenditure from gross national disposable income, one obtains gross saving:

> Gross saving = Gross national disposable income – Final consumption expenditure

2.13   Gross saving and net capital transfers receivable are then used to finance investment in fixed assets (gross capital formation). If the own-fund is short, the country is engaging in net borrowing (-), if own-fund is more than gross capital formation, the country is engaging in net lending (+):.

> Net lending (+)/ net borrowing (-) = (Gross saving + Capital transfers receivable – Capital transfers payable) – Gross capital formation

Appendix 2:
Exercise on business principle and national accounting principles

Questions 2.1

Look at the income statement of a business firm below. This firm had neither inventories of finished goods nor inventories of materials purchased.

a) Show the incomes of this business.
b) Which incomes are considered output in national accounting (or can be used to calculate output of this business)?
c) Show output, intermediate consumption, and value added of this firm.
d) At what type of price in national accounting this output is measured?

Sales		1000
Cost of goods bought for resale		-400
Gross profit		600
Interest paid on loans		-50
Interest received on deposits		10
Operating expense		-280
Wages and salaries	200	
Cost of materials	20	
Cost of services	60	
Net income		280

Questions 2.2

Let us assume that a company opens its business at the beginning of period 1. It acquired a computer equipment worth of $500 and it planned to depreciate the computer by a straight line in 5 years. In the following period, the company acquired another computer of the same type and quality but its average price increased during the period by 10%.

a) Present, on the basis of **business accounting**, gross capital formation, gross fixed assets, depreciation, and net fixed assets (i.e. gross fixed assets less depreciation for the two periods).
b) Present, on the basis of **national accounting**, gross capital formation, gross fixed assets, depreciation, and net fixed assets (i.e. gross fixed assets less depreciation for the two periods).
c) Can you derive gross capital formation in each period by using gross fixed assets recorded in business accounting? In what conditions can this be done?

Note: Use the following table form to fill in the answers:

Business/national accounting principle		
End of period	Period 1	Period 2
Gross capital formation	500	550
Gross fixed assets		
Depreciation/consumption of fixed capital		
Asset of period 1		
Asset of period 2		
Fixed assets net of depreciation		

Questions 2.3

Use the information in the income statement below to prepare the production account of this company X. It is assumed that prices of goods and materials increased 5%. Questions: (a) identify type of activity of the company; (b) revalue inventories of both goods and materials; (c) identify the transactions that are not treated as intermediate consumption in national accounts; (d) calculate the value of output, intermediate consumption, gross value added and components of value added.

Income statement of company X

		Sales, net of discounts, returns, VAT and other sales taxes		**1400**
Less		**Cost of goods sold (in this case, it is cost of goods bought for resale)**		**1000**
	Equal	Inventory of goods for resale at the beginning of the period		200
	Plus	Net cost of purchases for resale		1100
		Purchases net of discounts, returns and allowances	1000	
		Freight-in cost	100	
	Less	Inventory of goods for resale at the end of the period		-300
Equal		**Gross profit**		**400**
Less		**Operating expenditure**		**350**
	Plus	Opening stock of materials		10
	Plus	Purchase of materials		50
	Less	Closing stock of materials		-15
	Plus	Wages and salaries		200
	Plus	Rent, electricity and heating		50
	Plus	Property tax and license fees		10
	Plus	Depreciation		10
	Plus	Non-life insurance		5
Equal		**Operating income**		**50**
	Plus	Other income		0
		Interest received		0
	Less	Other expense		-10
		Interest paid on loan	10	
Equal		**Net income before income taxes**		**40**
Less		Income taxes		-10
Equal		**Net income after income taxes**		**30**
Less		Dividend		5
Equal		**Retained earning**		**25**

The resulting 45 is the cost of materials used in book value.

Part II
Methods and practices in estimating value added by kind of economic activity

Chapter 3. Measurement of output and intermediate consumption

A. Introduction

3.1   Basic data that are used by national accountants to compile output, intermediate consumption, value added, GDP and other national accounts indicators are, by convention, collected by specialized agencies in the statistical system of a country or by specialized units in its statistical office. Although the data collected, in principle, may be in line with international recommendations that are based on fundamental principles of the SNA, these recommendations generally avoid suggesting adjustments to the reported data, particularly with respect to the revaluation of inventories and stocks of assets to current market prices or with respect to imputation of implicit transaction costs. As a result, the data that are collected are in the same form and content as reported by respondents, except for some necessary adjustments to correct for statistical problems faced by data collectors such as missing data. For this reason, in many cases, national accountants must adjust the data to make it fit the national accounts concepts. This chapter will discuss these necessary adjustments. In addition, it will suggest methods as far as possible for estimating in a consistent way the activities that are not or cannot be fully covered by surveys.

3.2   In principle, exhaustiveness in the production boundary coverage is the ideal national accountants wish to achieve. In practice, statisticians always have to face a certain trade-off between exhaustiveness in coverage and the ability to track trends. Exhaustiveness is a picture taking exercise that may be possible once in a while and that is necessary for the purpose of getting a realistic picture of the situation at a given time period. However, the cost of doing that regularly may be beyond the financial capability of many statistical offices. On the other hand, in the decision making process of both businesses and policy makers, trend analysis of structural changes and growth is regarded as more important. This requires time series of data, i.e. the kind of data that can be regularly and consistently collected over time. Thus, countries may, in their collection survey program, deliberately decide not to regularly collect data on a number of economic activities that are too costly to capture such as illegal activities in order to reduce costs. Given that type of decision by data collectors, national accountants may figure out ways to make the coverage more complete, but this will be done if there exist proxy indicators that can be regularly collected for the purpose of imputation and/or extrapolation. Here there is a trade-off between exhaustiveness and consistent sustainability of the trend.

B. Agricultural output

3.3   The term "agriculture" refers broadly to ISIC Rev. 4, section A, entitled "Agriculture, forestry and fishing", which includes the following divisions:

    a) 01: Crop and animal production, hunting and related service activities;
    b) 02: Forestry and logging;
    c) 03: Fishing and aquaculture.

Methods of measurement and estimation

3.4   For agriculture quantity of physical output is estimated first. This physical output is then valued at the price per physical unit at the farm gates. Physical output is measured by regions and then multiplied with the average regional price per physical unit at the farm gates. The method used in agriculture in most countries cannot be based on sales as applied to manufacturing and other service activities (which will be discussed later) because a significant part of crops and other agricultural output is not for sale but for own final consumption. Sales therefore do not reflect the full amount of production. It is for this reason that the physical output of crop must be measured directly.

Box 3.1. Commodity flow method for agricultural production

Output + Imports =	Inputs to production of other goods	+	Final consumption of households	+	Change in inventory	+	Exports

3.5   To fully check the reliability of agricultural output, the use of commodity flow methods is always important to reconcile between the use and supply of a given agricultural product, which come from different sources: from survey on production to household survey on expenditures and other sources such as foreign trade statistics. Thus, even for some products that cannot be directly surveyed, output may be indirectly derived through the use of the commodity flow method shown in Box 1. In Thailand, although logging is banned in the country, to make GDP more comprehensive and exhaustive, national accountants there have to impute illegal logging into GDP calculation by incorporating logs arrested by police. In general, the use of estimates of illegal activities made by the police and other relevant agencies allows national accountants to impute their output into the calculation of GDP.

3.6   In almost every country, agricultural output is produced by both corporations and households, but the estimation of output is normally prepared at the aggregate level of the whole economy. Agricultural output of corporations is estimated separately, if needed, and then the residual is allocated to households.

3.7   In developing countries, a major part of agricultural output produced by households is for own intermediate and own final consumption. It is therefore important to identify the output produced for own use. Own final consumption will provide data for final consumption of households later. Crops and plants may be estimated for the whole economy first, and then the output of households is obtained by deducting the output of corporations from the output of the total economy. Own intermediate consumption of agricultural output is estimated either indirectly or by household survey. The indirect approach would first require the estimation of the manufacturing output of households and then the estimation of the agricultural inputs used to produce that manufacturing output.

Table 3.1. Output of agriculture by sources of production

	Corporations	Households		
		Market	Own intermediate consumption	Own final consumption
Crops				
…				
Animal husbandry				
Fishery				
Forestry				
Supplementary agricultural products		x	x	x

Crop output

3.8   Output of crops should exclude losses that occur during the harvesting, but losses that occur after harvesting should be part of output but treated as intermediate consumption in agricultural processing activity.

3.9   For activities like crops, fruits, aqua-culture that are land-based, their physical quantity outputs are normally measured by multiplying land areas devoted to the activities and their annual land yield rates. Yield rates are seasonally collected by crop cuts, but land uses are normally measured in every 5-year agricultural censuses, either counting every agricultural household or using some advanced technique of taking aerial digital imagery of land from satellite.

3.10   Gross output of a crop in terms of values is measured by multiplying physical quantities with the average prices at the farm gates. The average prices are normally weighted average prices prepared for each type of crop. Weights may reflect shares in types of products of the same kind (for example different types of rice) and regions. Prices at farm gates are equivalent to basic prices, and thus exclude any product taxes, trade margins and transport costs that are invoiced separately to purchasers by farmers.[10]

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[10] Separate invoices are treated as separate purchasers of services in addition to purchases of agricultural products.

Box 3.2. General approach to estimation crop output, intermediate consumption and value added

Benchmark/census	Annual/quarterly
Output Quantity output of crop = Land area X Benchmark yield rate per unit of land Gross output of crop = Quantity output of crop X Benchmark average ex-farm gate prices	**Output** Current prices Similar to benchmark year but with updated land area, current yield rate, and current average ex-farm gate prices. Constant prices Output at constant prices can be obtained by multiplying quantity output with benchmark average ex-farm gate prices. Or Deflating output at current prices with appropriate price indices.
Intermediate consumption Detailed costs per unit of land by type of crop grown are obtained through surveys. These benchmark cost coefficients can be used to estimate current intermediate consumption. In case costs per unit of land by type of crop are not available, costs per quantity of output may be used, although the former is preferred as it reflects better investment decision. The reason is that input is required per unit of land while output depends not only on inputs but also on weather and other factors. Costs may be detailed in terms of specific inputs such as seeds, fertilizer, pesticide, fuels, service charges, etc. so that they can be updated to current prices in the following years, especially when input prices vary differently.	**Intermediate consumption** Constant prices Benchmark cost coefficients are used to estimate intermediate consumption at constant prices. Current prices Benchmark cost coefficients are brought to current prices by appropriate price indices.
Value added Value added = output – intermediate consumption	**Value added** Same formula as the benchmark year for either current or constant prices.

3.11   **Benchmark versus annual estimates**. The common practice in many countries is to carry out every 5-year census of agriculture to collect data on agricultural land in terms of land uses. The physical outputs of major crops from rice, wheat, etc. are individually estimated by the land area in use multiplied by respective land yield rates (see Box 3.1). Between the census years, only yield rates need to be surveyed, assuming land uses remain the same as the most recent census year. When drastic changes in natural conditions happen, it is necessary to update land area in use. Similarly, intermediate consumption such as seeds, fertilizers, pesticide, fuel, normal maintenance and repair of

fixed assets, rental of machinery and equipment, agricultural service charges, etc. per unit of land are collected for the census year. The intermediate consumption coefficients (or ratios) per unit of land by type of crop in the benchmark year are then applied to land areas in use to estimate intermediate consumption for each crop. These latter estimates are at the benchmark year prices, which must be updated to current prices using price indexes (see more detailed discussion of estimation techniques in Box 3.2).

3.12   There is, however, an exception. In some countries, like the United States of America, similar to manufacturing, the statistical unit is a farm which is treated as an establishment. Thus all farms are subject to regular five-year censuses and more frequent surveys using sampling technique. Data on physical output and sales and expenses are directly collected with equal importance. This is possible as farms are quite large and organized as incorporated enterprises which are required to keep business accounts. But this is not commonly practiced in most developing countries.

Agricultural services

3.13   Various agricultural services are normally required for each type of crop, livestock, fishery, and forestry. These services include the following: pest and disease control, harvesting, grading and packing crops, artificial insemination, etc. For the census year, they should be fully covered in the census or survey. However for annual and quarterly estimates, agricultural services may be extrapolated by using the benchmark coefficients derived for the census year, for example, the coefficient can be as simple as value of service over a unit value of quantity output. However it is always preferable to use coefficients per unit of land area in use for type of crops.

Supplementary agricultural output

3.14   In many developing countries, agricultural activities that are supplementary in nature are also important; their output can be for own final consumption or for sale. These outputs are either by-products of major crops such like rice straws that may serve as a source of energy, or products grown backyard for sale or for own consumption, be they fruits, vegetables, herbs, flowers, etc. For by-products of major crops, estimates may be obtained as a percentage of major crops. Backyard supplementary production is obtainable only through household surveys in terms of per capita consumption, preferably separating rural and urban households. If the products are seasonal, annual per capita consumption can be estimated by multiplying per capita consumption per week by the number of weeks during which they are available.

3.15   Special efforts should be devoted to collecting these supplementary agricultural products which are quite important in many countries at least for the benchmark year (See last line, table 3.1). For more current annual and quarterly accounts, they may be assumed to be a fixed share of household consumption of food with the share determined in the benchmark year.

Crop output that takes more than one year to mature

3.16   Output of a crop (or natural growth of cultivated assets such as plants grown for fruits or lumber) may be generated for the entire time span covering more than one accounting period from the time the crop is sown to the time it is harvested. To obtain the output for every accounting period, the harvested products less losses and wastes (i.e. finished products) must be allocated to each period on the basis of the share of actual costs (i.e. materials, services and labor) incurred during the period. Assuming that the costs incurred equally each month during the crop season and the total value of finished products is 100 for the case shown in the graph below, the first year will be allocated 4/11 and the second year 7/11 of the finished products. The example assumes that prices do not change; otherwise work-in-progress has to be revalued to current market prices.

3.17   The output of the first year is treated as work-in-progress to be entered into inventory (a part of gross capital formation). That inventory will have to be withdrawn after the crop is harvested the following year (negative change in inventory in gross capital formation). This example assumes there is no change in price.

3.18   The principle described above is not yet widely practiced. Most countries assign output and its associated costs to the time when crop is harvested. This latter practice is particularly common in the compilation of quarterly accounts.

Table 3.2. Estimation of crop output: an example

First accounting year				Second accounting year									
Crop sown										Crop harvested			**....**
-4	**-3**	**-2**	**-1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10...**
Output (last 4 months) = 36.4 Change in inventory = 36.4				Output (first 7 months) = 63.6 Change in inventory = -36.4									

Forestry, logging and related products

3.19   Forestry, logging and related products include planting and harvesting of trees and woods, production of charcoal by distillation (burning) of wood, as well as collection and gathering forest products such as bamboo, herbs, wild foods, honey, etc. The planting and harvesting of trees and woods are to be treated similarly to those discussed in paragraphs 3.11 – 3.13. However, if a country found it too complicate to apply the methods proposed in these paragraphs and planting of trees is minimal, it may select to use more simplified method such as the value of trees harvested and woods logged. Intermediate consumption is estimated by the same method applied to crops. Forestry services such as forest management, fire fighting and protection, pest control and transport of logs within the forest must also be estimated using the benchmark ratios of the census year.

Fishing and aquaculture

3.20   Aquaculture may be estimated using the same method applied to crops, which requires data on area devoted to aquaculture and yield per unit of water-covered area. Fishing, particularly at sea must be surveyed. Quantities are normally provided by the specialized agency. Output is then estimated by multiplying quantity with average unit price. Supplementary survey is needed for estimating intermediate consumption coefficients for the census year. These coefficients are then used to estimate intermediate consumption and value added.

Livestock output

3.21   The formula for estimating the output of livestock in general is based on the following relationship:

Output of live animals + imports = animals slaughtered + exports + change in animal stock

Table 3.3. Compilation of output of livestock and gross capital formation from the point of view of farmers

| | Total owned a year ago (number, weights) | Increase during the year | | Decrease during the year | | | Total currently owned (number, weights) | Change in stock = net increase in number, weights | Output of livestock = Change in stock + sale+given away and stolen + own consumption |
		Purchased or received as gifts during the year	Birth less death due to natural causes	Sale during the year	Given away and stolen	Own consumption			
	(1)	(2)	(3)	(4)	(5)	(6)	(7) =(1)+(2)+(3) -(4)-(5)-(6)	(8) = (7)-(1)	(10) =(8)+(4)+(5)+(6)
Cattle									
Poultry									
….									

3.22   Animals slaughtered must be based on and change in animal stock may be based on expert assumption on annual death and birth rates. Animals died of natural causes are not counted as output.

3.23   Output can be first estimated in terms of number, weight and then valued at basic prices. Animals have to be divided by two major types:[11]

  a) Those that are treated as fixed assets such as adult dairy animals, animals raised for their wool, breeding or as draught animals of more than one year old;

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[11]Users can find more details in 2008 SNA, para. 6.94-6.100 and in *A System of Economic Accounts for Food and Agriculture*, 1996, Food and Agriculture Organization (FAO).

b) Those that are treated as work-in-progress such as those reared for slaughter or young animals (one year old and less) reared to be used as fixed assets.

3.24   Change in animal stock should be revalued properly similarly to change in inventories discussed in table 3.3 below.

3.25   Special but small-scale survey, similar to other agricultural products survey, is needed to collect data on intermediate consumption at least for the benchmark year for the estimation of value added (see Box 3.1 for techniques of estimation).

C. Output and intermediate consumption of industrial activities

3.26   Industrial activities according to ISIC Rev.4 include the following sections:[12]

 a) B: Mining and quarrying ;
 b) C: Manufacturing ;
 c) D: Electricity, gas, steam and air conditioning supply ;
 d) E: Water supply; sewerage, waste management and remediation activities .

3.27   The output of these industrial activities can be goods or industrial services. Output of manufactured goods, not services, is more complex to measure as sales do not correspond with value of output, thus focus will be put only on this subject.

3.28   In order to measure the output of manufactured goods, it is necessary to sent questionnaires to business using the terminology that they are familiar with. The following terms are frequently used ones, although they may vary by industries:

 a) **Sales or revenues, net of returns and discounts**: These are gross sales at a given period that deduct returns by customers and discounts given to them later. Only sales or revenues net of returns and discounts are used in the calculation of outputs. Table 3.4 shows the derivation of output from sales. It is important to realize that the inventory has to be revalued to the prices at the time the sales take place. Spoiled or loss of inventories of finished and semi-finished goods during the accounting period should still be counted in calculating output, they will be taken out of inventories as other changes in volume at the end of the accounting period.

 b) **Cost of goods sold:** This has three components: cost of services purchased, cost of materials purchased and cost of labor. This information is readily available as the objective of a manufacturer is to derive the cost of the goods they sold. Since all goods manufactured (or produced) may not be fully sold in one period but go into inventory. At the same time sale may come from inventory. Thus sales and cost of goods sold does not reflect output and its manufacturing cost in a given period. The objective of a national accountant is to derive the cost of output incurred (which is intermediate consumption) to match with output produced. Similar to sales, inventories of materials purchased must be revalued to the prices at the time materials are taken out of inventories for use in production. Spoiled or

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[12] Readers may be able to consult *International Recommendations for Industrial Statistics 2008* (IRIS 2008) on what and how data on industry should be collected. The document can be downloaded free of charge from the UNSD website: http://unstats.un.org/unsd/statcom/doc08/BG-IndustrialStats.pdf. The documents on other language may also be available (see http://unstats.un.org/unsd/pubs/gesgrid.asp?method=meth).

loss of purchased materials are automatically treated as intermediate consumption by this method.

3.29   The formulas for deriving output and intermediate consumption are as follows:

a) Output in basic prices = Sales or revenues + Change in inventories of goods manufactured (including finished and semi-finished goods)[13]

b) Intermediate consumption in purchasers' prices = Cost of materials purchased - Change in inventories of raw materials + Cost of services purchased

3.30   Table 3.4 provides an example with the estimation method that gives an exact value of output. This is possible because the stock of physical inventory is assumed taken at the end of each period and revalued at the same time (line 3). In general, inventories are valued differently in business accounting either by LIFO, FIFO or other methods. Table 3.4 is the Canadian method that proves to be a good approximation.[14]

Table 3.4. Estimation of output from sales – an example

	Calculating operations	T_0	T_1	T_2	T_3
Information given					
1. Sales net of taxes and plus subsidies			80	120	272
2. Price index			100	125	200
3. Value of inventory at end of period (book value)		0	40	30	16
4. Change in inventory (book value)	$= (T_i - T_{i-1})$ applied to line (3)		40	-10	-14
Derived data					
5. Value of inventory at constant prices	$=$ Line (3)*100/ line (2)	0	40	24	8
6. Change in inventory at constant prices	$= (T_i - T_{i-1})$ from line (5)		40	-16	-16
7. Change in inventory at current prices	$=$ Line (6) * line (2)/100		40	-20	-32
8. Output at basic price	$=$ Line (1) + line (7)		120	100	240

3.31   The intermediate consumption obtained by formula (b) in para. 3.28 or in table 3.5 is just the interim intermediate consumption. This interim intermediate consumption must be adjusted to include the interest service charges implicitly charged on both interests the unit paid and received from banks; and include the insurance service charges implicit in the payment of premiums.

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[13] Semi-finished goods are also called goods in process.
[14] See *National Accounts: A Practical Introduction*, page 30, United Nations, ST/ESA/STAT/SER.F/85.

3.32   The service charge on interest receivable from banks can be estimated simply as: (Total FISIM on deposits/Total interest paid by banks in the economy) x Interest receivable from banks. Similarly the service charge on interest payable to banks can be estimated simply as: (Total FISIM on loans/Total interest receivable by banks on loans in the economy) x Interest paid to banks for loan payment. (More will be explained in section D of this chapter).

3.33   The service charge on insurance is estimated by multiplying premiums payable by the producer with the ratio of the output of insurance services over total premiums.

Table 3.5 Estimation of output and gross value added from sales and cost of sales – an example

C1=2+5+6	**Intermediate consumption at purchasers' prices**	3250	C2=2+3	**Output at basic prices**	4480
2=3-4	Use of materials at purchasers prices	2900	2	Sales	5000
3	Purchase of materials	3000	3	(+) Change in inventories of finished and semi-finished products (decrease)	-200
4	(-) Change in inventories of materials (increase)	100			
5	Electricity	150			
6	Other services	200			
7=C2-C1	**Gross value added at basic prices**	1230			

Note: This table assumes that changes in inventories have been corrected for changes in prices.

D. Output of distributive trade

3.34   Distributive trade activities (section G) according to ISIC, Rev.4 include the following divisions:[15]

    a) 45: Wholesale and retail trade, repair of motor vehicles and motorcycles ;
    b) 46: Wholesale trade, except of motor vehicles and motorcycles;
    c) 47: Retail trade, except of motor vehicles and motorcycles.

3.35   Distributive trade includes both wholesale and retail trade. The output of wholesale and retail services, which is called trade margin, is the difference between sales less the cost to repurchase the good sold at the time it is sold. Margins are in fact the output wholesalers and retailers generate in the economy. Table 3.6.1 shows how the transactions are recorded by business accountants.

Table 3.6.1. Cost of goods sold (or bought for resale) of trading corporations

	Sales, net of discounts, returns, VAT and other sale taxes		**120**
	Cost of goods sold (or cost of goods bought for resale)		**100**
Equal	Inventory of goods for resale at the beginning of the period		20
Plus	Net cost of purchases for resale		110
	Purchases net of discounts, returns and allowances	100	
	Freight-in cost	10	
Less	Inventory of goods for resale at the end of the period		-30

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[15] Readers may be able to consult *International Recommendations for Distributive Trade Statistics* 2008 (IRDTS 2008) on what and how data on industry should be collected. The document can be downloaded free of charge from the UNSD website: http://unstats.un.org/unsd/trade/M89%20EnglishForWeb.pdf. The documents on other language may also be available (see http://unstats.un.org/unsd/pubs/gesgrid.asp?method=meth).

3.36   Although not part of distributive trade, **Food and beverage service activities** (division 56), a part of **accommodation and food service activities** (section I of ISIC, Rev.4) is quite similar to distributive trade in the sense that an important part of food and beverage are bought for resale. In this case, output of food or beverage services is only the margin, similar to trade margin, a difference between sales and cost of goods bought for resale.

3.37   The trade margin recorded in business accounting is not the same that of national accounting because the cost of goods sold is measured by business accountants at book value, i.e. at the value the company actually paid for in the past. In national accounting, this book value must be revalued to the price the company has to pay if it wishes to restock the sold goods. This means that the inventory of product A, and as a consequence, the value of output bought for resale must be revalued by national accountants to the prices at the time the product is sold (See table 3.6.2). The revaluation principle is the same as shown in table 3.2. Table 3.6.2 shows that if the cost of goods sold is revalued from 100 to 110, the margin is only 10 instead of 20.

Table 3.6.2. Output of wholesale and retail services: an example

T-3	T-2	T-1	T
• Product A was bought at 100			• Product A was sold at 120. • Market value if the product sold is to be restocked: 110

Note:
In theory: Output at basic price = Trade margin = 120 – 110 = 10. Output is at basic price since sale is normally recorded net of taxes on products invoiced to purchasers.

Incorrect practice: Trade margin = 120 – 100 = 20 if inventories are not properly valued. The miscalculation is unacceptable during the time of high inflation if revaluation of inventories is not carried out. In the example, the difference of 10 is called holding gain, which is not part of output.

3.38   In many cases, a manufacturer may also involve in distributive trade and vice versa. In this case, revenues include both sales of goods manufactured and sales of goods bought for resale; cost of goods sold also include cost of goods bought for resale. These information are normally prepared by business accountants, thus it is important that they are collected as separate items so that output of distributive trade and output of manufactured goods can be calculated properly. Normal business accounting is presented as follows:

> Sales/Revenues
>> a) Sales of goods manufactured
>> b) Sales of goods bought for resale
> Cost of goods sold

    a) Cost of manufactured goods sold (Note: This is not the same as cost of goods manufactured)
    b) Cost of goods bought for resale

3.39   The information above allows for the calculation of output of manufactured goods and distributive trade margins only. Costs for both activities (manufacturing and retail) are normally lumped together and therefore it is normally not possible to separate intermediate consumption of manufacturing and that of distributive trade, unless the two activities are at two different locations with separate cost accounts.

E. Construction

3.40   Construction (section F of ISIC, Rev.4) includes the following divisions:[16]

    a) 41: Construction of buildings;
    b) 42: Civil engineering, which includes:
- Construction of road and railways;
- Construction of utility projects; and
- Construction of other civil engineering projects such as industrial facilities (other than buildings), waterways, harbor, dredging of water ways, dams, etc.).

    c) 43: Specialized construction activities, which includes:
- Demolition and site preparation;
- Electrical, plumbing and other construction, installation activities;
- Building completion and finishing; and
- Other specialized construction activities.

3.41   Vertical integration of construction with manufacturing and other activities requires separation whenever data on each separate activity is available, particularly when they cross classification of letter classes.

3.42   Construction involves general and special trade contractors. General contractors undertake complete projects. Special trade contractors are engaged in only part of the work on a construction project for example painting, plumbing, installing electric wiring, heating, air-conditioning, elevators, demolition, exaction, etc. The special trade contractors normally work on sub-contract from the general contractor. The collection of data requires elimination of double-counting and therefore the value of revenues to be used for calculating output should net out values payable to subcontracts.

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[16] Readers may be able to consult *International Recommendations for Construction Statistics* on what and how data on construction should be collected. The document can be downloaded free from the UNSD website: http://unstats.un.org/unsd/publication/SeriesM/SeriesM_47rev1E.pdf. The documents on other language may also be available (see http://unstats.un.org/unsd/pubs/gesgrid.asp?method=meth).

3.43   For construction statistics, there are five sources:

a) **Establishment surveys**. These surveys are on construction and construction-related companies through **establishment surveys**.

b) **Household income and expenditure survey** captures **own-account construction by households.**

c) **Survey of household unincorporated enterprises (HUEMs which is discussed in chapter 5) captures construction on contracts that are not covered by construction establishment surveys**. Construction as part of household activities is quite significant in developing countries. For some developing countries without any source of survey data on households, the estimation of construction is based roughly on per-capita space requirement. Estimated increase in population would allow for the estimation of construction, particularly in rural areas.

d) **Own construction by the corporations**. This can be obtainable through industrial and service surveys.

e) **Own construction by general government**. Own construction by general government is quite significant, particularly in construction and major repairs of roads, dikes, waterways, etc. The government budget is the main source for this activity.

3.44   The value of construction by establishments of the benchmark year may be extrapolated to current periods by using indices on value of construction put in place that might be regularly collected on the monthly, quarterly or annual basis. If this is not available or available at a later date, employment data on construction or data on construction permits approved may be used instead. Other indicators may also be used such as cement used. In national accounting, construction put in place is treated as output even though the construction projects have not been finished and put in use.

F. Output of financial intermediation

3.45   Financial intermediation is included in section K of ISIC, Rev.4 which includes the activities in the following divisions and groups:

a) 64: Financial service activities, except insurance and pension funding:
- Monetary intermediation;
- Activities of holding companies;
- Trusts, funds and similar financial entities;
- Other financial service activities, except insurance and pension funding activities.

b) 65: Insurance, reinsurance and pension funding, except compulsory social security;

c) 66: Activities auxiliary to financial service and insurance activities.

3.46   Financial intermediation includes monetary intermediation in divisions 64 and 65 of ISIC, Rev.4, which is the subject of this chapter. Other financial services are generally measured by revenues/sales just like other market services.

3.47   Output of financial intermediation companies in banking, insurance services and pension fund services cannot be directly measured since they do not normally charge their customers for their services except for some minor incidental services. Banks earn their main source of income by the difference between the interest earned by providing loans and the interest paid on deposits. Pension funds and insurance companies accept contributions and invest them in order to pay their customers. Their output has to be measured indirectly.

Output of banking services

3.48   Output of banking services is measured as follows:

Output = Explicit service charges + implicit service charges (FISIM)

Implicit service charges (FISIM) = (Interest rates on loans – reference rate) x Stock of loans + (Reference rate - Interest rates paid on deposits) x Stock of deposits.

Box 3.3: Example on output of banks

Problem: Assuming for the whole year, bank A accepted a total deposit of 5 billion from customers and paid them 250 million, i.e. on average at 5% annual interest rate. The bank then lent out 4.5 billion, received 360 millions, i.e. at 8% annual interest rate. When lending, the bank has also charged a one-time service charge of 1%, for which it received 45 millions. What then is the output of this bank?

Solution: Assuming the reference rate is the midpoint of the deposit rate and the lending rate then the reference rate is 6.42% which is calculated as (250+360)/(5000+4500).
- Service charge on deposits: (0.0642 – 0.050)x5 = 71
- Service charge on loans: (0.08-0.0642)x4.5 = 71
- Explicit service charge = 45.0
- Total output of bank A is 71+715+45 = 187

This solution according to the 2008 SNA is different from the solution based on the SNA 1993. In SNA 1993, the output of bank A is equal to 45+ (360-250) = 155.

The solution in this example is calculated using the reference rate specific to bank A. Normally a reference rate may be decided for the whole economy and then applied to all banks. The reference rate is also selected in this example for simplicity as the midpoint between the deposit and lending rate. This avoids the difficulty faced by many developing countries when interbank rate when strongly influenced by government policy may be fixed below both the deposit and lending rates.

3.49   The reference rate should contain no service element and reflect the risk and maturity structure of deposits and loans. The rate prevailing for inter-bank borrowing and lending may be a suitable choice as a reference rate. For most developing countries, if it is not easy to select the appropriate reference rate, the average rate between the average interest paid on loans and deposits may be selected instead.

3.50   Output of **money lenders** who lend their own funds is calculated using the same formula described in para. 3.47, although only the first part of the formula applied as there is no deposits. This recommendation of 2008 SNA is a change as compared to SNA 1993. The output of money lenders in this case is comparatively larger than before due to the exorbitantly high interest rates money lenders charge his customers in most developing countries. The 2008 SNA reasons that higher output compensates for higher risk undertaken by money lenders.

3.51   Output of central bank may be calculated by production costs if the output calculated by the 2008 SNA becomes too cumbersome (See 2008 SNA, para. 6.151-6.156).

3.52   **Allocation of FISIM to users**. FISIM must be allocated to users. When FISIM are allocated to industries or general government, they are treated as intermediate consumption; when they are allocated to households as consumers, they are treated as final consumption. Household unincorporated enterprises using services from financial intermediaries with deposits and loans are treated like industries. Service charges paid by

a user on interest received on deposits or paid on interest on loans provided by financial intermediaries are estimated by using the ratios shown below.

$$\text{Service charge ratio on deposits} = \frac{\text{FISIM on deposits}}{\text{Total interest on deposits}}$$

$$\begin{array}{c}\text{Estimated service charge} \\ \text{paid by a user on interest} \\ \text{received on deposits}\end{array} = \begin{array}{c}\text{Interest on} \\ \text{deposits received} \\ \text{by the user}\end{array} \times \frac{\text{FISIM on deposits}}{\text{Total interest on deposits}}$$

$$\text{Service charge ratio on loans} = \frac{\text{FISIM on loans}}{\text{Total interest on loans}}$$

$$\begin{array}{c}\text{Estimated service charge} \\ \text{paid by a user on interest} \\ \text{paid on loans}\end{array} = \begin{array}{c}\text{Interest on loans} \\ \text{paid by the user}\end{array} \times \frac{\text{FISIM on loans}}{\text{Total interest on loans}}$$

3.53   Information on interests is normally collected by the Central Bank. With close cooperation of the Central Bank, appropriate data forms may be developed so that interest, deposit, loans for different users can be collected to serve the purpose of FISIM calculation and allocation. These kinds of information are collected only for enterprises which actually pay for them. Data on enterprises may be allocated to industries by simple shares of preliminary value added that have not been adjusted for FISIM.

Output of life insurance services

3.54   Output of life insurance services is measured as follows:

Output =	Actual premiums earned (excluding prepayments of premiums)
Plus	Premium supplements (equal to the income gained from the investment of the insurance technical reserves, which also include prepayments, reserves for pending and unexpected. claims)
Minus	Benefits due (including outstanding claims that are not yet paid)
Minus	Increases (*plus* decreases) in life insurance technical reserves

Box 3.4. Example on how to calculate output of life insurance

Data from life insurance companies
- Employers' contribution as part of compensation of employees (COE) = 14
- Employees' contribution = 8
- Premium supplements (also called property income attributable to policy holders) = investment income (interest, dividends, capital gains are excluded) from assets of pension funds = 7
- Withdrawals from life insurance = 16
- Increase in actuarial reserves = 11

Derived information
- Total contribution = Employers' contribution + Employees' contribution + Premium supplements = 14+8+7=29
- Output of life insurance = Total contribution – Withdrawals from life insurance – Increase in actuarial reserves = 29 -16 -11 = 2
- Employees' net contribution = Employees' contribution + Premium supplements – Life insurance output (life insurance service charges) = 8+7-2 = 13
- Adjustment of change in households' net equity in pension funds = Total contribution – Life insurance output (insurance service charges) – Withdrawals from life insurance = 29 -2 -16 = 11 = Increase in actuarial reserves

Cash flow of the life insurance company

Benefits	16	Employers' contribution	14
		Employees contribution	8
Increase in actuarial reserves	11	Property income	7
Output	2		
Total	29	Total	29

Output of non-life insurance services

3.55   Output of non-life insurance services is measured as follows:

Output =   Actual premiums earned (excluding prepayments of premiums)
      Plus   Premium supplements (equal to the income gained from the investment of the insurance technical reserves, which also include prepayments, reserves for pending and unexpected claims)
      Minus   Adjusted claims incurred (including outstanding claims that are not yet paid)

3.56   It is highly likely that output of non-life insurance services gyrates widely over the years due to the movement of claim payment. Some countries have introduced the 5-year moving average taking the average of the current year and the preceding four years to reduce the up-and-down of output and thus value added. When claims are too high particularly when catastrophic accidents happen, output may become negative. The 2008 SNA advised that total premiums earned and total premium supplements should remain as they are, though claims should be adjusted to reflect only normal past experiences, using moving average for instance. Another possibility is to measure output by

production costs. Output and other components for income and financial accounts are shown in the box. The latter can be ignored by compilers of production accounts.

Box 3.5.1: Example on how to calculate output of non-life insurance

Data from non-life insurance companies
- Employers' own purchase of insurance (premiums) = 10
- Employers' contribution to premiums for employees as part of compensation of employees (COE) = 4
- Employees' own premiums = 8
- Premium supplements (also called property income attributable to policy holders) = investment income (interest, dividends, capital gains are excluded) from assets of non-life insurance companies = 7
- Claims paid = 16
- Increase in provisions (actuarial reserves) for outstanding claims = 11
- Increase in provisions (actuarial reserves) for prepayment = 0

Derived information
- *Total premiums* = Employers' own premiums + Employers' contribution on behalf of employees + Employees' premiums + Premium supplements = 10+4+8+7=29.
- *Output of insurance companies* (insurance service charges) = Total contribution – (Claims paid + Changes in provisions for outstanding claims) = 29 -16 -11 = 2. Insurance service charges must be allocated to insurance policy holders; they can be allocated on the basis of premiums payable.
- *Premium supplements* may be allocated to different sectors also on the basis of premiums payable by each sector.
- *Net non-life insurance premiums* = Premiums + Premium supplements – Insurance service charges = 29-2 = 27.
- *Claims paid* = 16
- *Provisions against for claims* = Net non-life insurance premiums – Insurance service charges – Claims paid = 27 -16 = 11 = Increase in provision for outstanding claims
- Claims incurred = Claims paid + provisions against outstanding claims = 16+11=27
- Net non-life insurance premiums earned = claims incurred = 27.

Box 3.5.2. Normal and special case of non-life insurance

Normal case: case 1

Output of insurance companies (insurance service charges) = Premium contribution + Premium supplements – (Claims paid + Changes in the provisions for claims outstanding)

Special case: case 2

New method in 2008 SNA avoids low or negative output because actual claims incurred are too high due to exceptional calamity	Use adjusted claims paid based on past behavior instead of actual claim paid

For example:
Actual claims paid: 16
Adjusted claim: 8
Adjusted claims are based on past experiences. This can be calculated as the moving average ratio of claims over the sum of premiums plus premium supplement; the length of the period coverage for the moving average may be decided arbitrarily but with the purpose to make the ratios smooth:

Unadjusted output = 29 – (16+ 11) =2
Adjusted output = 29 – (8+ 11) = 10
Net non-life insurance premiums = Premiums + Premium supplement - Insurance service charges = 29 – 10 = 19

Output of annuity

3.57   Annuity is a special form of life insurance where households carry out its own saving. There are many forms of annuity. One of it is that the policy holder pays a lump sum to the company and then expects to receive a stream of regular incomes over time. Another form is the opposite in which the policy holder makes regular payment to the company in expectation that it will give a given lump sum at the end of the contract. In whatever form, the output to the company is the difference between the expected income the company receives and the income it has to pay out over the lifetime of the contract.

3.58   Output of an insurance corporation administering annuities similar to the output of life insurance is calculated on the basis of the following information provided by insurance company calculated for each year as:

   a) The property income attributable to the annuitants. The item is parallel to the concept of premium supplement in the life insurance context;
   b) *Less* the amount payable to the annuitants (or surviving beneficiaries) under the terms of the annuity;
   c) *Less* the change in the annuity reserves but excluding the initial payments for new annuities.

3.59   For the case of lump-sum payment at the beginning, assuming that a 10,000 lump sum is paid in by the policy holder, the discount rate is 5% and the policy holder is entitled to receive from the insurance company 600 a year. Then output is 500 (= 10,000 x 0.05) – 600 – (-190) = 90. The value -190 is the reduction in the annuity reserves as calculated by the insurance company. For the case of lump-sum payment at the end, the regular payment is 600 in order to expect a certain lump sum payment at the end of X amount, the premium is 600, premium supplement is based on the accumulated contribution paid in up to that point, the change in the annuity reserve (in this case is an increase) is the necessary reserve made regularly to assure the lump-sum payment of X to the policy holder at the end of the contract.

Output of pension services

3.60   Output of funded pension fund services is measured as follows:

Output =	Actual pension contributions
Plus	Supplementary contributions (equal to the income from the investment of the pension funds technical reserves
Minus	Benefits due
Plus	Change in the actuarial reserves

Box 3.6. Example on how to calculate output of funded pension scheme

Definition:

    Funded pension scheme presented here is contribution-defined, which means that benefits are fully based on the contributions made by employers and employees to the pension scheme and the property income supplements. Conceptually, funded pension scheme is a saving scheme of the households and could be treated similarly to individual life insurance. The SNA, however, makes an exception in recording funded pension scheme. It records explicitly benefits paid and contributions received. Because of that, adjustment for change in net equity has to be recorded so as to keep saving of households and the pension fund unchanged. This treatment will affect income and financial accounts but not the production account.

Example:

Data from pension funds
- Employers' contribution as part of compensation of employees (COE) = 14
- Employees' contribution = 8
- Property income supplements (also called property income attributable to policy holders) = investment income (interest, dividends, capital gains are excluded) from assets of pension funds = 7
- Pension benefits = 16
- Increase in actuarial reserves = 11
- Operating cost includes 2 for compensation of employees only (just to simplify the recording)

Derived information
- *Total contribution* = Employers' contribution + Employees' contribution + Property income supplements = 14+8+7=29
- *Output of pension funds* = Total contribution – Pension benefits – Increase in actuarial reserves = 29 - 16 -11 = 2
- *Employees' net contribution* = Employees' contribution + Property income supplement – Pension output (pension fund service charges) = 8+7-2 = 13
- *Adjustment of change in households' net equity in pension funds* = Total contribution – Pension output (pension fund service charges) – Pension benefits = 29 -2 -16 = 11 = Increase in actuarial reserves

Output of social insurance schemes which may be unfunded (i.e. paid by employers without an explicitly set-up fund)

3.61   Social insurance schemes can either be provided by government under a social security scheme or by an employer for his employees. Outputs of these schemes are measured by costs if costs can be separated**.**

3.62   **In case of government, the social insurance scheme or fund is treated as part of the output of general government**.

Output of other financial services

3.63   **Output of foreign exchange and securities dealers** are measured by trade margins (the difference between the purchasers' price of the dealer less the purchasers'

for the buyer) but holding gains due to price fluctuation must be excluded. (See output of wholesale and retail trade services).

3.64 **Output of other financial intermediation services like security, loan and insurance brokers, advisors on investment** is measured by fees or commissions charged to customers.

G. Output of non-financial services

3.65 Non-financial services include a large number of activities classified in the following sections of ISIC, Rev.4:

a) H: Transportation and storage;
b) I: Accommodation and food service activities – see also previous discussion on distributive trade;
c) J: Information and communication;
d) L: Real estate activities;
e) M: Professional, scientific and technical activities;
f) N: Administrative and support service activities;
g) P: Education;
h) Q: Human health and social work activities;
i) R: Arts, entertainment and recreation;
j) S: Other service activities.

3.66 Output of market non-financial services is the sum of revenues receivable for the services rendered. These revenues normally called fees should exclude interest receivable on investing financial assets. They should also exclude taxes on products assed on these revenues.

3.67 Output of transportation and storage that cover railroad, airlines, shipping, trucking, pipelines for the benchmark year must be collected through censuses of transportation. For annual and quarterly value added industry reports are major source of information, but when they are not yet available, employment, taxes collected or ton-kilometers, passenger-kilometers could be used. Communication and telephone may be extrapolated by number of calls made, tons of mail delivery, etc. Employment, taxes, number of customers (like students) are major indicators for other nonfinancial service activities.

3.68 In the case that these service activities are non-market, which means that the government is the main source of funding for the activities such as public education and health, the output of these services will be measured by production costs which are discussed below.

H. Output of non-market services

3.69   Non-market services such as education, health, administrative and national security services may occur at any economic activity, which is provided free or is sold at economically insignificant prices. The output of these services is measured at production costs. Non-market output includes those produced by the following institutional sectors:

    a) General government;
    b) Non-profit institutions serving households.

3.70   For the calculation of output of non-market services at basic prices, it is assumed that operating surplus is zero and the output is equal to the sum of:

    a) Intermediate consumption;
    b) Compensation of employees;
    c) Consumption of fixed capital;
    d) Other taxes less subsidies on production.

Table 3.7. Government output by types of services

	Operating costs of public schools, public hospital, transport system, public parks and library, housing services, collection of refuses, etc.	Operating costs of general administration, national defense and security, maintenance of public works and other collective objectives	**Total**
	=Individual final consumption expenditures + sales or fees charged to individuals	**=Collective final consumption expenditures**	
	(1)	(2)	(3) = (1)+(2)
1. Intermediate consumption on goods and services	40	40	**80**
2. Compensation of employees	160	60	**220**
3. Consumption of fixed capital	5	10	**15**
4. Other taxes less subsidies on production	0	0	**0**
Government output by type of services (= 1+2+3+4 in each column) and grand total	**205**	**110**	**315**

3.71   Table 3.7 shows how government output by types of services can be prepared. This table should be prepared in conjunction with compilation of government final

consumption expenditures presented in table 4.1 of the following chapter 4. Activities included in the government sector should produce goods and services that are provided free or almost free to society and individuals**.**

3.72   **All government-owned corporations are not part of the general government sector. Not only that, any government unit that keeps full set of accounts and charges market prices or prices that cover costs for their goods and services produced should be treated as quasi-corporations and included in the corporations sector**.

3.73   Goods and services that are included in intermediate consumption are actual goods and services used in the accounting period and therefore purchases of goods may have to be adjusted for changes in inventories (methods of adjustment have been previously discussed). This is particularly important for military arsenals (bullets, for example) that can be used only once. The SNA1993 treats purchases of these military goods as intermediate consumption even though they are put in inventories for future uses. The 2008 SNA treats them as intermediate consumption only when they are used up.

3.74   Goods included in intermediate consumption are current goods, therefore goods that serve as fixed assets must be excluded. Expenditures on construction and major repairs and maintenance which are treated as gross capital formation must also be excluded. Expenditures on military systems and equipments that can be repeatedly used are treated by the 2008 SNA as fixed assets, and therefore should not be included in intermediate consumption. This is a change from the SNA1993. Some expenditures on research and development, database and software development when capitalized should not be treated as intermediate consumption.

I.   Output of goods and services produced for own use

3.75   Goods and services produced for own final use may be market or non-market depending on whether the producers are market or non-market producers. These goods include:

   a) Goods produced by households for own consumption (either for final or intermediate uses):[17] This type of goods can occur in any kind of activity from agriculture to manufacturing, as it has been discussed in relevant sections. Sources of information come from household income and expenditure surveys;

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[17] It is important to recognize that for household unincorporated enterprises only, the 2008 SNA allows for the production for own intermediate use. In general, and for corporations, own production to be used in the same period as inputs by the same establishment, according to the SNA, will neither be treated as output or intermediate consumption (see SNA1993, 6.152). There is no change of this rule in 2008 SNA (para. 6.87). However, for household activities, all goods produced whether for own final consumption or not will be treated as output (2008 SNA, para. 6.32).

b) Owner-occupied dwelling services (discussed below);
c) Value of services provided to households by paid domestic staff. Imputed only by compensation of employees paid. Sources of information come from household income and expenditure surveys;
d) Own-account construction (discussed in previous section);
e) Own-account research and development: Output is measured by production costs discussed in para. 3.65. Extrapolation relies on employment data in terms of working hours. Sources of information come from industry survey.
f) Own-account software development. Extrapolation relies on employment data in terms of working hours. Sources of information come from industry survey.

3.76   Goods and services produced for own use should be valued at equivalent market prices. For instance, production for own consumption of a certain crop should be measured at the market prices of that crop at the farm gate. For own construction of houses, owner-occupied dwellings that may have equivalent market prices for example construction cost or rental per square meters of similar quality, these market prices should be used. In most cases, equivalent market prices are not available; therefore the method of measuring output by costs as shown in the measuring of output of non-market goods and services should be used.

3.77   **Services of owner-occupied dwellings.** This item makes up a significant share of GDP (normally not less than 4%). It is an activity of the unincorporated household enterprises that produce real estate services to households similar to those produced by market real estate enterprises. This output is estimated by using equivalent market rent per unit of space (square feet or square meters) of a certain quality to be applied to space occupied by households. Data on housing conditions is provided by Census of housing and/or population which must be updated by information on new construction. Data on rentals must also be collected in order to estimate the total value of rentals which is the output of owner-occupied dwellings. Some countries that do not have data on rentals estimate this output roughly by adding assumed consumption of fixed capital (which require the value of owner-occupied dwellings and an assumed average life expectation) with cost of maintenance. Given the output of the benchmark year, the output in a current period is simply extrapolated by space and price indexes.

3.78   **Research and development (R&D) and software and database for own use**. One point that needs clarification in terms of classification is that when R&D is own produced, if it is produced by market producers it is market service, but if it is produced by non-market producers, it is classified as nonmarket services. The output of these activities is estimated by costs spent on their development, which is similar to the estimation of non-market output. Only part of R&D may be capitalized when if it generates long-term benefits for the producers.

J. Output of originals and copies

3.79   The production of books, recordings, films, software, tapes, disks, etc. is a two-stage process of which the first stage is the production of the original and the second stage is the production and use of copies of the original. The original becomes asset of the producers, and its output value is measured at the price it received when sold. If not sold, it may, most of the time, be valued at costs similar to non-market output, unless it is possible to estimate the net value it generates for the owner throughout its life time.

3.80   Copies in the second stage are valued at the prices copies are sold or rented out in the market. The payment for the use of the originals in doing this is treated as intermediate consumption. If the original is owned by the copy makers, it is treated as its own asset, and consumption of fixed capital should be calculated.

Part III
Methods and practices in estimating final expenditures

Chapter 4. Measurement of final expenditures

4.1   This chapter will discuss the measurement of various components of final expenditures which include final consumption expenditure, exports and imports and finally gross capital formation. It also touches on the issue of how to capitalize an expenditure.

A.   Final consumption expenditure

4.2   Final consumption includes goods and services, which are used by households or the community to satisfy their individual wants and social needs. Thus final consumption is broken down into:

- a) Final consumption expenditure of households;
- b) Final consumption expenditure of general government;
- c) Final consumption expenditure of non-profit institutions serving households.

4.3   For households, all consumed goods - durable such as cars, refrigerators, air-conditioners, etc. and non-durable such as food, clothes - are part of final consumption, with the exception of purchases, own-construction or improvements of residential housing, which is treated as part of gross capital formation.

4.4   Included in final consumption expenditure of households are:

- a) All goods and services bought for final consumption by households;
- b) All goods produced for own final consumption by households, including those goods and services produced by household enterprises and retained for final consumption;
- c) Domestic services produced for own final consumption by employing paid staff such as servants, cooks, gardeners, chauffeurs;
- d) Services of owner-occupied dwellings (whose imputed values are equivalent market rentals);
- e) All goods and services acquired by households in barter transactions for final consumption;
- f) All goods and services received by households as payment in kind from producers;
- g) Expenditures incurred in "do-it-yourself" decoration, maintenance and routine repairs of own dwellings and personal goods;
- h) Payment to government units to obtain various kinds of licenses, permits, certificates, passports, etc.;

i) Explicit and imputed service charges on household uses of financial intermediation services provided by banks, insurance companies, pension funds, etc.

Table 4.1. Allocation of government expenditure to government final consumption expenditure

Expenditures on current goods and services	⟹	Government final expenditure
1. As non-market output of government less sales (see also table 3.6)		
Expenditures to produce non-market individual goods and services less sales for delivery free of charge or at insignificant prices to households such as education, health services, sports and recreation, culture, provision of housing services, collection of household refuse, operation of public transport, etc.	⟹	Government individual final consumption expenditure
Expenditure to produce non-market collective goods and services for general administration, national defense, security and other common benefits to the community as a whole.	⟹	Government collective final consumption expenditure
2. As social benefit in kind		
Reimbursements from government's social security funds to households on specified goods and services bought by households on the market; Other social security benefits in kind except reimbursements: This includes goods and services which are *not produced* by the government sector but bought and distributed free or almost free to households under the social security funds (any payment by household must be deducted); Social assistance benefits in kind: This includes goods and services similar to *other social security benefits* but not under social security schemes.	⟹	Part of government final consumption expenditure
3. Expenditures on of capital goods	⟹	Government capital formation
4. Other expenditures		Uses in income and capital accounts
• Payment for social security, foreign assistance for current expenditures, etc. • Interest payments on debts • Re-payment of principle on debts		• Current transfers • Property income • Financial transactions

4.5   Included in the final consumption expenditure of general government and non-profit institutions serving households are:

a) Non-market output other than own-account capital formation, which is measured by production costs less incidental sales of government output (own-account capital formation is treated as government output and consumed as capital formation);

b) Expenditure on market goods and services that are supplied without transformation and free of charge to households (called by the SNA as social transfers in kind).

4.6   Practically, the compilation of government final consumption expenditure is based on the classification of data from actual consolidated annual budgets of all levels of the government (i.e. central, state and local governments) to appropriate national accounts concepts. Data on actual government expenditures are however not normally available at the end of the year, thus government expenditures must be estimated on the basis of budgeted expenditures using some relationships (simple ratios for example) between actual and budgeted expenditures in the past. Estimates of government output and final consumption expenditure will have to be revised when actual data is available.

B.   Exports and imports of goods and services

Definition

4.7   Exports and imports between the domestic economy and the rest of the world are transactions between residents and non-residents of an economic territory (see figure 2.4).

4.8   A transaction of goods and services (sales, barter, gifts) from residents to non-residents is an export and from non-residents to residents is an import. From this definition, purchases of goods and services by non-resident tourists in the country are treated as exports and purchases of goods and services by resident tourists outside of the country are treated as imports.

4.9   Exports and imports exclude all transactions in land, buildings and non-movable non-produced assets, and in financial assets (stocks, bonds, money, monetary gold, etc.) The SNA takes an exception rule on land, buildings and non-movable non-produced assets since they are still used for production purposes in the domestic economy. Financial assets are neither goods nor services.

4.10   Exports and imports occur when there are changes of ownership between residents and non-residents regardless of whether there are corresponding physical movements of goods across borders). However there are three exceptions that require

imputation of changes of ownership: (i) financial leasing; (2) deliveries between affiliated enterprises; and (iii) goods sent for significant processing to order or repairs. Goods bought from non-residents and sold to non-residents by commodity dealers within the same accounting period are not recorded as exports or imports.

Residents and non-residents

4.11   Exports and imports between the domestic economy and the rest of the world are transactions between residents and non-residents of an economic territory (see figure 4.1).

4.12   An institutional unit, for example a household, an enterprise, a non-profit unit, etc. is a resident unit when it has a center of economic interest in the economic territory in question. Center of economic interest is understood as ownership of land, ownership of structures or engaging in production in the territory for a long period of time (at least a year).

Figure 4.1. Exports and imports as transactions between residents and non-residents
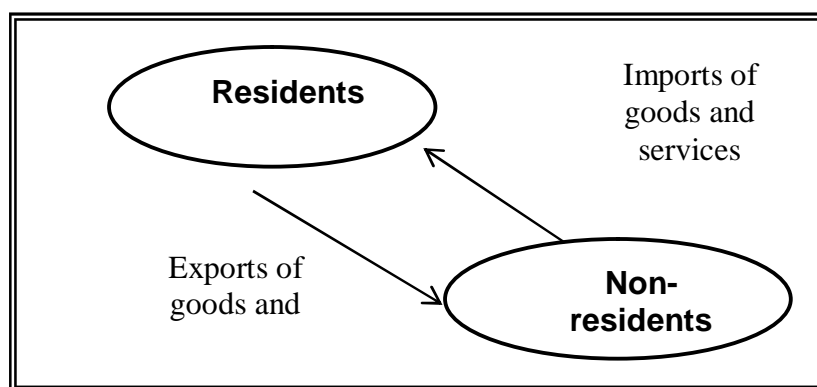
4.13   Military personnel, civil servants including diplomats employed abroad by an economic territory are residents of the territory that employs them.

4.14   Students are residents of their country of origin however long they study abroad.

4.15   International organizations are not considered residents of any national economy, but their workers are residents of the economy in which they are expected to have their abode for at least a year.

4.16   Owners of buildings and non-produced assets like land, subsoil assets, legal constructs like leases, etc. even though are not residents; they are treated as residents of the economy since these assets remain in the economy and serve the production activities of the economy. Transactions of them are not part of exports and imports.

Valuation of exports and imports

4.17   Exports are valued f.o.b. (free on board), i.e. at the prices at the domestic customs frontier before being shipped out. They should be, by definition, equivalent to purchasers' prices since they include domestic transport, and trade costs to bring the good to the ports, and also include taxes less subsidies on products paid by the purchasers or received by the producers.

4.18   Imports must also be valued f.o.b. (free on board), but in this case they are valued at the prices at the foreign custom frontier.

4.19   Imports are normally valued c.i.f. (i.e. including insurance and freight costs) at the domestic custom frontier by customs. To derive imports f.o.b., cost of freight and insurance services between the two borders must be estimated and deducted from imports c.i.f. Freight and insurance services on imports may be provided by either residents or non-residents. Those provided by non-residents are imports but those provided by residents are domestic output. Imports f.o.b. avoid counting domestic output as imports and avoid double counting imported freight and insurance services, as they are already included in data on imports of services.

Estimation

4.20   Instructions on preparing balance of payments published by the IMF provide details on methods to prepare exports and imports.[18] Foreign trade statistics that reflects official merchandise trade across borders recorded by customs is the main source of data for exports and imports. However, in general, it does not cover:

  a) Imports and exports through smuggling particularly for countries with land borders with other countries;
  b) Exports of fish and purchases of oil on the high seas;
  c) Imports and exports of military goods by government that are often not recorded;
  d) Imports and exports of services paid through the banking system, from postal, telephone, electricity, transport, hotels, consultancy services, electronic trade in services, financial and insurance services, etc.

4.21   Items (a) to (b) may be based on certain benchmark studies and in the absence of any additional information may be assumed to change over time in the same way exports and imports of merchandise change for years between benchmark years.

4.22   Items (c) may be obtainable only from government, even though some time they may be obtained from trade statistics of the country trade counterpart. Items in (d) can be obtainable from the Central Bank which collects data from banks under its supervision,

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[18] IMF, Balance of Payments Manual. Free electronic document:
http://www.imf.org/external/pubs/ft/bopman/bopman.pdf.

from postal, telephone, electric, airlines, transport and shipping, insurance and financial companies that do business across borders.

C. Gross capital formation

4.23   Gross capital formation in the SNA is the same as the concept of *investment in capital goods* used by economists. It includes only produced capital goods (machinery, buildings, roads, artistic originals, etc.) and improvements to non-produced assets. Gross capital formation measures the additions to the capital stock of buildings, equipment and inventories, i.e. the additions to the capacity to produce more goods and income in the future.

4.24   Non-produced assets such as land, natural resources, patented entities may also be used as capital in an establishment or enterprise or the whole economy but they are not part of the gross capital formation in the SNA.

4.25   In business accounting, investment in capital goods may include acquisitions less disposals of non-produced assets (such as land, mineral resources, etc.). At the national level, the inclusion or exclusion of non-produced assets would not affect the value of investment in capital goods, as the sale of a non-produced asset by one economic entity will be offset by a purchase of the same asset by another economic entity.

Common usage of the term "investment"

4.26   In common usage (business and households) the concept of investment is very broad. It includes:

        a) Investment in produced and non-produced assets (i.e. patents, goodwill, natural resources);
        b) Investment in financial assets.

4.27   Gross capital formation which is a major factor in changing the values of non-financial assets in the economy includes (see table 2.3 for the classification of assets and the effects of gross capital formation on assets):

        a) Gross fixed capital formation;
        b) Changes in inventories;
        c) Acquisition less disposals of valuables (like jewellery and works of art).

Gross fixed capital formation

4.28   Practically for the compilation of gross fixed capital formation, the worksheet that includes assets by types should be used (see table 4.2). This will be discussed later.

Conceptually, gross fixed capital formation includes all goods and related services that can be used repeatedly for more than one year to produce other goods and services. It reflects the following types of transactions:

a) Acquisitions less disposals of new or existing produced assets such as dwellings, other building structures, machinery and equipment, cultivated assets (e.g. trees and livestock), mineral exploration, computer software, entertainment, literary or artistic originals and other intangible fixed assets, capitalized research and development;

b) Costs of ownership transfers on non-produced, non-financial assets like land and patented assets;

c) Major improvements to produced and non-produced, non-financial assets that extend the lives of assets (e.g. reclamation of land from sea, clearance of forests, rock, etc., draining of marches or irrigation of forests, and prevention of flooding or erosion);

d) Acquisitions can be in terms of purchase, own-account production, barter, capital transfer in kind, financial leasing, natural growth of cultivated assets and major repairs of produced assets;

e) Disposals can be in terms of sale, barter, capital transfer in kind, financial lease. Exceptional losses, such as those due to natural disasters (fire, drought, etc.) are not recorded as disposal.

4.29   It is important to realize that assets in business accounting are measured at book values and are adjusted for depreciation, therefore the difference between the values of assets of the two periods would not provide the value of gross fixed capital formation (see table 4.3 for the factors that change values of assets during an accounting period). These factors include acquisitions less disposals of assets and inventories (adding to the value of assets as gross capital formation), consumption of fixed capital (reducing the value of assets) and other changes in assets that may be volume changes and/or price changes). Thus, to get a proper value of gross fixed capital formation, assets must be revalued. However, it is much better to ask for information on new investment in fixed capital directly from businesses.

Changes in inventories

4.30   Inventories include:

a) Materials and supplies;

b) Work-in-progress (growing crops, maturing trees and livestock, uncompleted structures, uncompleted other fixed assets, partially completed film productions and software);

c) Finished goods;

d) Goods for resale.

Table 4.3. Classification and formation of non-financial assets

Types of non-financial assets	Opening balance sheet	Changes in the balance sheet			Closing balance sheet
		Gross capital formation	Consumption of fixed capital	Other changes in balance sheet	
	(1)	(2)	(3)	(4)	(5) = (1)+(2)-(3)+(4)
Produced assets					
Produced fixed assets					
Dwellings					
Other buildings and structures					
Non-residential buildings					
Other structures					
Land improvements					
Machinery and equipment					
Transport equipment					
ICT equipment					
Other machinery and equipment					
Weapons systems					
Cultivated assets					
Livestock for breeding, dairy, etc.					
Vineyards, orchards and other plantations					
Intellectual property products					
Research and development					
Mineral exploration and evaluation					
Computer software and databases					
Entertainment, literary or artistic originals					
Other intellectual property products					
Inventories					
Materials and supplies					
Work in progress					
Finished goods					
Military goods					
Goods for resale					
Acquisitions less disposals of valuables					
Acquisitions less disposal sof non-produced assets					
Natural resources					
Land					
Subsoil assets					
Mineral and energy reserves		Not applicable			
Non-cultivated biological resources					
Water resources					
Other natural resources					
Acquisitions less disposals of contracts, leases and licenses					
Contracts, leases and licenses					
Purchase, sale of goodwill and marketing assets					

D.   Capitalization of own-account capital formation: an example

4.31   Many activities from own-account construction of dwellings, own-account research and development and software development are capitalized by the SNA. This means they are used as fixed assets over a time period longer a year to produce other goods and services. Without being capitalized, the goods and services used to produce them are treated as intermediate consumption and the wages and salaries paid as well as consumption of fixed capital in producing them make up gross value added. The example below will be used to show the necessary imputations in the accounts.

Table 4.1. Account without imputation of own-account capital goods: an example

Output at basic prices	**120**
Goods and services used in production	**40**
Gross value added at basic prices	80
Other taxes on production	0
Compensation of employees (COE)	60
Consumption of fixed capital (CFC)	10
Net operating surplus	10

Cost of own-account R&D: 11
- Goods and services: 2
- COE: 8
- CFC: 1

Table 4.2. Account with imputation of own-account capital goods: an example

	Original output before capitalization	Output after capitalization	
		Primary output	Secondary output
Output at basic prices	**120**	**120**	**11**
Goods and services used in production	**40**	**38**	**2**
Gross value added at basic prices	**80**	**82**	**9**
Other taxes on production	0	0	0
Compensation of employees (COE)	60	52	8
Consumption of fixed capital (CFC)	10	9	1
Net operating surplus	**10**	**21**	**0**

4.32   After enumerating the costs incurred in generating research and development (R&D), which is shown in the red box within table 4.1, the output of R&D is imputed as the sum of costs (which is 11 in the example). Thus now the company produces two products: (1) its own principal product which is still valued at 120 (calculated on the basis of sales), and (2) its secondary product which is value at cost at 11. Thus when own-account production is capitalized instead of being treated as merely current cost of production, the output and value added generated by the company and thus the whole economy increase by the same amount of output capitalized, which is 11 in the example (see table 4.2). Essentially, this means that the imputed income retained by the company (or saving in the national accounts concepts) is utilized to purchase its own output as gross capital formation. So in terms of balancing supply and uses of goods and services in the economy, out of the output of 131, sales to others is 120 and 11 is sales to itself as gross capital formation.

4.33   **The consequence of imputed capitalization is higher gross value added and thus higher GDP by the same imputed amount**. With this imputation, it is expected by economists specializing in productivity analysis and the 2008 SNA that the imputed intellectual property assets can explain productivity effect on economic growth. Other economists are still uneasy of imputations that go beyond actual transactions, particularly in case of research and development where they may not yield any concrete results. In addition the depreciation of these assets can only be based on some convention.

4.34   **The treatment of military weapons systems as gross fixed capital formation** is in fact not an imputation since they have useful lives of more than one year and can be used repeatedly. It is doubtful that the increase in the accumulation of these assets explains economic growth. This is the reason that for analysis of economic growth only non-military assets should be used.

E. Estimation of gross capital formation

4.35   A worksheet shown in table 4.4 will help facilitate the compilation of gross fixed capital formation (GCF) and inventories by kind of assets, which must be in purchasers' prices. The main focus is on obtaining data for columns (1), (2) and (3). GCF for each kind of asset is derived from domestic production, imports which are then reduced by exports. In addition to utilizing these sources to estimate investment in fixed assets, surveys on investment of enterprises would provide the total value of investment to be used as total controls. Surveys are normally designed to find indicators that allow for the extrapolation of benchmark data on fixed assets.

4.36   Construction statistics provide a major source of information to construct gross capital formation in dwellings, other buildings and structures. From construction

statistics, only activities that result in fixed assets or that prolong the assets' life will be counted as assets (i.e. major repairs).

Table 4.4. Worksheet for compiling gross fixed capital formation

Types of non-financial assets	Domestic production	Imports	Exports	Gross capital formation
	(1)	(2)	(3)	(4) = (1) + (2) – (3)
Produced assets				
Produced fixed assets				
Dwellings				
Other buildings and structures				
Non-residential buildings				
Other structures				
Land improvements				
Machinery and equipment				
Transport equipment				
ICT equipment				
Other machinery and equipment				
Weapons systems				
Cultivated assets				
Livestock for breeding, dairy, etc.				
Vineyards, orchards and other plantations				
Intellectual property products				
Research and development				
Mineral exploration and evaluation				
Computer software and databases				
Entertainment, literary or artistic originals				
Other intellectual property products				
Inventories				
Materials and supplies				
Work in progress				
Finished goods				
Military goods				
Goods for resale				
Acquisitions less disposal of valuables				
Acquisitions less disposal of non-produced assets				
Natural resources		Not applicable		
Land				
Subsoil assets				
Mineral and energy reserves				
Non-cultivated biological resources				
Water resources				
Other natural resources				
Acquisitions less disposals of contracts, leases and licenses				
Contracts, leases and licenses				
Purchase, sale of goodwill and marketing assets				

4.37   Machinery and equipment are obtained from domestic production, which after deducting exports is an important source of data on GCF. Merchandise imports of machinery and equipment would normally identify another important source of supply.

4.38   Weapons system must be based on government sources.

4.39   Cultivated assets are derived from agricultural statistics and the work of national accountants on agriculture.

4.40   Intellectual property relies on industrial surveys and imputation of data by national accountants particularly with data on employment to be used for estimation or extrapolation.

4.41   Data on inventories must rely on industrial and distributive trade surveys. Most countries focus mainly on inventories kept by major industrial producers and enterprises involved in distributive trade, and national strategic inventories of important commodities such as petroleum, rice, and wheat that are kept by government.

F. Estimation of consumption of fixed capital

4.42   Special characteristics of consumption of fixed capital include:

a) Consumption of fixed capital is a cost of production. It measures the decline in the current values of the stock of fixed assets owned and used by producers as a result of physical deterioration, normal obsolescence and normal accidental damages during the accounting period;

b) Thus, consumption of fixed capital can be measured directly or indirectly. The direct method is through surveys of produced fixed assets at market at two consecutive periods and then calculating the decline in the market values of the stock of fixed assets. The indirect method recommended by the SNA is the perpetual inventory method, which is an approximation of market valuation and less costly to implement. Depreciation in business accounting is not acceptable in national accounting since it is based on historical book values;

c) The example below shows the difference between depreciation used in business accounting and consumption of fixed capital, which is the economic concept adopted by the SNA.

Table 4.4. Depreciation and consumption of fixed capital

	1. Depreciation in business accounting at book value (straight line over 4 years)							
		Calculating method	T_{-4}	T_{-3}	T_{-2}	T_{-1}	T	T_{+1}
1	Gross capital formation at book value (GCF)			800				
2	Depreciation at book value (D)	D= Line (1)/4		200	200	200	200	0
3	Net capital stock at book value, end of period*	NCS=NCS+GCF-D	0	600	400	200	0	0

	2. Consumption of fixed capital in national accounting by the perpetual inventory method							
		Calculating method	T_{-4}	T_{-3}	T_{-2}	T_{-1}	T	T_{+1}
4	Price index of fixed asset			100	105	106	115	
	At base year price of T_{-2}							
5	Gross capital formation (GCF)			840				
6	Consumption of fixed capital (CFC)	= Line (5)/4		210	210	210	210	0
7	Net capital stock, end of period	=NCS+ GCF-CFC	0	630	420	210	0	0
	At current market price							
8	Consumption of fixed capital at current market prices	=Line (6) price-adjusted by line (4)		200	210	212	230	0
9	Net capital stock at current market prices, end of period*	= Line (7) price-adjusted by line (4)		600	420	212	0	0

*By convention, depreciation and CFC start in the year in which GCF takes place.

Notes to table 4.4:

- The very simple example below shows how depreciation in business accounts and consumption of fixed capital is calculated. It is assumed that the fixed asset was bought at time T-3 for 800 and entered in the business account at this price (e.g. book value, or historical value), has a lifetime of 4 years and will be scrapped after that. The value of the fixed asset is assumed to decline proportionally over 4 years (straight line depreciation).

- Table 4.4.(1) shows the calculation of depreciation in business or government accounting. Gross capital formation is recorded at book value. As the asset survives 4 years, depreciation is simply calculated by dividing the book value by 4.

- Table 4.4.(2) shows the calculation of consumption of fixed capital by using the perpetual inventory method. The method requires first the calculation of gross capital stock and consumption of fixed capital at the base year price and then the inflating of these values into current prices by using price indices. Thus the following steps are required:

  o The gross capital stock at book value is converted to the price of a base year. In this example, the base year is set at T-2.

- o The consumption of fixed capital at the base year price is calculated by using the same straight -line depreciation assumption. Net capital stock at the base year price is the difference between gross capital stock and consumption of fixed capital.
- o The next step is to derive consumption of fixed capital and net capital stock at current market values by using the price indices.

- As can be seen in table 4.4.(2), the calculation of the consumption of fixed capital of one fixed asset with a 4-year lifetime at time T requires data on gross capital formation of that kind of asset from year T-3 on. The consumption of fixed capital of buildings with 30-year lifetime at the present time will require data on annual gross capital formation of buildings of the same kind for 30 years before that. Thus, the calculation of consumption of fixed capital requires long time-series of data on gross capital formation, their average service life and their probability of retirement. In practice, the compilation of net capital stock and the calculation of consumption of fixed capital require a combination of obtaining an initial benchmark estimate of capital stock (by survey) and series of gross capital formation statistics.

- The simple method shown in table 4.4 omits the effects of asset mortality, i.e. how assets are retired around the average service life especially when there is more than one fixed asset of the same kind. The assumption of a straight-line depreciation may need to be replaced by a more realistic assumption that is appropriate for each kind of assets as some depreciate quickly at the beginning and slowly at the end of its service life, while the opposite is true for others.

- For more detailed information on the perpetual inventory method, readers are advised to read chapter 8 of the handbook, *Links Between National Accounting and Business Accounting* (United Nations, ST/ESA/STAT/SER.F/F76) or *Measuring of Capital: A Manual on the Measurement of Capital Stocks, Consumption of Fixed Capital and Capital Services* (OECD).

G. Relationship between consumption of fixed capital, net capital formation, net saving and net value added

4.43.   Gross capital formation is the actual investment expense to increase stocks of non-financial assets. However, part of it is to replace the fixed assets that are used up in production. The using up of fixed assets is reflected in physical deterioration, normal obsolescence or normal accidental damages. Thus the economic increase in fixed assets is net capital formation, which equals gross capital formation less consumption of fixed capital. Correspondingly, net value added and net saving are calculated by subtracting consumption of fixed capital from gross value added and gross saving.

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Appendix 4.1:
Exercise on estimation of consumption of fixed capital and net capital stock

Given that a firm bought two assets. Asset 1 was bought at t-4 at 300 and had a lifetime of 3 years. Asset 2 was bought at t-3 at 800 and had a lifetime of 4 years. Calculate value of net capital stock, and consumption of fixed capital of the firm from time t-4 to t with the assumptions that price indices of the two assets varied similarly, and that the two assets depreciated linearly.

	t-4	t-3	t-2	t-1	t
Asset 1	300				
Asset 2		800			
Price index	100	105	106	115	120

Appendix 4.2:
Exercises on GDP by production and final expenditure

Given the attached information (which is highly simplified):

1. Estimate gross value added (VA) and VA/output ratio for each industry by ISIC, Rev. 4 categories (sections):

A	Agriculture, hunting, forestry and fishing
B	Mining and quarrying
C	Manufacturing
D+E	Electricity, gas and water supply
F	Construction
G+I	Wholesale, retail trade; repair of motor vehicles, motorcycles and personal and households goods; hotels and restaurants
H+J	Transport, storage and communications
K+L+M+N	Financial intermediation; real estate, renting and business services
O	Public administration and defense; compulsory social security
P+Q+R	Education; health and social work; other community, social and personal services
T	Private households with employed persons

2. Estimate output, intermediate consumption (IC) and gross value added (VA) for non-market activities.

3. Estimate GDP by production approach.

4. Estimate final expenditure by type of expenditure:
   - Final consumption expenditure (C) for government, non-profit institutions serving households (NPISHs) and households
   - Gross capital formation (I)
   - Net exports (X-M).

5. Estimate GDP by expenditure and compare it with GDP by production approach.

Information:

A. market output		
Industry	**Output** (Basic prices)	**Intermediate consumption** (Purchasers' prices)
Construction/repairs	300	250
Livestock	150	80
Forestry & fishing	280	96
Oil extraction	100	40
Garments	250	100
Other manufacturing	120	70
Electricity & water	40	15
Transport	145	86
Crops	450	140
Trade mark-up	230	90
Hotels & restaurants	120	55
Real estate	100	67
Business services	90	40
Private schools	40	23
Private hospitals	60	34
Recreation	50	30
Other personal services	100	60

B. Non-market economic activities	
Central and local government services	
Compensation of employees	200
Purchases of materials and services (current expenditures only)	100
Consumption of fixed capital	60
Public schools and state colleges and universities (completely free)	
Compensation of employees	100
Purchases of materials and services (current expenditures only)	40
Consumption of fixed capital	10
Public hospitals (completely free)	
Compensation of employees	120
Purchases of materials and services (current expenditures only)	70
Consumption of fixed capital	20
Non-government, churches and temples, others	
Compensation of employees	40
Purchases of materials and services (current expenditures only)	70
Consumption of fixed capital	5
C. Other estimated items	
Imputed value of owner-occupied dwelling units (based on equivalent market rent)	150
Purchases of materials and services for minor repairs	30
Residual	120
Consumption of own production of crops	70

D. Import taxes and other taxes on products less subsidies	250
E. Purchases of goods and services by households for consumption	950
F. Gross fixed capital formation	120
G. Change in inventory	20
H. Exports of goods and services f.o.b.	750
I. Imports of goods and services f.o.b.	600

Guides:

- Non-profit institutions serving households (NIPSHs) include non-market economic activities that are not mainly financed by government.
- Non-market activities that are mainly financed by the government should be classified into the general government sector.
- Output of general government and non-profit institutions serving households is calculated as the sum of compensation of employees, intermediate consumption and consumption of fixed capital.
- Final consumption expenditure of government includes: output of government services less sales, plus output of other non-market activities financed by government (public schools and hospitals, etc.) less sales, plus purchases of goods and services by government to be distributed free to households. Final consumption expenditure of NPISHs includes output of NPISHs less sales plus their purchases of goods and services to be distributed free to households.

Chapter 5. An integrated strategy for compiling GDP by the use of supply and use tables

A. Introduction

5.1   The supply and use tables (SUT) are in the core of a national accounting system that fully describes the supply and use of any product in an economy. It is the basis for preparing an input-output table in which its core is an invertible square-table, an analytical model that is based on the assumption that each industry produces only one product. Input-output table is a tool for economic analysis and modelling, it may need the SUT, not vice versa. In actuality, most industries produce more than one product and therefore SUT is designed to reflect this reality. For this reason, SUT as the tool to compile GDP by three approaches in an integrated manner is the subject matter of this chapter. Even though SUT has been a central part of a national accounting system since the publication of the 1968 SNA, its role in compiling national accounts annually and even quarterly should deserve more attention for the sake of improving the quality of estimates. In addition, the preparation of SUT also facilitates the preparation of a symmetric input-output table as the balancing of a SUT is much easier than balancing of an input-output table. This chapter begins with the explanation of the supply and use tables and then moves on to describe steps to be taken in compiling GDP.

B. Description of supply and use tables (SUT)

5.2   In the SNA, the supply table shows, along each row, the kind of product produced by domestic industries and supplied by the rest of the world. Domestic products are measured at basic prices and imports are valued c.i.f. Total supply of each product in purchasers' prices is obtained by adding in trade and transport margins, and taxes less subsidies on products. C.i.f./f.o.b. adjustment (that is to eliminate the values of services like insurance and transport associated with imports but supplied by domestic suppliers) has already been incorporated in the supply table in the example shown below. Down each industry column in the supply table is products produced by an industry. For example, industry 2 produces a total value of 104, out of which 24 is value of goods and 80 is value of services.

5.3   The use table shows, in each industry column, the uses of goods and services (i.e. the cost structure) of industries and the value added generated by them. Along each row of the same table are the uses of each product either for intermediate consumption,

exports, final consumption or gross capital formation. They are all in purchasers' prices, the prices the users actually pay for.

5.4   The negative entry in the trade transport column in the supply table is to make the total of row 3 in the supply table equivalent to the total of row 3 in the use table, which shows only transport services directly used (which is not the transport services invoiced as part of trade margins).

5.5   Industries may be classified by International Standard Industrial Classification of All Economic Activities (ISIC). Products (goods and services) are classified by Central Product Classification (CPC).

5.6   The total supply and the total uses at purchasers' prices of each product in SUT must be equal. These values are, however, statistically constructed and are not data that can be collected through surveys. Data collected by censuses or surveys include output at basic prices, imports c.i.f., taxes less subsidies on products, trade and transport margins on traded goods, exports, final consumption expenditure and gross capital formation.

5.7   To statistically create the total supply at purchasers' prices of each good, data on goods produced by industries must be supplemented by data on imports, wholesale and retail trade margins on the same good which are collected by censuses or surveys, and taxes less subsidies on margins which are estimated based on tax rates and the tax information from the government budget data. Trade margins on each good are calculated when output of trade is calculated.

5.8   The total supply at purchasers' prices are then equated to the total uses at purchasers' prices and used as the total control in the use table. Uses for intermediate consumption are collected by surveys on intermediate consumption of a sample of statistical units in each industry and then grossed up to the total industry output.

5.9   Data on gross capital formation to be reliable should be based on surveys. Data on government final consumption is based on budget records of government expenditure. Data on household final consumption is based on both household income and expenditure survey, retail trade survey and then confronted with residuals given other information when balancing the use and the supply tables.

5.10   Direct purchases abroad by residents are reported as part of household final consumption, they are then also treated as imports.

5.11   Direct purchases at home by non-residents, for simplicity and also due to the fact that it may be derived by balancing technique and therefore may be undistinguishable from resident household final consumption by type of products; it is treated as an adjustment.

5.12   The SUT prepared for the base year may include a few hundred of industries but may have up to a few thousands of products. Products when elaborated at the very

detailed level help facilitate the balancing of the supply and use, for example it is much easier to allocate and balance the use and resource of a specific product like rice or wheat than a more aggregate class of products like cereals. The precise number of products to be detailed depends on the importance in the economy of the specific products to be selected. For annual and quarterly SUT, the number of industries and products should be limited to no more than 50 as the objective of this SUT is to get more reliable estimates of GDP and its components in a timely manner, and not for the preparation of solid foundation of economic statistics for the base year.   .

C. The use of SUT in compiling national accounts with limited information

5.13   The structure of SUT of the base year can be used to compile either annual or quarterly GDP. This has been practiced by a number of countries such as the Netherlands and Australia with 30-40 industries and products.[19] In the discussion below, it is assumed that the structures in the supply table as well as the use table constant prices are constant. This assumption is fully compatible with the fact that the structure of the economy in current prices may change from one accounting period to another accounting period due to the fact that price of each product varies differently and thus the implicit price of each industry output also varies differently as a result. This point has been stressed in the example in the introduction chapter. In fact, only prices of individual products exist; there is no such thing as prices of industry outputs. Thus the extrapolation of SUT is first implemented on the basis of the constant prices of the base year SUT and therefore all data collected must be deflated to the prices of the base year. Then the SUT in current prices is obtained by inflating the SUT in constant prices in the second stage.

Data requirement

5.14   The method requires the following data:

a) **Table 2**. The supply coefficient of the base year: This assumes that the shares of products produced in each industry remain the same as the base year. It also assumes that coefficients of trade margins (i.e. trade margin of each product divided by the sum of domestic output and import in basic value) remain unchanged.

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[19] *A Supply and Use Model for Editing the Quarterly National Accounts, Australia, Research Paper, 2006*, see http://www.abs.gov.au/AUSSTATS/abs@.nsf/productsbytitle/677EA0FA7DA82424CA25723600113E3B?OpenDocument. Australia estimates quarterly GDP using supply and use table in current values first. The author however considers the compilation of GDP in constant price first is more appropriate since only the structure of the base year is assumed to be the same; the structure in current prices may vary. See also Timmi Graversen, application of the commodity flow method in the compilation of QNA (2002): http://www.h.scb.se/scb/projekt/iariw/program/2Bkvt.pdf.

b) **Table 3**. The use coefficient of the base year: This assumes that the input and value added coefficients in each industry remain the same.

c) **Table 4**. Data on industry output collected by surveys (deflated to base year t): In order to use table 2 and table 3 in base year prices, price indexes on products are needed in order to create price indexes of industry outputs.

d) **Table 5.** Data on exports and imports (deflated to base year t), household final expenditure (extrapolated by retail statistics and other information), government final expenditure from budget plan, gross capital formation (extrapolated by indicators obtained by survey and information on new fixed assets as part of the output of the construction industry and other machinery producing industry).

Steps to be taken

5.15   Creation of price indices for industry output (see table 6 and the note on the formula used in deriving them):
   a) Price survey produces only price indexes for products;

   b) Price indexes for industry output must be created using price indexes for products and the shares of products in each industry in the supply table as weights.

5.16   Creation of the supply table of t+1 in constant prices:

   a) The output coefficients in table 2 are applied to the industry output in constant prices from table 6 to obtain the products produced in each industry;

   b) Fill in the value of imports that are available in table 5;

   c) Estimate trade margins on the basis of the trade coefficient in table 2;

   d) Estimate taxes less subsidies on products, either with available detailed data or only with the total value of taxes less subsidies which are broken down into taxes less subsidies by products from the same share as in the supply table of table 1;

   e) The total supply of products is the sum of the components shown in the derived supply table in table 7.

5.17   Creation of the use table of t+1 in constant prices:

   a) The input-output coefficients in table 3 are also applied to the industry output in table 6 to derive the input flows. Data on exports, final consumption of households and government and data on gross capital formation available in table 5 are entered in the use table;

b) The sum of total use by product is then compared with the total supply by product in the newly derived supply table obtained in para. 5.15;

c) The preliminary derived use table is shown in table 8;

d) In table 8, a number of discrepancies can be identified for correction:

- The large discrepancy that can be easily identified is in household final consumption as household final consumption is much lower than the base year in both goods and services (for goods from 100 down to 88; and for services down from 28 to 10.3) when total value added is higher. If this is the case the discrepancy can be added to household final consumption. The discrepancies in both goods and services may be largely resolved by assigning them to final household consumption. There is only a small discrepancy left that cannot be possibly corrected;
- Since household final consumption of goods is down substantially; surveyed data and other estimated data should be verified carefully.

5.18   The explanation above is just for illustration; however, this is exactly the kind of analytical work, even though more complicated in actuality that is needed to verify the estimates.

5.19   Creation of the supply and the use in current prices:

a) The supply table in current prices should be established first. Price indexes of products in table 4 should be applied to inflate the outputs produced by each industry. Other flows such as imports, taxes less subsidies should be in their own current values. Trade margins should be set up by cost approaches; otherwise the same margin ratios of the base year should be applied to current values of outputs plus imports.

b) The value of supply in current prices in the supply table should serve as total control to derive other flows in the use table. For final expenditures, exports are in their own current values, other components may be based on appropriate CPI. The intermediate flows may be inflated in such a way to guarantee the values of total controls.

Basic information required

Table 1. Supply and use tables at the base year (year = t)

	Supply table	Output of industries			Total product output at basic prices	Imports c.i.f.	Trade margins	Taxes less subsidies on products	Total supply of products at purchasers' prices
		(1)	(2)	(3)	(4)=(1)+(3)	(5)	(6)	(7)=(4)+(6)	(8)
(1)	Goods	156	24	0	180	15	33	13	241
(2)	Services	9	80	0	89	7	0	7	103
(3)	Transport services directly purchased		0	42	42	0	-33	0	9
(4)	Direct purchases abroad by residents				0	3			3
(5)	Direct purchases at home by non-residents								0
(6)	Total industry output at basic prices/column total	165	104	42	311	**25**	0	3	356

	Use table	Intermediate consumption of industries			Total IC	Exports f.o.b.	Household final expenditure	Government final expenditure	Gross capital formation	Total use of products at purchasers' prices
		(1)	(2)	(3)	(4) =(1)+.(3)	(5)	(6)	(7)	(8)	(9)
(1)	Goods	25	35	13	73	28	100		40	**241**
(2)	Services	32	20	4	56	9	28	10	0	103
(3)	Transport services directly purchased	2			2	0	7		0	9
(4)	Direct purchases abroad by residents				0		3			3
(5)	Direct purchases at home by non-residents				0	1	-1			0
(6)	Total uses at purchasers' prices (1)+.+(5)	59	55	17	131	**38**	**137**	**10**	**40**	356
(7)	Gross value added at basic prices (9)-(6)	106	49	25	**180**	GDP = GVA+T = 180 + 20 = 200 GDP= Exports - Imports + Final expenditure + GCF = 38-25+137+10+40 =200				
(8)	Taxes less subsidies on production and imports				**20**					
(9)	Industry output at basic prices	165	104	42	311					

Table 2. The supply coefficient table of the base year (year = t)

		Output of industries			Total economy	Trade margins	Taxes less subsidies on products
		(1)	(2)	(3)	(4)=(1)+...(3)	(5)	(6)
(1)	Goods	0.9455	0.231	0		0.169231	
(2)	Services	0.0545	0.769	0		0	
(3)	Transport services directly purchased	0	0	1			
(4)	Direct purchases abroad by residents						
(5)	Direct purchases at home by non-residents						
(6)	Total industry output at basic prices	1.000	1.000	1.000			
(7)	Other column total						

Table 3. The use coefficient table of the base year (year = t)

		Intermediate consumption of industries		
		(1)	(2)	(3)
(1)	Goods	0.1515	0.3365	0.3095
(2)	Services	0.1939	0.1923	0.0952
(3)	Transport services directly purchased	0.0121	0	0
(4)	Direct purchases abroad by residents			
(5)	Direct purchases at home by non-residents			
(6)	Total uses at purchasers' prices (1)+.+(5)	0.3575	0.5288	0.4047
(7)	Total gross value added/GDP			
(8)	Gross value added at basic prices (10)-(6)	0.6424	0.4711	0.5923
(9)	Taxes less subsidies on production and imports			
(10)	Industry output at basic prices	1.000	1.000	1.000

Table 4. Information on industry output obtained by survey on year t+1 (already deflated to base year prices)

		(1)	(2)	(3)
(1)	Industry output at basic prices (current prices)	181.5	110.2	42.4
(2)	Price indexes of products	1.05	1.03	1.02

Table 5. Information on final expenditures obtained by survey on year t+1 (already deflated to base year prices)

		Imports	Exports f.o.b.	Household final expenditure	Government final expenditure	Gross capital formation
(1)	Goods	16	30	88.0		41.9
(2)	Services	8	10	10.3	9.3	0
(3)	Transport services directly purchased	0	0	6.1		0
(4)	Direct purchases abroad by residents	0		3		
(5)	Direct purchases at home by non-residents		1	-1		
(6)	Total	24	41	106.4	9.3	41.9

Derived information

Table 6. The derived price indexes for industry outputs

		(1)	(2)	(3)
(1)	Price indexes of industry outputs	1.047818	1.019231	1.02
(2)	Industry output at basic prices (current prices)	181.5	110.2	42.4
(3)	Industry output in base year prices (constant prices)	173.2	108.2	41.6

Note: Price index of industry output is calculated by the following formula:

Matrix of the supply coefficient x vector of price indexes of products = vector of price indexes of industry outputs

$$
\begin{vmatrix} 0.945455 & 0.2 & 0 \\ 0.054545 & 0.8 & 0 \\ 0 & 0.0 & 1 \end{vmatrix}
\; x \;
\begin{vmatrix} 1.05 \\ 1.01 \\ 1.02 \end{vmatrix}
\; = \;
\begin{vmatrix} 1.04781818 \\ 1.01923077 \\ 1.02 \end{vmatrix}
$$

Table 7. The derived supply table for year t+1 in base year prices

	Supply table	Output of industries			Total economy	Imports	Trade margins	Taxes less subsidies on products	Total supply at purchasers' prices
		(1)	(2)	(3)	(4)=(1)+..+(3)	(5)	(6)	(7)	(7)= (4)+..+(6)
(1)	Goods	163.8	25.0	0.0	188.7	16	34.5	13.4	252.7
(2)	Services	9.4	83.2	0.0	92.6	8	0.0	6.4	107.1
(3)	Transport services directly purchased	0.0	0.0	41.6	41.6	0	-34.5	1	7.9
(4)	Direct purchases abroad by residents					3			3
(5)	Direct purchases at home by non-residents								
(6)	Total industry output at basic prices	173.2	108.2	41.6					
(7)	Other column total					27.0	0.0	20.8	367.7

Table 8. The derived use table for year t+1 in base year prices (preliminary table to be further corrected)

	Use table	Intermediate consumption of industries			Total economy	Exports f.o.b.	Household final expenditure	Government final expenditure	Gross capital formation	Total supply at purchasers' prices	Statistical discrepancies
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)=(1)+.+(8)	(10)
(1)	Goods	26.2	36.4	12.9	75.5	30	88.0		41.9	235.4	-17.3
(2)	Services	33.6	20.8	4.0	58.4	10	10.3	9.3	0	88.0	-19.1
(3)	Transport services directly purchased	2.1			2.1	0	6.1		0	8.2	0.3
(4)	Direct purchases abroad by residents						3			3.0	0.0
(5)	Direct purchases at home by non-residents					1	-1			0.0	0.0
(6)	Total uses at purchasers' prices (1)+.+(5)	61.9	57.2	16.8	136.0	41	106.4	9.3	41.9	334.6	
(7)	Total gross value added/GDP				207.8						
(8)	Gross value added at basic prices (10)-(6)	111.3	51.0	24.8	187.0						
(9)	Taxes less subsidies on production and imports				20.8						
(10)	Industry output at basic prices	173.2	108.2	41.6	323.0						

GDP by production approach = 207.8
GDP by final expenditure approach = 41+106.4+9.3+41.9-24 = 171.6
Preliminary discrepancy in final expenditure approach: -36.17

Part IV
Collection of economic data to support national accounts compilation

Chapter 6. An integrated strategy for economic data collection to support national accounts compilation

A. Introduction

6.1   What do we mean by an integrated strategy for economic data collection? It simply means:

a) Conceptual harmonization among statistical agencies; and

b) Implementation harmonization which delineates clearly the scope of statistical responsibility of each agency in the statistical system in the master plan for statistical development in order to avoid overlapping in data collection and to ensure that every economic activity in the economy is covered as far as possible.

Conceptual harmonization

6.2   **Conceptually**, all parts of the economic statistical system should be based on a coherent set of internationally agreed concepts, definitions, classifications and accounting rules, which are defined in the System of National Accounts. It is for this purpose that the international macroeconomic statistical standards in specific sectors, such as Balance of Payments Manual (BPM5), Government Finance Statistics Manual (GFSM 2001) and Monetary and Financial Statistics Manual (MFSM 2000) have been developed or revised to make them fully harmonized with the SNA in terms of concepts, rules of measurement and classification systems.

6.3   **Administratively at a national level**, the same effort on harmonization should also be implemented not only in the same fields of specialized statistics but at the level of basic statistics such that they can be collected in the forms and contents that can be easily reclassified into the concepts of national accounts and other fields of statistics for cross comparison and linkage. This would require a close coordination between agencies compiling national accounts, agencies compiling balance of payments, financial statistics, government finance statistics, agencies that need statistics to serve their regulatory power like the central bank, commission on insurance, commission on security exchange, and the Ministry of Finance responsible for the budgets and tax collection. These agencies would have to establish **administrative forms for required data** on transactions that are precisely defined to facilitate their own regulatory and analytical purposes. With

coordinated efforts for harmonization, the data collected should also satisfy the needs of national accounts and other fields of statistics.

Harmonization of regular activities on the basis of a national master plan for statistics

6.4   The national master plan for statistics should have three components: development of administrative and financial data and data on other producers. A plan for improving national accounts requires a plan for improving basic statistics.

a) ***Development of administrative data.*** The public sector, which includes state enterprises and general government services, normally makes up a significant part of GDP. Data on public sector activities can be easily obtainable if laws are passed to guarantee their availability for statistical use. Close cooperation between statistical agencies and other government agencies with respect to forms and contents of data reporting helps in collecting up-to-date and appropriate data for national accounting purposes.

b) ***Development of financial data.*** Financial enterprises, particularly banks and insurance and pension funds, are usually closely regulated and limited in number. Close cooperation between statistical agencies and regulatory agencies with respect to forms and contents of data reporting helps in collecting up-to-date and appropriate data for national accounting purposes.

c) ***Development of data on non-financial market producers.*** Other market producers are usually numerous; therefore statistical tools for data collection must be developed and implemented within a master plan. This will be elaborated in the next section.

B. Strategy for the development of data on non-financial market producers

6.5   The focus of this chapter is an elaboration of a strategy to fully cover the economic activities of market producers. There is no one method that can be applied to all economic activities, simply because the statistical units upon which data can be collected vary by types of business organizations such as:

a) **Agricultural activities.** Agriculture may be surveyed more easily and at lower cost with different approach. Direct measurement of physical output is a general approach taken by most counties.

b) **Corporations**. Production units like corporations which must be legally incorporated and must regularly pay business income taxes and other production taxes, can be more easily identified through administrative data and surveyed.

c) **Household unincorporated enterprises**. Collection of data on other units like numerous households, which although engaged in production, may not have to register with the government, and do not even have fixed premises, must be based on different method.

6.6   However no matter what method to be used, the strategy must be based on a plan that maps out clearly 10-year cycles of population and household census, and either 5-year cycles of economic censuses, with the sampling frames frequently updated for annual, quarterly, or monthly economic surveys (see figure 6.1). The different approaches are discussed below.

Figure 6.1.
Data Collection by Census and Survey as Background for a Master Plan of Statistical Development
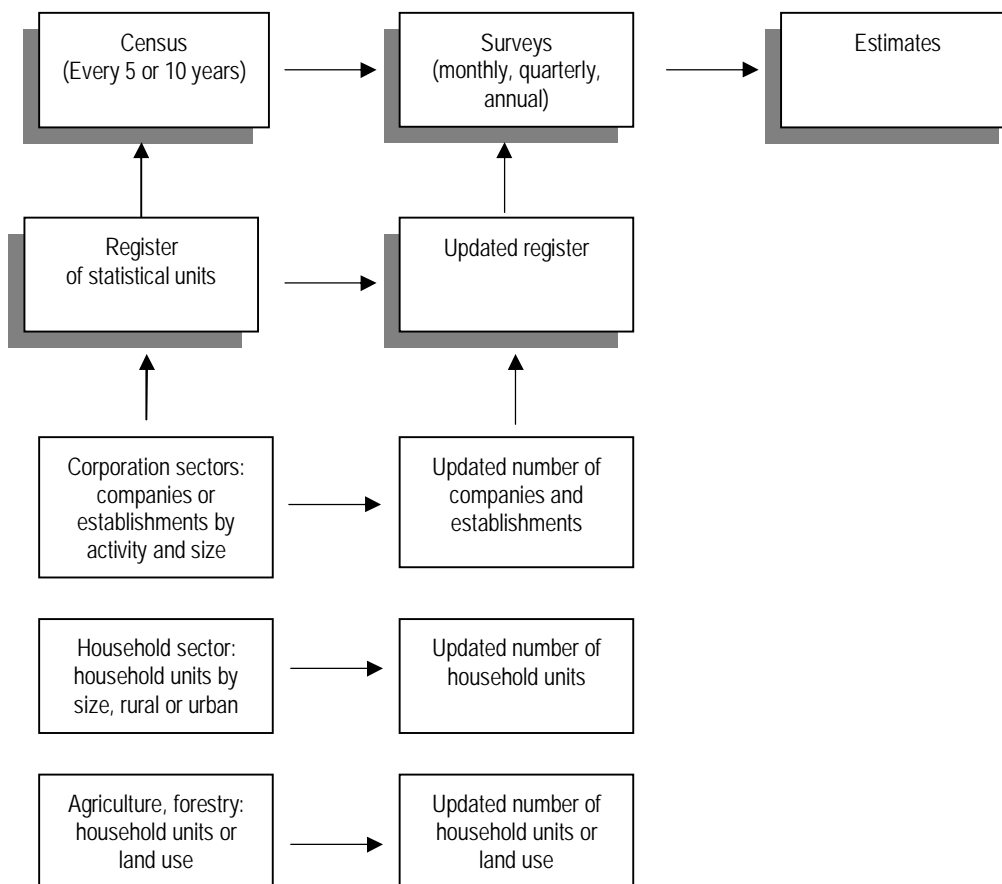
I.   Agriculture and the like: Surveying by the use of land areas as statistical units in agriculture

6.7   **Sampling frame**. Instead of using the production units as the statistical units on which surveys are carried out, areas in agricultural use become the statistical units. Land areas with specialized use is the main frame to collect statistics of agriculture in many countries, particularly for measuring output of crops, which are already discussed at length in Chapter 3.

6.8   Given the method used here, the output of agriculture is measured for the total economy first and then given the output of agriculture of corporations (which may be measured similarly to the output of other non-financial corporations), the output of households is derived as a residual.

Figure 6.2. List and non-list frame of enterprises in the economy
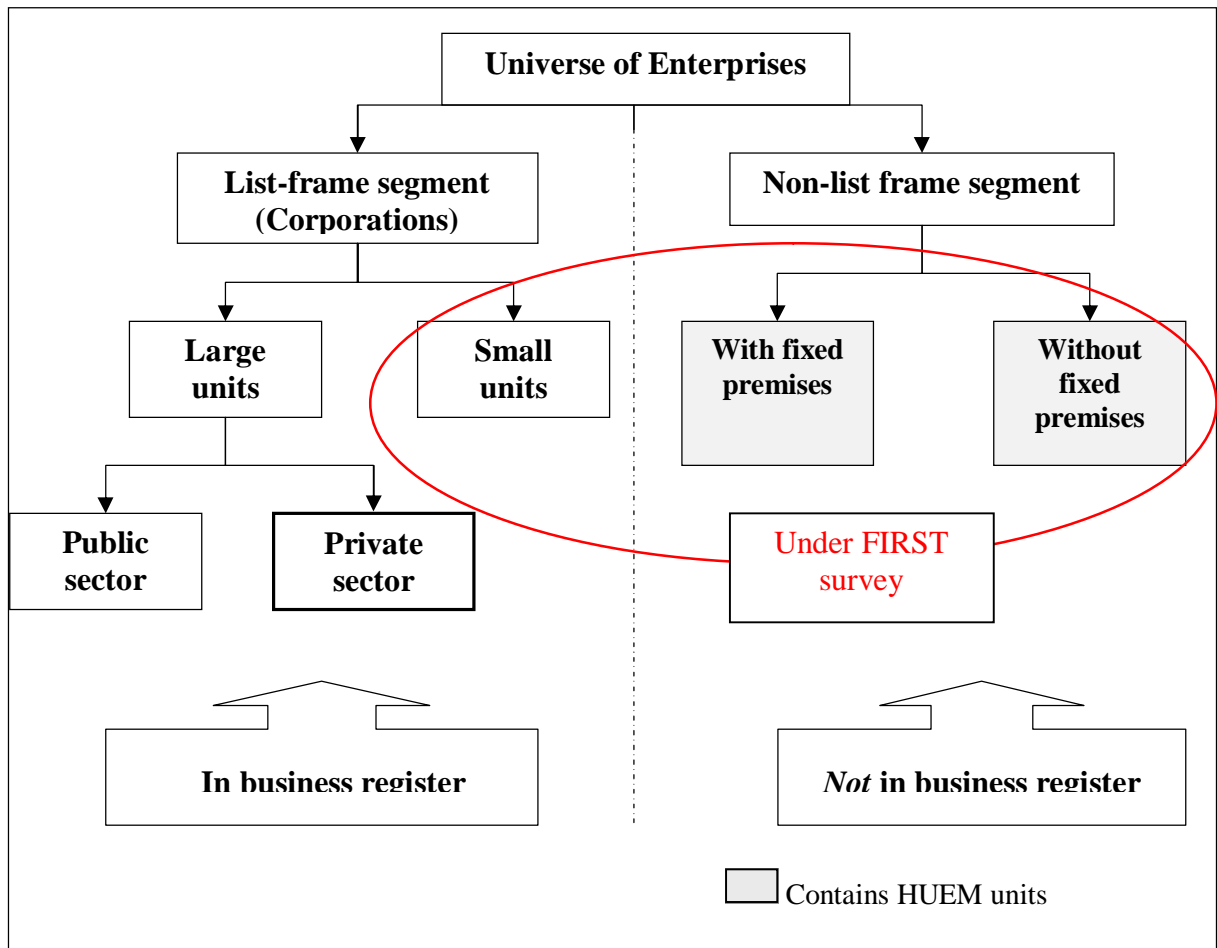
II.   Corporations: Surveying by the use of establishments in corporations as statistical units

6.9   **Sampling frame**. Sampling frame needs to be created for establishment units in the corporations sector, which is called the list frame segment of the universe of enterprises (see figure 6.2 and figure 6.4). To reduce costs of data collection, the economic censuses which help create the frame can be greatly simplified by focusing only on registering corporations and their associated establishments with request for only a limited number of data points that is necessary for the purpose of raising up to the total economy level the s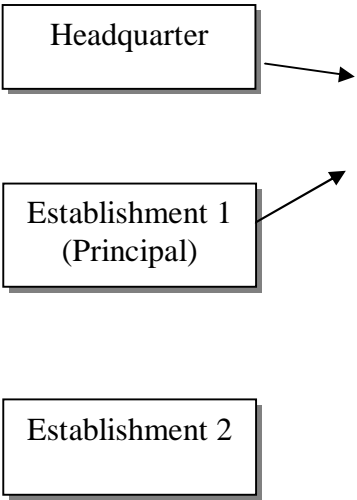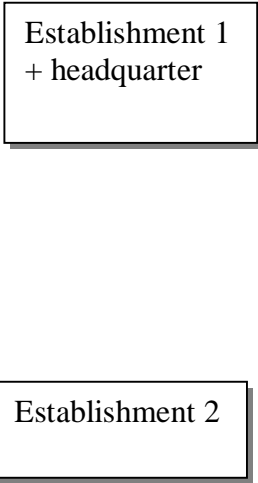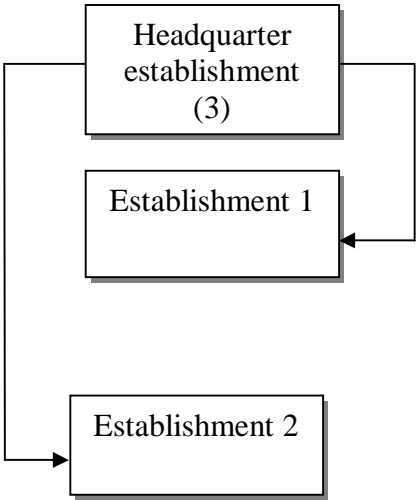urvey results. Data requested include locations, personnel contacts, kind of main economic activity (ISIC), number of employees, sales and sales of main products. In case that these data can be obtained by administrative sources, the economic survey can be done away with. An identification code system is also needed in order to help allocate within-enterprise inputs (headquarter service for example) to establishments. [20]

6.10   To serve the purpose of compiling regional and local GDP, local units of corporations which can provide production data should be treated as establishments. Figure 6.3 shows the new treatment recommended in 2008 SNA. Output of local units, for instance the headquarter unit, can be calculated by costs. This output is then imputed as intermediate consumption of other establishments in the corporation by their shares of output or employment.

6.11   **Corporations, whether financial or non-financial**, are legally recognized by government authorities. Thus, the registration and coverage for statistical purposes in principle is not an issue since as legal entities they have the right to enter transactions and contracts with other legal entities independently of their share-owners, but they are also obligated by laws to keep full set of business accounts, pay taxes and are subject to auditing by authorities. International recommendations for data collection are mainly addressing these sectors

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[20] Readers may be able to consult *International Recommendations for Industrial Statistics* on what and how data on industry should be collected. The document can be downloaded free of charge from the UNSD website: http://unstats.un.org/unsd/statcom/doc08/BG-IndustrialStats.pdf. The documents on other language may also be available (see http://unstats.un.org/unsd/pubs/gesgrid.asp?method=meth)

Figure 6.3. Establishments in corporations: a scheme of imputation

A given corporation that has two establishments producing good for sale and a headquarter providing services to their establishments without charges (see below)	Old treatment (all costs of headquarter are distributed to main establishment (1))	New treatment (distribution of headquarter output as intermediate consumption (IC) to all other establishments)
Headquarter → Establishment 1 (Principal) → Establishment 2	Establishment 1 + headquarter Establishment 2	Headquarter establishment (3) Establishment 1 Establishment 2

Data

Establ. 1	Establ. 2	Headquarter
Output: 200	Output: 100	No sale/revenues
IC: 100	IC: 30	IC: 30
VA = 100	VA = 70	VA: 15

Old treatment

Establ. 1	Establ. 2
Output: 200	Output: 100
IC: 100 + 30	IC: 30
VA = 70	VA = 70

GDP = 140

New treatment

Establ. 1	Establ. 2	HQ est. 3
Output: 200	Output: 100	Imputed output:45
IC: 100+30	IC: 30+15	IC: 30
VA = 70	VA = 55	VA= 15

GDP = 140 (same as old treatment)
With 3 establishments in 3 locations

III.   Households as production units and statistical units

6.12   The coverage of the production units in the household sector (see figure 6.4 and figure 6.2) which are called **unincorporated enterprises** is problematic and difficult if not impossible to set up a register simply because in many countries they are too numerous, may not have fixed locations and are not required to register or even licensed by the government. In order to measure the production of households properly, households will be divided into:

a) **Households as consumers**: These households do not set themselves up as units of production, but mainly work as wage earners for other institutional sectors such as corporations, government, NPISHs and other household enterprises to earn a living, and/or support themselves by receiving property and transfer income from

other institutional sectors. Even principally as consumers, they may produce two types of services that must be measured with data collected from household income and expenditure survey and housing/residential construction statistics:

- **Owner-occupied dwelling services**: The output of this is measured by imputation of estimated equivalent rentals based on space by type of quality owned.
- **Domestic services for own consumption with staff**: This output is measured by compensation of employees paid out to staff.

b) **Households as producers for own final consumption (NON-HUEMs)**: These are mostly households involve in agricultural production. In addition to agricultural output, there are some other incidental production for own final use or for sale, whether in rural or urban areas, such as making clothes or preserved food. This incidental production may be small and can only be measured through household income and expenditure survey or most of the time simply estimated by equating supply and demand by commodity. These are called NON-HUEMs in contrast to HUEMs which are discussed below.

c) **Households as unincorporated enterprises with market production (HUEMs)**: This important segment is discussed below in a separate section due to its importance.

Household unincorporated enterprises with market production (HUEMs) as statistical units

6.13.   A household unincorporated enterprise with market production (HUEM) is a subset of household unincorporated enterprises as defined by the SNA, but with:

a) "primary objective of generating employment and incomes to the persons concerned" as defined by the ILO in the resolution of the 15th International Conference of Labour Statisticians (2008 SNA, para. 25.37); and

b) "…at least some production for sale or barter (2008 SNA, para. 25.46)".

Figure 6.4. SNA institutional framework

Area subject to 1-2 survey — SNA household sector				SNA corporations sector		SNA general government sector and NPISH sector
HUEM units		Non-HUEM units: • Producing only for own final uses • Subsistence farmers		Household quasi-corps.	Incorporated enterprises, gov. quasi-corps.	Nonmarket units (general government, NPISH)
Agriculture (commercial agriculture)	Non-Agriculture					
Informal / Formal	Informal / Formal					**This is the part of the system that some analysts are interested in.**
statistical units: household enterprises that do not incorporate						

6.14.   The first condition in 6.13(a) is more important because any household can have some incidental sale. However, to be a HUEM as defined above, **a HUEM must have entrepreneurial spirit in the sense that they try to pursue production for the market on a regular basis**; therefore HUEMs should exclude the unincorporated household units that only have some incidental sales. For this reason, subsistence farmers who must always sell some of their outputs on the market to pay for non-food survival needs should not be treated as HUEMs. Incidental sales of NON-HUEMs should be covered by the same method of data collection like production for own consumption discussed in para. 6.12(b).

6.15.   The definition of HUEMs as refined would allow for, on the basis of internationally comparable concepts, the collection of employment, production statistics and as a result estimation of value added from HUEMs. It also provides data to make the household sector in the SNA more comprehensive. The ESCAP/ECSWA/ECLAC project with the participation of Mongolia, Sri Lanka, Palestine, the Philippines, and Saint Lucia has been implemented to test the concept and the 1-2 survey method to measure HUEMs.[21]

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[21] See *Unified Data Collection Strategy for Measuring the Informal Sector and Informal Employment (UDCS-ISIE)* prepared by Pietro Gennari, Margarita F. Guerrero, Zeynep Orhun of the UNESCAP Statistics Division and Gulab Singh of the United Nations Statistics Division (UNSD), October 2008. See also the Vu Quang Viet report written for ESCAP, *Compilation of output and gross value added*

6.16.   **Informal sector and HUEMs**. The collection of data on HUEMs, together with other information on employment size; type of economic activity; and with or without incorporation, registration with authority, social protection of labour by social security; rural versus urban and possibly other factors will allow countries and analysts identify **the informal sector as a part of HUEMs given their own choice of criteria** (see figure 6.4). This is helpful given the fact that **there exists no internationally accepted definition of the informal sector.** The 2008 SNA in recognizing this fact has written that "…there is broad agreement that no single criterion on its own is sufficient to determine what is meant by informal; several criteria must be considered." (2008 SNA, para. 25.18).

C. Measuring HUEMs

6.17.   In general, there are two methods of collecting data on HUEMs: area sampling method and 1-2 survey based on labour force survey currently being tested.

Area sampling method

6.18.   Area sampling method is part of a comprehensive program such as the Fully Integrated Rational Survey Technique (FIRST) methodology first recommended by the United Nations as a data collection strategy on economic statistics in developing countries.[22] This methodology is again recommended in the United Nations manuals on industrial statistics and distributive trade recently revised to make it in line with the SNA 2008.[23]

6.19.   Essentially, this is part of the two stages survey, which has the following steps:

   a)   First, sample the census enumeration blocks and canvas all households in the sampled blocks to identify the households that operate HUEM units;
   b)   Second, survey all HUEMs that are identified.

6.20.   The raising factor is population.

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from the data collected for Household Unincorporated Enterprises with At Least Some Market Production (HUEMs), to elaborate further the role and definition of HUEMs, Feb. 2009.

[22] The strategy is discussed in *Strategies for Measuring Industrial Structure and Growth* (Studies in Methods, Series F, No. 65, New York, 1994. Sales number E.94.XVII.11, http://unstats.un.org/unsd/publication/SeriesF/SeriesF_65E.pdf.
[23] *International Recommendations on Industrial statistics*, http://unstats.un.org/unsd/statcom/doc08/BG-IndustrialStats.pdf and *International Recommendations on Distributive Trade Statistics,* http://unstats.un.org/unsd/trade/M89%20EnglishForWeb.pdf.

6.21.   The method mentioned in para. 6.8 when applied to only HUEMs is a more restricted than the FIRST methodology. FIRST combines small units of the list-frame segment with HUEMs in the non-list frame segment (see figure 6.2), with the main purpose of reducing the cost of data collection in the countries that do not even have a register of all corporations, especially small ones.   In this case, HUEMs which are classified to the household sector must be separately identified from small corporations which are classified to the corporations sector.

6.22.   Area sampling probably should be applied only to HUEMs, when small corporations are listed in the register.

1-2 Survey on the basis of labor force survey

6.23.   1-2 survey is quite similar to area sampling method. The main difference is an attempt to reduce cost by combining it with a labour force survey. It has the following steps:

  a) First, a labour force survey (LFS) stratified by regions (for example provinces) is used in the first phase:
  - To gather information on employment in HUEMs, which can be further identified for informal employment, and for employment in the informal sector; and
  - To identify the household unincorporated enterprises with at least some market production (HUEMs) of which informal sector enterprises are a subset.

  b) Second, survey either all or a sample of the identified HUEMs. The type of survey in the second phase is an enterprise survey.

6.24.   1-2 survey is tied with the labour force survey and therefore it is expected that the 1-2 survey is sustainable.

6.25.   For non-benchmark years, the employment in HUEMs collected through labour force survey will be used to estimate output, intermediate consumption and value added of HUEMs.

6.26.   **The labour force survey (LFS)** counts the status of individuals in order to examine if an individual is in the labour force, and then whether he is employed or unemployed during the reference period. This is generally based on sampling of households. It is a widely accepted technique for producing official statistics on labour force, employment and unemployment. It counts simply as being employed if a person has one or many jobs.

6.27.   **Establishment survey (ES)** is another method to get statistics on employment and output by surveying production units like HUEMs. This method does not provide

statistics on unemployment. ES counts jobs held in each production unit therefore an individual may be counted more than once if that person holds two or more jobs.

6.28.   ES reflects better the links between production output and employment in a production unit. Therefore employment in ES is a better indicator to estimate output and value added.

6.29.   To reduce the problem of being counted once or more than once by either of the surveying methods, the use of working hours is a better indicator for extrapolating production indicators.

Part V
National accounts in constant prices

Chapter 7. Double deflation method

A. Introduction

7.1   This short-cut method is an alternative to the one presented in chapter 11 of the *Handbook of Input-Output Table Compilation and Analysis* (Series F, No.74, United Nations, 1999).

7.2   The more comprehensive method presented in chapter 11 relies on the availability of the full supply and use tables (SUT) of a given current year and the ability to split uses at purchasers' prices in the use table into four separate components: basic value which is in turn split into domestic products and imported products, trade and transport margins and taxes less subsidies on products. Each component is then independently deflated by either its own price indexes or the base-year coefficients. The method requires only producer price indexes (PPI). SUT may be estimated by the modified RAS method with supplementary current information if available.

7.3   The short-cut method presented below has two versions: one with the full SUT of a given current year, which may be again estimated by the modified RAS method and another with no SUT. The short-cut method utilizes price indexes on final consumption expenditure (CPI), exports, imports, gross fixed capital formation and changes in inventories. The short-cut method tries to avoid the splitting of the uses in purchasers' prices into four components as mentioned above, and instead trying to utilize all price indexes that are available. Producer price indexes (PPIs) are used to deflate outputs produced by industries. Final uses are deflated by various price indexes: household final consumption expenditure is deflated by consumer price indexes (CPI), exports by export price indexes, imports by import price indexes, fixed capital formation by price indexes for fixed capital formation (or some equivalent) and inventories by producer price indexes. Intermediate consumption at purchasers' prices are deflated by some implicit price indexes that are calculated during the deflation process to guarantee that the total uses at current or constant purchasers' prices must equal the total resources at current or constant purchasers' prices. The calculation of the implicit price indexes for intermediate consumption will be made clear later. The definition of type of price indexes can be seen in appendix 1.

B. General methodology

7.4   The general methodology is based on: (1) the derivation of the total resources and consequently the total uses at constant prices; (2) the deflation of the final expenditures to obtain GDP at constant prices by the final expenditure approach; (3) the derivation of intermediate consumption at constant prices as the difference between (1) and (2) and then the implicit price deflators by product for intermediate consumption; and (4) the application of the implicit price deflators to derive values at constant prices for intermediate consumption by industries, value added by industries and finally GDP by the production approach.

Step I: Derive total resources at constant purchasers' prices

Table 7.1. The supply table

	Products at basic prices domestically produced	Imports c.i.f.	Total supply at basic prices	Trade and transport margins	Taxes less subsidies on products	Total resources at purchasers' prices
	(1)	(2)	(3)	(4)	(5)	(6)
Product 1 Product 2 ... Product n						

7.5   Steps 1 include the followings

(1) Domestically produced products at constant basic prices: Deflate domestically produced products at current basic prices by producer price indexes. In case that only industry output is available, use the shares of products in each industry in the base year to breakdown the industry output into separate products.
(2) Imports: Deflate imports by import price indexes.
(3) Total supply at basic prices in column (3) is the sum of column (1) and column (2).
(4) Trade and transport margins: Unless there are price indexes for trade and transport margins, they can be deflated as follows:
   - Calculate the trade and transport ratios column (4) / column (3) of the base year: call it v
   - Calculate constant values of trade and transport margins as follows: Multiply v by the deflated value in column (3) to obtain $v*(3)$.
(5) Calculate subsidies and taxes on products as follows:
   - Calculate the tax/subsidy ratios column (5) / column(3) of the base year: call it t
   - Calculate constant values of taxes and subsidies as follows: Multiply t by the deflated value in column (3) to obtain $t*(3)$.

- Calculate the total resources at constant purchasers' prices by adding the columns (3)+(4)+(5).

(6) Equate the total uses at constant purchasers' prices in the use table to the total resources at constant purchasers' prices in the supply table.

Table 7.2. The use table

| | Intermediate consumption at purchasers' prices | Final expenditure | | | | Total resources at purchasers' prices |
		Exports f.o.b.	Final consumption at purchasers' prices	Gross fixed capital formation	Changes in inventories	
	(1)	(2)	(3)	(4)	(5)	(6)
Product 1						
Product 2						
...						
Product n						

Step II: Derive constant GDP by final expenditure approach

7.6   Step II includes the following:

(1) Deflate exports by export price indexes.
(2) Deflate final consumption expenditure by consumer price indexes (CPI). Make sure that CPI reflects both urban and rural consumption. The part on production for own use should be deflated by producer price index (PPIs).
(3) Deflate gross fixed capital formation by purchasers' price indexes for capital goods. (If purchasers' price indexes for capital goods are not available, values at purchasers' prices must be split into basic value, trade and transport margins, and taxes on products less subsidies). The derivation of the constant values for each component is similar to those described in (4) and (5) of step I.
(4) Deflate inventories by PPIs for producers. Deflate inventories for wholesalers and retailers by appropriate price indexes created as in step (3) above. For wholesalers, only transport margin is taken into account, for retailers transport margins and wholesale margins have to be taken into account. If information is not available PPIs may be used.
(5) Sum the components of final expenditure above to get final expenditure in constant prices.
(6) GDP at constant prices is the sum of final expenditure derived in (5) less total imports at constant prices derived in step II.

Step III: Derive implicit price deflators for intermediate consumption by products and industries

7.7   Step III includes the following:

(1) Calculate intermediate consumption by products at constant purchasers' prices by deducting the final expenditure at constant prices obtained in (5) of step II from the total use of products at constant prices.
(2) Calculate intermediate consumption by products at current purchasers' prices in a similar way.
(3) Calculate the implicit price deflators for intermediate consumption by products by the current values over the constant values derived in (1) and (2).
(4) Derive the implicit price deflators for intermediate consumption for each industry by using the implicit price deflators for intermediate consumption products and the weights of the intermediate consumption in the use table either of the base year or of the current year.
(5) Use the implicit price deflators for industry to deflate industry output.
(6) Calculate constant value added by industry by deducting constant intermediate consumption by industry from output by industry.

Step IV: Derive GDP by the production approach and the statistical discrepancy

7.8   Step IV includes the following:

(1) Calculate GDP at constant prices by the production approach by adding the total value added at constant prices to taxes less subsidies on products at constant prices.
(2) The difference between the GDP by the production approach and that obtained by the final expenditure approach is the statistical discrepancy. The GDP by the final expenditure approach is considered the more reliable one.

Appendix 7.1:
Types of price indexes

The following types of price indexes are normally collected by statistical agencies:

- **Producer price indexes (PPI)**: The price collected for a product included in the PPIs is the revenue received by its producer. Sales and excise taxes are not included in the price because they do not represent revenue to the producer. In this way, PPIs are in fact indexes of *basic prices* in the terminology of the SNA. PPIs cover both goods and services. In some countries PPIs are called wholesale price indexes.

- **Consumer price indexes (CPI)**: The price reflects the actual payments by households. It is the SNA purchasers' price. It may also include imputed expense such as for owner-occupied housing. In many countries, only transactions in urban areas are considered in the calculation of CPIs, which may not be representative of price changes in the rural areas.

- **Import and export price indexes**: Price indexes measure the change over time in **transaction prices** (the market sale price) of goods and services exported from or imported into a country. Import prices are measured at c.i.f. including duties and freight and insurance costs. Exports are measured at f.o.b. excluding duties and freight and insurance costs.

Appendix 7.2:
Examples

Two examples are given below. The first one assumes that the full supply and use tables (SUT) are available for the current year. This SUT may be compiled from the data collected through surveys or from the simple RAS method given only final expenditures and industry output or the modified RAS method when additional data are available. Readers can read about the RAS methods in chapter IX of the *Handbook of Input-Output Tables Compilation and Analysis*. An example of the simple RAS method is also shown in appendix 7.3 of this chapter. The two examples are based on the same information on SUT of the base year given below.

Supply and use tables of the base year and other indicators calculated from them

Industry output is always measured in basic prices in the following examples.

Table 7.3. The supply table of the base year

	Industry 1	Industry 2	Industry 3	Total domestic output at basic prices	Imports c.i.f.	Trade and transport margins	Taxes less subsidies on products	Total supply at purchasers' prices
Product 1	156	24	0	180	15	33	13	241
Product 2	9	80	0	89	7	27	7	130
Product 3	0	0	62	62	0	-60	0	2
Industry output	165	104	62					

Table 7.4. The use table at purchasers prices of the base year

	Industry 1	Industry 2	Industry 3	Intermediate consumption by products	Exports	Final expenditure	Total uses at purchasers' prices
Product 1	25	35	13	73	28	140	241
Product 2	32	20	10	62	9	59	130
Product 3				0		2	2
Intermediate consumption by industries	57	55	23	135			
Value added	108	49	39				
Industry output	165	104	62				

Table 7.5. Indicators at the base year calculated from SUT

	Trade and transport ratios (Trade and transport margins/sum of total domestic and imports)	Taxes less subsidies on products ratios (Taxes less subsidies on products/Sum of total domestic and imports)
Product 1	0.169231 (=33/195)	0.066667 (=13/195)
Product 2	0.28125 (=27/96)	0.072917 (=7/96)

Example 1:
Double deflation when the full SUT of the current year is available

SUT of a given year at current prices and price information

The supply and use tables of the year to be deflated are given below. These tables are obtained either by surveys or RAS methods. Whether through surveys or by RAS methods, the total supply at purchasers' prices in the supply table cannot be obtained directly but by the sum of its components. The total supply is obtained first then the total uses in the use table are equated to it.

Table 7.6. The supply table at current prices of the given year

	Industry 1	Industry 2	Industry 3	Total domestic output at basic prices	Imports c.i.f.	Trade and transport margins	Taxes less subsidies on products	Total supply at purchasers' prices
Product 1	177	35		212	18	37	13	280
Product 2	12	84		96	9	30	7	142
Product 3			70	70	0	-67	0	3
Industry output	189	119	70		27	0	20	

Table 7.7. The use table at current purchasers prices of the given year

	Industry 1	Industry 2	Industry 3	Intermediate consumption by products	Exports	Final expenditure	Total uses at purchasers' prices
Product 1	30	40	16	86	33	161	280
Product 2	34	24	12	70	12	60	142
Product 3				0		3	3
Intermediate consumption by industries	64	64	28				
Value added	125	55	42				
Industry output	189	119	70	156	45	224	

Table 7.8. Price indexes of the given year

	Producer price indexes (PPIs)	Import price indexes	Export price indexes	Consumer price indexes (CPI)
Product 1	120	130	125	121
Product 2	115	130	113	118
Product 3				117

Price index for product 3 applies only to transports that are hired directly by users or for passengers.

Deflation process

1. Deflate the supply table

The deflation process follows the instructions given in step I of the general methodology.

Table 7.9. The supply table of the given year at constant prices

	Industry 1	Industry 2	Industry 3	Total domestic output at basic prices	Imports c.i.f.	Trade and transport margins	Taxes less subsidies on products	Total supply at purchasers' prices
Product 1	147.50	29.17		176.67	13.85	32.24	12.70	235.45
Product 2	10.43	73.04		83.48	6.92	25.42	6.59	122.42
Product 3			60.23	60.23	0	-57.67	0	2.56
Industry output	157.93	102.21	60.23		20.77	0	19.29	

2. Deflate the use table

- Deflate exports and final expenditure (see step II, in section B).
- Calculate intermediate consumption by products at constant purchasers' prices by deducting exports and final expenditure from the total uses, which are all at constant prices. The total uses are equated to the total supply obtained in the supply table.
- Distribute the total intermediate consumption by product at constant prices to each industry on the basis of the shares of uses in the use table at purchasers' prices of the current year.

Table 7.10. The use table at constant purchasers prices of the given year

	Industry 1	Industry 2	Industry 3	Intermediate consumption by products	Exports	Final expenditure	Total uses at purchasers' prices
Product 1	26.51	35.35	14.14	76.00	26.40	133.06	235.45
Product 2	29.60	20.90	10.45	60.95	10.62	50.85	122.42
Product 3						2.56	2.56
Intermediate Consumption by industry	56.11	56.24	24.59		37.02	186.47	360.44
Value added	101.82	45.96	35.64				
Industry output	157.93	102.21	60.23				

3. Results

- GDP at constant prices by the production approach = 101.82 + 45.96 + 35.64 + 19.29 = 202.72.

- GDP at constant prices by the final expenditure approach = 186.47 + 37.02 - 20.77 = 202.72.

- There is no statistical discrepancy between the constant values of GDP since it does not appear between their current values.

Example 2:
Double deflation without the full SUT of a given year

Incomplete SUT of a given year at current prices and other information are given below

Table 7.11. The supply table at current prices of the given year

	Industry 1	Industry 2	Industry 3	Total domestic output at basic prices	Imports c.i.f.	Trade and transport margins	Taxes less subsidies on products	Total supply at purchasers' prices
Product 1					18	37	13	
Product 2					9	30	7	
Product 3					0	-67	0	
Industry output	189	119	70					

Table 7.12. The use table at current purchasers prices of the given year

	Industry 1	Industry 2	Industry 3	Intermediate consumption by products	Exports	Final expenditure	Total uses at purchasers' prices
Product 1					33	161	
Product 2					12	60	
Product 3						3	
Value added							
Industry output	189	119	70				

Table 7.13. Price indexes of the given year

	Producer price indexes (PPIs)	Import price indexes	Export price indexes	Consumer price indexes (CPI)
Product 1	120	130	125	121
Product 2	115	130	113	118
Product 3				117

Price index for product 3 applies only to transports that are hired directly by users or for passengers.

Strategy for deflation

With the information given above, before deflating, statisticians have to derive statistically complete information on final expenditure products, total output, and total intermediate consumption by industries. It does not require however to derive the full matrix of intermediate consumption (depicted in the use table by an empty box).

1. Derivation of minimum information in current prices for the current year

Step 1: Begin with the supply table with the following tasks:

- Use the supply matrix of the base year to derive the products produced by each industry with an assumption that the product shares in each industry in the current year remains the same as in the base year. If surveys provide this information, it is not necessary to go through this step. In addition, the crude assumption above can be supplemented by limited available data.
- Calculate the total supply of domestic products.
- Calculate the total supply of products in purchasers' prices by adding together the supply of domestic products, imports, trade and transport margins and taxes less subsidies on products.
- Product 3 is transport services such as the transport of passengers that are directly consumed.

Table 7.14. The supply table at current prices of the current year

	Industry 1	Industry 2	Industry 3	Total domestic product output at basic prices	Imports c.i.f.	Trade and transport margins	Taxes less subsidies on products	Total supply at purchasers' prices
Product 1	178.6909	27.46154		206.1524	18	37	13	274.152
Product 2	10.30909	91.53846		101.8476	9	30	7	147.848
Product 3			70	70	0	-67	0	3
Industry output	189	119	70					

Step 2: Derive necessary data for the use table:

- Equate the total uses of products at purchasers' prices to the total supply of products at purchasers' prices above.
- Calculate the total intermediate consumption (IC) by products as the difference between the total uses and the sum of exports and final expenditure.
- Also calculate IC by industry and value added by industry by using the IC/output and value added/output of the base year.

Table 7.15. The use table at current purchasers prices of the current year

	Industry 1	Industry 2	Industry 3	Intermediate consumption by products	Exports	Final expenditure	Total uses at purchasers' prices
Product 1				80.152	33	161	274.152
Product 2				75.847	12	60	147.848
Product 3				0		3	3
Intermediate consumption	65.2909	62.932	25.968				
Value added	123.7091	56.067	44.032				
Industry output	189	119	70				

GDP by the production approach: 123.71+56.067+44.03+20 = 243.8087
GDP by final expenditure approach = 224+45-27 = 224

There exists a statistical discrepancy between GDP derived by the two methods. There is no need to adjust the difference. However in the case that the RAS method is applied to derive the matrix of intermediate consumption, it is necessary to adjust so that the sum of intermediate consumption by products (the column) is equal to the sum of intermediate consumption of industry (the row). Without the adjustment the RAS method would not converge.

2. Double deflation process

Step 1: Begin with the deflation of the supply table:

- Deflate imports by import price indexes.
- Deflate domestic products by producer price indexes (PPIs).
- Deflate trade and transport margins and taxes less subsidies on products by using the base year ratios (see general methodology).
- Sum total domestic supply, imports, trade and transport margins and taxes less subsidies on products to obtain the total supply of products at constant purchasers' prices.
- Equate the value of the total supply at constant prices to the total uses at constant prices in the use table.
- Sum the deflated values in the supply matrix to obtain the output by industry at constant prices.

Table 7.16. The supply table at constant prices of the current year

	Industry 1	Industry 2	Industry 3	Total domestic output at basic prices	Imports c.i.f.	Trade and transport margins	Taxes less subsidies on products	Total supply at purchasers' prices
Product 1	148.91	22.88		171.79	13.85	31.42	12.37	6043
Product 2	8.96	79.60		88.56	6.92	26.86	6.962	129.30
Product 3			60.83	60.83	0	-58.27	0	2.56
Industry output	157.87	102.48	60.83		20.77	0	19.34	

Step 2: Deflate the use table:

- Deflate exports by export price indexes.
- Deflate final expenditure by price indexes of final expenditure (see step II, section B for detailed information).
- Calculate total intermediate consumption (IC) by products (the column) by deducting deflated values of exports, final expenditure from the deflated total uses of products.
- Calculate the implicit price deflators for IC by products by dividing their current values by their constant values.
- Apply the implicit price deflators for IC by products to calculate the implicit price deflators for IC by industry. The implicit price deflators for IC by industry as the weighted price deflators for IC by products. The weights are the share of products used as IC in each industry over the total IC in each industry in the base year.

The resulting implicit deflators for IC by products are as follows:

Product 1	1.145461
Product 2	1.118081

The resulting implicit deflators for IC by industry are as follows:

Industry 1	Industry 2	Industry 3
1.13009	1.135505	1.13355658

Table 7.17. The use table at constant purchasers prices of the current year

	Industry 1	Industry 2	Industry 3	Intermediate consumption by products	Exports	Final expenditure	Total uses at purchasers' prices
Product 1				69.97	26.40	133.06	229.43
Product 2				67.84	10.62	50.85	129.30
Product 3						2.56	2.56
Intermediate consumption	57.77	55.42	22.92				
Value added	100.10	47.06	37.93				
Industry output	157.87	102.48	60.83		37.02	186.47	361.30

GDP at constant prices by the production approach = 100.10+47.06+37.93+ 19.34 = 204.42

GDP at constant prices by the final expenditure approach = 186.47+ 37.02-20.77 = 202.72

The statistical error in GDP at constant prices comes from two sources: (a) the discrepancy in the total value of IC by industry and that of IC by products; and (b) the assumption of IC weights of the base year. The statistical discrepancy will be greatly reduced if the sum of IC by industry and the sum of IC by products are made equal. The two values can be made equal mechanically by adjusting the difference in IC to each industry proportionally. However it is always better to rely on the results of annual survey on overall IC ratios by industry and adjust them on expert knowledge. If it is unreasonable to adjust mechanically then it is better to leave the statistical error as it is.

Appendix 7.3:
The RAS method

The simple RAS method estimates the intermediate consumption matrix (IC) assuming that the column of IC by products and the row of IC by industry are known.

The modified RAS method allows for the pre-determining of some flows in the IC matrix, which are obtained from reliable sources. The modified method can be converted to the simple RAS method by setting to zeros the values of given elements from both the IC matrix of the base year and the estimated year. The total ICs are reduced accordingly. When the elements of the base year are zeros, the RAS method guarantees that estimated values of the same elements in the estimated year would be zeros. The actual values of the pre-determined elements will be entered in the estimated matrix when obtained from the RAS method.

Given the following information and the base year given in example 1:

Use matrix

	Industry 1	Industry 2	Industry 3	Intermediate consumption by industry
Product 1				86
Product 2				70
Product 3				0
Intermediate Consumption	66.05677	63.67089	26.27234	156

The following steps should be done:

1. Estimate input flows by using the input shares of the base year to distribute IC by industry to various products.

2. Go to the adjustment process:

- Calculate the column adjustment ratios by dividing the estimated IC column by the given IC column and apply the adjustment ratios to the rows of the IC matrix to make the estimated IC column equal to the given IC column (i.e. by dividing each row to the corresponding adjustment ratio).
- Calculate the row adjustment ratios by dividing the estimated IC row to the given IC row and apply the adjustment ratios to the columns of the IC matrix to make the estimated IC row equal to the given IC row (i.e. by dividing each column to the corresponding adjustment ratio).
- Repeat the process until all the adjustment ratios equal to 1.0.

Shown below is the data obtained after each successive iteration until the process converges to all adjustment ratios equal to 1.0.

It is important to remind users that the estimation process would not converge if the sum of the IC column is not equal to the sum the IC row.

				Estimated IC	Given IC	Adjustment ratios
Given IC	66.0568	63.6709	26.2723			
	28.9723	40.5178	14.8496	84.3397	86.00	0.98069
	37.0845	23.1531	11.4228	71.6603	70.00	1.02372
				0.0000	0.00	
Estimated IC	66.0568	63.6709	26.2723			
	29.5426	41.3155	15.1419	86.0000		
	36.2253	22.6166	11.1581	70.0000		
Estimated IC	65.7679	63.9321	26.3000			
Adjustment ratios	0.99563	1.00410	1.00105			
	29.6724	41.1467	15.1260	85.9450		0.99936
	36.3844	22.5242	11.1464	70.0550		1.00079
Estimated IC	66.0568	63.6709	26.2723			
	29.6914	41.1730	15.1357	86.0000		
	36.3558	22.5065	11.1376	70.0000		
Estimated IC	66.0472	63.6795	26.2733			
Adjustment ratios	0.99986	1.00014	1.00004			
	29.6957	41.1674	15.1351	85.9982		0.999979
	36.3611	22.5035	11.1372	70.0018		1.000026
Estimated IC	66.0568	63.6709	26.2723			
	29.6963	41.1683	15.1354	86.0000		1.000000
	36.3602	22.5029	11.1369	70.0000		1.000000
Estimated IC	66.0565	63.6712	26.2724			

Adjustment ratios					
	1.00000	1.00000	1.00000		
	29.6964	41.1681	15.1354	85.9999	0.999999
	36.3603	22.5028	11.1369	70.0001	1.000001
Estimated IC	66.0568	63.6709	26.2723		
	29.6964	41.1681	15.1354	86.0000	1.000000
	36.3603	22.5028	11.1369	70.0000	1.000000
Estimated IC	66.0568	63.6709	26.2723		
Adjustment ratios					
	1.00000	1.00000	1.00000		

Annex
Solutions to exercises

Solutions to exercises in Appendix 1: What is GDP?

Solution 1.1 (a)

Trade and transport margins are entered with zero because they are already included in the industry output.

Solution 1.1 (b)

		Industry	Final expenditure (final consumption + gross capital formation+ exports – imports) = 118+20+70-33	Output at purchasers' prices
1	Intermediate consumption	150	**175**	**325**
2=3-1	Value added at basic prices	160		
3	Output at basic prices	310		
4	Taxes on products less subsidies	15		
5=2+4	**GDP or value added at purchasers' prices**	**175**		
6=3+4	Output at purchasers' prices	**325**		

Solution 1.2

Indicator in constant prices must be derived first. Then output in constant prices is derived. Output in current prices is derived using price indexes.

Indicator in constant prices	1	1.17	1.24	1.30	1.24
Output in constant prices	110	128.2	136.2	143.0	136.1
Output in current prices	110	132	143	143	137.5

Solution 1.3

First estimates

Resources	Million tons	At basic price	Trade and transport margins	Taxes	At purchasers' prices
Output	1.5	300			
Import	0.4	81.6			
Total resource	1.90	381.6	24	2.2	407.8

Uses	Million tons	At basic price	Trade and transport margins	Taxes	At purchasers' prices
Own consumption	0.8	160	0	0	160.0
Consumption by industry	0.2	40	4	0.4	44.4
Exports	0.2	40	4	0.4	44.4
Final uses	0.8	160	16	1.4	177.4
Change in inventory	0.1	20	2	0	22.0
Marketed final uses	0.7	140	14	1.4	155.4
Total uses	2.0	400.0	24.0	2.2	426.2

The first estimates show that total uses are higher than total resources, but it is believed that total uses are more reliable thus marketed final uses (0.7) should be reduced to 0.6 to reduce total uses to 1.9.

Second estimates

Uses	Million tons	At basic price	Trade and transport margins	Taxes	At purchasers' prices
Own consumption	0.8	160	0	0	160
Consumption by industry	0.2	40	4	0.4	44.4
Exports	0.2	40	4	0.4	44.4
Change in inventory	0.1	20	2	0.2	22
Marketed final uses	0.6	120	12	1.2	133.2
Total	1.9	380.0	22.0	2.2	404.0

For the second estimates, the total value of uses and resources at basic price and at purchasers' prices are still not equal. This is due to the fact that all uses are measured at farm gate prices. This does not reflect the prices of imports which are different from prices at farm gates. Therefore to assure the values of uses and resources are equal, except for own consumption, other values may have to be scaled to make the value of total uses equals to the value of total resources (=381.6).

Final estimates

Uses	Million tons	At basic price	Trade and transport margins	Taxes	At purchasers' prices
Own consumption	0.8	160	0	0	160
Consumption by industry	0.2	40.3	4	0.4	44.7
Exports	0.2	40.3	4	0.4	44.7
Change in inventory	0.1	20.1	2	0.2	22.3
Marketed final uses	0.6	120.9	12	1.2	134.1
Total	1.9	381.6	22	2.2	405.8

Finally the value at purchasers' prices in the table on resources must also be changed to be the same as the ones in the table on uses.

Solutions to exercises on Appendix 2: Links between business accounting and national accounting

Solution 2.1

a) Business incomes include sales and net interest received (interest received less interest paid)
b) Sales less cost of sales are treated as output in national accounting
c) Output = 600, intermediate consumption = 80, value added = 520
d) Basic price

Solution 2.2 (a)

Business accounting principle

End of period	Period 1	Period 2
Gross capital formation	500	550
Gross fixed assets (book value)	500	1050
Depreciation	100	210
Asset of period 1	100	100
Asset of period 2		110
Fixed assets net of depreciation	400	840

Solution 2.2 (b)

National accounting principle at market price of period 2

End of period	Period 1	Period 2
Gross capital formation	550	550
Gross fixed assets	550	1100
Consumption of fixed capital (CFC)	110	220
Asset of period 1	110	110
Asset of period 2		110
Fixed assets net of CFC	440	880

Solution 2.4 (a)

From the description of goods sold, this company is a trading company. No goods are produced and therefore its output is calculated as trade margins.

Solution 2.4 (b)

Revaluation of cost of goods bought for resale

Cost of goods sold (in this case, it is cost of goods bought for resale)		1010
Inventory of goods for resale at the beginning of the period		210
Net cost of purchases for resale		1100
Purchases net of discounts, returns and allowances	1000	
Freight-in cost	100	
Inventory of goods for resale at the end of the period		-300

Revaluation of materials used

Materials used	45.5
Opening stock of materials	10.5
Purchase of materials	50
Closing stock of materials	-15

Solution 2.4 (c)

Transactions that are not part of intermediate consumption

Types of transactions in business accounting	Types of transactions in national accounting
Wages and salaries	Primary income
Property tax and license fees	Other taxes on production
Depreciation	Concept not used in national accounting
Non-life insurance premiums	Current transfer (only part of this amount is the service charge that is intermediate consumption)
Interest received	Current transfers in the form of property income
Interest paid on loans	Current transfers in the form of property income
Income taxes	Current transfers
Dividends	Current transfers in the form of property income

Solution 2.4 (d)

Output of trade margins

Output at basic prices		390
Sales	1400	
Less goods bought for resale	-1010	

Intermediate consumption at purchasers' prices

Intermediate consumption		95.5
Materials used	45.5	
Services[24]		
Rent, electricity and heating	50.0	

Gross value added at basic prices presented in the form of T-account

		Output at basic prices	390
Intermediate consumption	95.5		
Gross value added at basic prices	294.5		

Components of gross value added

1	Gross value added at basic prices	294.5
2	Wages and salaries	200
3	Other taxes on production	10
4=1-(2+3)	Gross operating surplus	10
5	Consumption of fixed capital	?
?6=4-5	Net operating surplus	?

In the above calculation, it is not possible to calculate net operating surplus since consumption of fixed capital in national accounting is not the same as depreciation used in business accounting. Depreciation is based on book value, while consumption of fixed capital is normally based on perpetual inventory method.

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[24] Service charges on insurance and interest have not been calculated and introduced as part of intermediate consumption as the information given here is not enough to calculate them.

Solutions to exercise in Appendix 4.1: Calculation of net capital stock and consumption of fixed capital

The solution needs to be calculated at constant prices, in this case at the prices of t-4. Gross capital stock are only for the sake of identifying the period where the asset extinct. The net capital stock of a given period is equal to the net capital stock at the end of the previous period less consumption of fixed capital in the current period. Net capital stock is conventionally called capital stocks that are used for productivity analysis.

Consumption of fixed capital and net capital stock are inflated by price indexes to obtain values in current prices for the compilation of national accounts in current prices.

Gross capital formation, consumption of fixed capital, net capital stock at the prices of t-4

At prices of t-4	T(-4)	T(-3)	T(-2)	T(-1)	T
Gross capital formation	300	762			
Total gross capital stock	**300**	**1062**	**1062**	**762**	**762**
Asset 1	300	300	300	0	0
Asset 2	0	762	762	762	762
Total consumption of fixed capital	**100**	**290**	**290**	**190**	**190**
Asset 1	100	100	100		
Asset 2		190	190	190	190
Net capital stock	**200**	**671**	**381**	**190**	**0**
Asset 1	200	100	0	0	0
Asset 2		571	381	190	0
Price index		100	105	106	115	120

Gross capital formation, consumption of fixed capital, net capital stock at current prices

At current prices					
Gross capital formation	300	800			
Total gross capital stock	400	1115	1126	876	914
Asset 1	300	315	318	0	0
Asset 2	100	800	808	876	914
Total consumption of fixed capital	100	305	404	219	229
Asset 1	100	105	202		
Asset 2	0	200	202	219	229
Net capital stock	200	705	404	219	0
Asset 1	200	105	0	0	0
Asset 2	0	600	404	219	0

Solutions to exercises in Appendix 4.2: GDP by production and final expenditure

Solution to Question 1

	Industry	Output	IC	VA	VA/O ratios
A	**Agriculture, hunting, forestry, fishing**	**880**	**316**	**564**	**.6409**
	Crops	450	140	310	.6889
	Livestock	150	80	70	.4667
	Forestry & fishing	280	96	184	.6571
B	**Mining and quarrying**	**100**	**40**	**60**	**.6000**
	Oil extraction	100	40	60	.6000
C	**Manufacturing**	**370**	**170**	**200**	**.5405**
	Garments	250	100	150	.6000
	Other manufacturing	120	70	50	.4167
D+E	**Electricity, gas and water supply**	**40**	**15**	**25**	**.6250**
F	**Construction, construction repairs**	**300**	**250**	**50**	**.1667**
G+I	**Wholesale, retail trade; repairs; hotels and restaurants**	**350**	**145**	**205**	**.5857**
	Trade mark-up	230	90	140	.6087
	Hotels and restaurants	120	55	65	.5417
H+J	**Transport, storage and communications**	**145**	**86**	**59**	**.4069**
K+L+M +N	**Financial intermediation; real estate, renting and business services**	**340**	**137**	**203**	**.5971**
	Imputed value of owner-occupied dwelling units (taken from part C)	150	30	120	.8000
	Real estate	100	67	33	.3300
	Business services	90	40	50	.5556
O	**Public administration and defense; compulsory social security**	**360**	**100**	**260**	**.7222**
	Central and local government non-market services (taken from part B)	360	100	260	.7222
P+Q+R	**Education; health; other community, social and personal services**	**725**	**327**	**398**	**.5490**
	Public schools, state colleges and universities (taken from part B)	150	40	110	.7333
	Public hospitals (taken from part B)	210	70	140	.6667
	Private schools	40	23	17	.4250
	Private hospitals	60	34	26	.4333
	NGO, churches and temples, others (taken from part B)	115	70	45	.3913

	Recreation	50	30	20	.4000
	Other personal services	100	60	40	.4000
	TOTAL	**3610**	**1586**	**2024**	**.5607**

Comments: Gross value added/output ratios are calculated for the base year when data on output, intermediate consumption and value added are all available through censuses or annual surveys. These ratios are then used to estimate gross value added thereafter when only data on output is available.

Solution to Question 2

Output, intermediate consumption, gross value added of non-market activities			
	Output	**IC**	**VA**
Central and local government services	**360**	**100**	**260**
Compensation of employees	200		200
Purchases of materials and services	100	100	
Consumption of fixed capital	60		60
Public schools and state colleges and universities	**150**	**40**	**110**
Compensation of employees	100		100
Purchases of materials and services	40	40	
Consumption of fixed capital	10		10
Public hospitals	**210**	**70**	**140**
Compensation of employees	120		120
Purchases of materials and services	70	70	
Consumption of fixed capital	20		20
Non-government, churches and temples, others	**115**	**70**	**45**
Compensation of employees	40		40
Purchases of materials and services	70	70	
Consumption of fixed capital	5		5

Comments:

1. The solution provides only "estimates" which are the best that one can obtain given the available information.
2. In computing output, or intermediate consumption, one needs to have "use of materials and services", not "purchases of materials and services". On the one hand, part of the materials purchased may be put in inventory. On the other hand, materials may be withdrawn from the inventory to be used in production. At any point in time, the following balance must be true:

   - Purchase of materials + Beginning inventory of materials = Use of materials + Ending inventory of materials
   - Use of materials = Purchase of materials - Increase in inventory of materials

Solution to Question 3

GDP by production approach:

GDP = Total gross value added at basic prices + import taxes and other taxes on products less subsidies = 2024 + 250 = 2274

Solution to Question 4

Final consumption expenditure of the government (GFCE)

Final consumption expenditure of the government is equal to the sum of:	**720**
Output of government services less sales	360
Other non-market services provided free by government (public schools and hospitals)	360
Purchases of market goods and services to be distributed to households	0

Final consumption expenditure of non-profit institutions serving households (NPISHFCE)

Final consumption expenditure of NPISHs is equal to the sum of:	**115**
Output of NPISHs services less sales	115
Purchases of market goods and services to be distributed free to households	0

Final consumption expenditure of households (HHFCE)

Final consumption expenditure of households is equal to the sum of:	**1170**
Purchases of goods and services by households	950
Imputed value of owner-occupied housing	150
Consumption from own production of crops	70

Gross capital formation (GCF)

Gross capital formation	**140**
Gross fixed capital formation	120
Change in inventory	20
Acquisitions less disposals of valuables	0

Net exports (X-M) = Exports - Imports
$$= \quad 750 - 600$$
$$= \quad 150$$

Solution to Question 5

GDP by final expenditure approach

GDP   = Final consumption expenditure + Gross capital formation + Net exports

GDP   =   GFCE + NPISHFCE + HHFCE + GCF + Net exports
=   720 + 115 + 1170 + 140 + 150
=   2295

Comparison of GDP by production and final expenditure approach

GDP by production approach: 2274

GDP by final expenditure approach: 2295
Difference: 21

If one assumes that GDP by production approach is more accurate, then the best GDP estimate is 2274 and 21 is considered statistical error.

GDP   =   2274
Final expenditure   =   2295
Statistical error   =   -21

The statistical error is 0.9% of GDP.

In many developing countries, gross value added/output ratios that are derived from production survey on establishments for the base year are used to estimate value added. These data are supplemented by actual annual data on large corporations, especially state-owned and by data on government expenditures. Very few countries are financially capable of carrying out surveys on retail sale or even gross capital formation therefore GDP based on the final expenditure approach is less reliable. In such a situation, the production approach is more reliable than the final expenditure approach. In some countries like the United States, who can afford extensive surveys on final expenditure, the final expenditure approach is considered more reliable than that based on value added/output ratios. In other countries which can afford surveys on both production and final expenditure, it is not possible to know which is more reliable. This is the case in Canada. The statistical discrepancy is halved, with one half being subtracted from the higher estimate of GDP and the other being added to the lower estimate.