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CHAPTER 9

SUPPLY AND USE TABLES

AND THE INPUT-OUTPUT FRAMEWORK

INTRODUCTION

- 9.01 The purpose of this Chapter is to provide an overview of supply and use tables and of the input-output framework.
- 9.02 The core of the input-output framework is the supply and use tables in current prices and prices of the previous year. The framework is completed by the symmetric input-output tables which are derived from the supply and use tables by using assumptions or additional data.

The supply and use and symmetric input-output tables can be extended and modified for specific purposes such as productivity accounts, labour accounts, quarterly accounts, regional accounts and environmental accounts in monetary or physical terms.

- 9.03 Supply and use tables are matrices describing the values of transactions in products for the national economy categorised by product type and industry. These tables show:
- (a) the structure of the costs of production, and the income generated in the production process;
 - (b) the flows of goods and services produced within the national economy;
 - (c) the flows of goods and services between the domestic economy and the rest of the world; for analysis in a European context, a distinction is required between intra-EU flows and flows with countries outside the EU.
- 9.04 A supply table shows the supply of goods and services by product and by producing industry, and distinguishes supply amongst domestic industries and imports. A schematic outline of a supply table is given in Table 9.1.

Table 9.1 — Schematic outline of a supply table

Supplies	Producing industries	Rest of the world	Totals
Products	Output values	Import values	Total supply by product
Totals	Total industry output	Total imports	Total supply

9.05 A use table shows the use of goods and services categorised by product and by type of use.

The uses shown in the columns are as follows:

- (a) intermediate consumption by industry;
- (b) final consumption expenditure: households, government and NPISH;
- (c) gross capital formation; and
- (d) exports.

In the columns under the intermediate consumption by industry, the table shows the components of gross value-added, as follows:

- (a) compensation of employees;
- (b) other taxes less subsidies on production;
- (c) net mixed income, net operating surplus and consumption of fixed capital.

A schematic outline of a use table is given in Table 9.2 below.

Table 9.2 — Schematic outline of a use table

Uses	Industries	Final consumption	Gross capital formation	Rest of the world	Total
Products					
Total	Intermediate consumption	Final consumption	Gross capital formation	Exports	Total use
Components of value added	Compensation of employees Other taxes less subsidies Net operating surplus Consumption of fixed capital				

9.06 In the supply and use tables the following identities apply:

- (a) for each industry, output equals intermediate consumption plus gross value added;
- (b) for each product, supply equals the sum of all uses, shown in balanced rows in the supply and use framework.

This identity is valid only when supply and use are on the same valuation basis, i.e. both at purchasers' prices or both at basic prices (see paragraphs 9.30 to 9.33).

Accordingly, for each product:

supply at purchasers' prices is equal to

output of the product at basic prices

plus imports at basic prices

plus trade and transport margins

plus taxes *less* subsidies on products

which is equal to use of the product at purchasers' prices, which is equal to

intermediate demand for the product

plus final consumption expenditure

plus gross capital formation

plus exports.

At the level of the total economy, total intermediate demand is equal to total intermediate consumption, trade and transport margins sum to zero over the whole economy as they are matched by the output of the margin industries, and so this identity can be stated as:

output + imports + taxes on products less subsidies on products = Intermediate consumption + final consumption + gross capital formation + exports

therefore

output – intermediate consumption + taxes on products less subsidies on products

= final consumption + gross capital formation + exports less imports

which shows the equivalence of the production and expenditure approaches to measuring GDP;

- (c) gross value-added as the difference between output and intermediate consumption by industry. It is identical to the sum of the incomes generated. So gross value-added equals the sum of compensation of employees, consumption of fixed capital, net operating surplus/mixed income, and other taxes less subsidies on production. This enables the consistency of the income approach to measuring GDP to be checked with the production approach.

9.07 Supply and use tables are the central framework for industry analyses, such as analysis of output, value added, compensation of employees, employment, operating surplus/mixed income, taxes (less subsidies) on production, gross fixed capital formation, consumption of fixed capital and capital stock.

9.08 The supply and use tables contain the flows in the following accounts:

- (a) the goods and services account;
- (b) the production account;
- (c) the generation of income account.

These accounts show the generation of income and the supply and use of goods and services by institutional sector. The supply and use tables can complement this information by showing a breakdown by industry and by showing volume and price changes. The information by institutional sector in the sector accounts and the information by industry in the supply and use tables can be linked by a cross-classification table such as that given in Table 9.3 below.

Table 9.3 — Table linking supply and use tables to sector accounts

	Industries (NACE)	Total
Sector		
S.11 Non-financial corporations		
Intermediate consumption		
Gross value added		
Compensation of employees		
Other taxes less subsidies on production		
Consumption of fixed capital		
Net operating surplus/mixed income		
Output		
Gross fixed capital formation		
Stock of fixed assets		
Employment		

	Industries (NACE)	Total
Sector		
S.12 Financial corporations		
Intermediate consumption		
...		
Employment		
S.13 General government		
S.14 Households		
S.142 Own-account workers		
Services of owner-occupied dwellings		
S.15 NPISH		
Sector totals		
Intermediate consumption		
....		
Employment		

9.09 A symmetric input-output table is shown in Table 9.4, and is a matrix showing how supply matches uses using a product-by-product or industry-by-industry categorisation of output and the detailed transactions of intermediate consumption and final uses. There is one major conceptual difference between a symmetric input-output table and a use table: in the use table, the entries show how products are used by industries in intermediate consumption, whereas in a symmetric input-output table there are two alternative presentations:

- (a) the entries show how products are used as intermediate consumption to make products, or
- (b) the entries show how the outputs of industry are used in the intermediate consumption of other industries to create the industrial output.

Accordingly, in a symmetric input-output table either a product or an industry classification is employed for both rows and columns.

Table 9.4 — Schematic outline of a symmetric input-output table, for products

	Products produced	Final consumption	Gross capital formation	Rest of the world	Total
Products used	Intermediate consumption	Final consumption of households, NPISHs and government	Gross capital formation	Exports	
Totals					
Components of gross value added					
Rest of the world					
Total					

9.10 Most statistical information that can be obtained from producer units indicates what type of products they have produced and sold and, usually in less detail, what type of products they have bought and used. The format of the supply and use tables is designed to fit in with this type of statistical information (i.e. products used by industry).

- 9.11 By contrast, information of a product-by-product or industry-by-industry nature as required by the symmetric input-output table is not often available. For example, surveys of industries usually provide information about the type of products used in production, and about the products produced and sold. Information on inputs used in making specific products is usually not available.
- 9.12 Information arranged in the form of supply and use tables is the starting point for constructing the more analytical form of symmetric input-output tables. The industry by product information in the supply and use tables can be converted into symmetric tables, by adding extra information on the input structures, or by assuming identical input structures or market shares by product or by industry.
- 9.13 Supply and use tables and the input-output framework combine three different roles:
- description,
 - statistical tool,
 - tool for analysis.

DESCRIPTION

9.14 Supply and use tables give a systematic description of the generation of income and supply of product, and use by industry. Developments of the inputs and outputs of production processes of individual industries are shown in the context of the national economy, i.e. related to the production processes of other domestic industries and the rest of the world and final consumption expenditure.

A major role of supply and use tables is to show changes in the structure of the economy, e.g. changes in the importance of various industries, changes in the inputs used and outputs produced and changes in the composition of final consumption expenditure, gross capital formation, imports and exports. Such changes may reflect developments such as globalisation, outsourcing, innovation and changes in labour costs, taxes, oil prices and exchange rates.

Supply and use tables in prices of the previous year are used to compile GDP volume growth statistics, for describing changes in economic structure in nominal or volume terms. They also provide a framework in which to present national price changes and changes in labour costs.

STATISTICAL TOOL

- 9.15 Using information on production, expenditure and income in the construction of supply and use tables, and reconciling inconsistent estimates, generates a reliable and balanced set of national accounts, including the estimates of key aggregates such as GDP in current prices and prices of the previous year.
- 9.16 In measuring GDP at market prices, three basic approaches can be adopted: the production approach, the expenditure approach and the income approach. These three different approaches are used in the compilation of the supply and use tables as follows:
- (a) according to the production approach, GDP at market prices is equal to output at basic prices minus intermediate consumption at purchasers' prices, plus taxes (less subsidies) on products;
 - (b) according to the expenditure approach, GDP at market prices is equal to the sum of final use categories minus imports: final consumption expenditure + gross capital formation + exports – imports;
 - (c) according to the income approach, GDP at market prices is equal to the sum of compensation of employees, consumption of fixed capital, other taxes less subsidies on production and net operating surplus/mixed income, plus taxes less subsidies on products.

A single estimate of GDP at market prices is derived when the supply and use tables are balanced.

9.17 The supply and use tables are, in particular, useful for estimating GDP at market prices according to the production approach and expenditure approach. Major data sources for this are business surveys and administrative data such as VAT records and excise duties. Supply and use tables are used to combine information from the production and expenditure approaches by calculating and balancing supply and use at the product level. In this method, supply of a specific product is calculated and allocated to various uses, such as final consumption expenditure of households, intermediate consumption and exports. The income method does not provide the same robust balancing exercise, as operating surplus and mixed income are usually estimated as a residual on the basis of information from the other two approaches. However, the income method improves the balancing when the structure of the factor income components can be estimated. The consistency of supply and use tables with the sector accounts can be checked through linkage tables as shown in Table 9.3. This confrontation can help in the estimation of GDP at market prices, by comparing information from the profit-and-loss accounts of companies with the equivalent industry estimates.

9.18 The supply and use tables serve a variety of statistical purposes:

- (a) identifying gaps and inconsistencies in data sources;
- (b) making estimates by residual, for example estimating the final consumption of specific products as a residual after other uses of the products have been allocated;

- (c) making estimates by extrapolating figures from a base period to later periods for which less reliable information is available. For example, annual figures may be estimated on the basis of the detailed supply and use figures for a benchmark year, and later quarterly figures can be estimated by extrapolating from the reference period;
- (d) checking and improving the consistency, plausibility and completeness of figures in the supply and use tables and derived figures such as those in the production accounts. To this end, the balancing process is not limited to supply and use tables at current prices:
 - (1) with the aid of the tables such as Table 9.3 showing the linkage with the sector accounts, a direct comparison can be made between production, expenditure and income estimates from the supply and use system, and those from independent sources used in the sector accounts. Reconciliation at this stage guarantees that, following the supply and use balancing process, consistency is obtained between the supply and use tables and the sector accounts;
 - (2) deriving symmetric input-output tables from the supply and use tables can give feedback revealing inconsistencies and weaknesses in the supply and use tables.

- (3) by compiling supply and use tables at current prices and in volume terms for two or more years, estimates of changes in volumes, values and prices can be balanced simultaneously: compared to compiling and balancing supply and use tables for a single year in isolation at current prices only, this is a major extension of the effectiveness of the supply and use framework;
- (e) weighting and calculation of index numbers and price and volume measures, e.g. of GDP by deflating final uses by product or of GDP by applying the double-deflation method by industry. Deflation is carried out at the lowest possible level of aggregation of transactions, consistent with reliable estimates of price movements, for the following reasons:
- (1) generally speaking, price and volume indicators will be more representative at a low level of aggregation;
 - (2) quality change can be measured better at a lower level of aggregation, e.g. changes in the composition of the supply or use of a product group can be taken into account;

- (3) available price indices from price statistics are often of the Laspeyres type. The objection that they are applied in place of the theoretically more appropriate Paasche type is less severe if they are used at a low level of aggregation.

Balancing of supply and use of a product is easier when the number of products distinguished is higher and the source data is available at this level of detail. The quality of the balanced results will be higher; this is in particular true when there are data gaps.

TOOL FOR ANALYSIS

- 9.19 A major analytic strength of input-output tables is that they enable the measurement of not only first order effects when there are, for example, changes in energy prices or labour costs, but also second order and more indirect effects. For example, a significant increase in energy prices will affect not only those industries that use energy intensively, but also those industries that use the outputs of energy-intensive producers. Such indirect effects can be highly relevant, as they are sometimes more significant than the direct effects.

SUPPLY AND USE TABLES IN MORE DETAIL

Classifications

- 9.20 The classification used for industries in supply, use and input-output tables is the NACE and the classification employed for products is the CPA; these classifications are fully aligned to each other: at each level of aggregation, the CPA shows the principal products of the industries according to the NACE.

- 9.21 In the supply and use tables, the classification for products is at least as detailed as the classification for industries, e.g. the three-digit level of the CPA and the two digit-level of the NACE.
- 9.22 Industry and product classifications can be based on three different types of criteria: supply-criteria, demand-criteria and size. For productivity analysis, products and their producers are in principle classified by type of production process. For analysis of demand, products are classified by similarity of purpose, for example luxury goods are grouped together, or similarity of marketing relationship such as the sales outlet type. For input-output analysis, the same classification of products or industries is used for supply and demand. The classification is defined in such a way that the size of each class is not too small or too large a part of the national economy. For international classifications, this implies that the quantitative importance of most of the classes is substantial in many countries.
- 9.23 The industry and product classifications in the national accounts are necessarily based on a mixture of such criteria and also the legacy of history. They are mainly defined from a producers' point of view, and so less well suited to analysing supply and demand. Compilers and users of national accounts data on industries and products should have a good notion of what is actually included and excluded in each of the groups and their implications. For example, the industry real estate activities include the services of owner-occupied dwellings and the industry insurance excludes social security funds.

- 9.24 Local KAUs within one industry can have different production processes. This may reflect substantial differences in vertical integration, with ancillary activities such as cleaning, transport, administration and canteen services contracted out, machinery rented, labour contracted in via temporary agencies, and marketing. It may also reflect differences between legal and illegal producers or between producers in different regions.
- 9.25 Due to the changing economic importance of different industries and products, changes in production processes and the appearance of new products, the industry and product classifications are updated regularly. However, a balance has to be struck between keeping abreast of changes in the economy, and the need for comparability of data over time combined with the costs involved of such major changes for the producers and users of the data.
- 9.26 The product classification in the supply and use tables is generally more detailed than the industry classification. There are four major reasons for this:
- (a) available data on products are often much more detailed than those on industries;
 - (b) the characteristic output of one industry may be subject to substantially different tax regimes and prices, for example when there is price discrimination. Compilation and analysis benefit from different products being distinguished;
 - (c) to enable high quality deflation and the estimation of measures in volume terms, the product groups are homogeneous and well linked to the available price deflators;

(d) to ensure a transparent compilation process, separate products are needed to reveal major specific national accounts conventions, such as the services of owner-occupied dwellings, insurance and the market and non-market output by government units.

9.27 The distinction between market output, output for own final use and non-market output is only to be used for the total output by industry; the distinction is not required for each product group.

9.28 The distinction between market producers, producers for own final use and non-market producers is used for industry when such different types of producers are present. In general, this distinction will therefore only be used for sub-classifying a very limited number of industries such as health care and education.

9.29 For analysing the economy of Member States from a European perspective or for deriving supply and use tables for the whole EU, imports and exports are subdivided into:

- (a) intra-EU flows, distinguishing between within the European Monetary Union and with other Member States;
- (b) imports and exports with non-EU countries.

Valuation principles

- 9.30 In the supply table, flows of goods and services are valued at basic prices. In the use table, the flows of goods and services are valued at purchasers' prices. In order to have a consistent valuation for the supply and use tables, Table 9.5 shows the transition of supply at basic prices to supply at purchasers' prices. As supply equals use for products, two identities now hold:
- (a) supply at purchasers' prices is equal to use at purchasers' prices;
 - (b) supply at basic prices is equal to use at basic prices.
- 9.31 Gross value added is recorded at basic prices. It is output valued at basic prices less intermediate consumption valued at purchasers' prices.
- 9.32 Gross value added at factor cost is not a concept used in the ESA. It can be derived from value added at basic prices by subtracting other taxes (less subsidies) on production.
- 9.33 The transition from supply at basic prices to purchasers' prices involves:
- (a) reallocating trade margins;
 - (b) reallocating transport margins;

- (c) adding taxes on products (except deductible VAT);
- (d) deducting subsidies on products.

A similar transition applies to transforming use at purchasers' prices into use at basic prices; however, this will amount to deducting taxes on products and adding subsidies on products. Tables 9.8 and 9.9 show the transition in more detail. These tables also serve analytical purposes, such as analysis of prices and analysis of the consequences of changes in the rates of taxes on products.

9.34 Thus, the following tables result from the balancing process:

- (a) supply and use Tables 9.5 and 9.6 showing the final results of balancing totals of supply and use by products at purchasers' prices;
- (b) the tables on trade and transport margins (Table 9.7) and on taxes (less subsidies) on products (Table 9.8).

Table 9.5 — Supply table at basic prices, and the transformation into purchasers' prices

Supplies	Industries (NACE) 1 – 2 – 3 – 4 - ...	Rest of the world	Total supply at basic prices	Trade and transport margins	Taxes less subsidies on products	Total supply at purchasers' prices
Products (CPA) 1 2 3 4	Output by product and industry	Imports by product (CIF)	Total supply by product			
Total	Total output by industry			0		
Market output				0		
Output for own final use		0		0		
Non-market output		0		0		

Table 9.6 — Use table at purchasers' prices

Uses	Industries (NACE) 1 – 2 – 3 – 4 - ...	Final consumption	Gross capital formation	Rest of the world	Total
Products (CPA)	Intermediate consumption of products by industry	Final consumption expenditure by product and by	Gross capital formation by product and by	Exports by product (FOB)	Total use by product
1					
2		(a) households	(a) gross fixed capital formation		
3		(b) NPISH	(b) changes in valuables		
4		(c) government	(c) changes in inventories		
...					
Total	Total intermediate consumption by industry	Total final consumption	Total gross capital formation	Total exports	Total use of products
Compensation of employees	Gross value added components by industry				
Other taxes less subsidies on production					
Consumption of fixed capital					
Net operating surplus					
Mixed income					
Total	Total inputs by industry				
Supplementary information					
Gross fixed capital formation					
Fixed capital stock					
Employment					

Trade and transport margins

Table 9.7 — Trade and transport margins — supply

	Trade and transport margins on the supply of products			
	Wholesale trade	Retail trade	Transport	Trade and transport margins
Products (CPA)				Trade and transport margins on total supply by product
1				
2				
3				
4				
Total	Total wholesale trade	Total retail trade	Total transport	Total margins on supply by product

Table 9.7 — Trade and transport margins — use (continued)

Trade and transport margins on the use of products					
	Industries (NACE) 1 – 2 – 3 – 4 - ...	Final consumption	Gross capital formation	Exports	Trade and transport margins
Products (CPA)	Trade and transport margins on intermediate consumption by product and by industry	Trade and transport margins on final consumption expenditure by product and by	Trade and transport margins on gross capital formation by product and by	Trade and transport margins on exports	Trade and transport margins on total use by product
1		(a) households	(a) gross fixed capital formation		
2		(b) NPISH	(b) changes in valuables		
3		(c) government	(c) changes in inventories		
4					
Total	Trade and transport margins on intermediate consumption, total by industry	Total trade and transport margins on final consumption	Total trade and transport margins on gross capital formation	Total trade and transport margins on exports	Total margins on use by product

- 9.35 Part of the transition of supply tables from basic prices to purchasers' prices, and the transition of use tables at purchasers' prices into basic prices, is the reallocation of trade margins. Valuation at basic prices implies that the trade margins are recorded as part of the product trade, while valuation at purchasers' prices implies that the trade margins are allocated to the products to which they apply. The same situation holds for transport margins.
- 9.36 The total of trade margins by product is equal to the total of trade margins by the trade industries plus the trade margins by other industries. The same identity holds for transport margins.
- 9.37 Transport margins include transportation costs paid separately by the purchaser and included in the use of products at purchasers' prices but not in the basic prices of a manufacturers' output or in the trade margins of wholesale or retail traders. Such transport margins include in particular:
- (a) transport of goods from where they are manufactured to where the purchaser takes delivery of them, in the event that the manufacturer pays a third party for the transport and provided that this amount is invoiced separately to the purchaser;
 - (b) transport of goods arranged by the manufacturer or by the wholesale or retail trader in such a way that the purchaser has to pay separately for the transport costs even when the transport is carried out by the manufacturer or the wholesale or retail trader themselves.

- 9.38 All other costs of transporting goods are not recorded as transport margins, e.g.:
- (a) if the manufacturer transports the goods himself, such transportation costs are included in the basic prices of the manufacturer's output; this transport represents an ancillary activity and the individual costs of transport are not identifiable as transportation costs;
 - (b) if the manufacturer arranges for the goods to be transported without a separate invoice for the transport services, such transportation costs are included in the basic prices of the manufacturer's output; such transportation costs are identifiable as such and are recorded as part of the manufacturer's intermediate consumption;
 - (c) if wholesale and retail traders arrange for goods to be moved from where they take delivery of them to where another purchaser takes delivery, the costs involved are included in the trade margin if no separate charge is made for transportation to the purchaser. Again, as with manufacturers, such costs represent an ancillary activity of wholesale and retail traders or the purchase of an intermediate service, thus entering trade margins but not transport margins;
 - (d) if a household buys goods for final consumption purposes and arranges for transport by a third party, the transport costs involved are recorded as final consumption expenditure on transport services and not included in trade or transport margins.

9.39 Table 9.7 shows a somewhat simplified picture of a trade and transport margins matrix, for the following reasons.

- (a) In transforming the uses, a distinction needs to be made between wholesale trade and retail trade in order to take account of the differences in their prices. In drawing up the tables, it should be borne in mind that wholesale traders sell directly to households as well as industries, for example furniture, and that retail traders sell to industries such as cafes and restaurants, as well as households.
- (b) In calculating and analysing trade margins on products for final consumption expenditure by households, for each product group the most important distribution channels may also be distinguished in order to take account of the differences in their prices; the distinction between wholesale trade and retail trade is not detailed enough. For example, goods and services can be bought by households in a supermarket, a grocery, flower shop, department store, abroad or obtained as income in kind. For some products, secondary sales are important, as in the case of cigarette sales by cafes, restaurants and petrol stations. Sales by retailers are adjusted to obtain the value of sales to households, for example sales to businesses, government and tourists should be deducted. Of course, such distinctions can only be introduced if the available data sources provide sufficient information for estimates of the importance of each of the distribution channels. Even for one trader or transporter, different products generally have different margins. Data on margins by type of product are the most appropriate and used when available.

- (c) In calculating transport margins, a distinction by type of transport such as rail, air, sea and inland waterway, and road, is useful.

Taxes less subsidies on production and imports

9.40 Taxes on production and imports consist of:

- (a) taxes on products (D.21):
 - (1) value added type taxes (VAT) (D.211);
 - (2) taxes and duties on imports excluding VAT (D.212);
 - (3) taxes on products, except VAT and import taxes (D.214);
- (b) other taxes on production (D.29).

Similar categories are distinguished for subsidies.

9.41 Supply at basic prices includes other taxes less subsidies on production. In order to make the transition from basic prices to purchasers' prices, the various taxes on products are added and the subsidies on products deducted.

Table 9.8 — Taxes less subsidies on products

Taxes less subsidies on supply

	Taxes less subsidies on product supplies							Total taxes less subsidies on products
	VAT	Taxes on imports		Other taxes on products	Subsidies on imports		Other subsidies on products	
Products (CPA)								Taxes less subsidies on total supply by product and by use
1								
2								
3								
4								
Totals								

Table 9.8 — Taxes less subsidies on products (continued)

Taxes less subsidies on uses

	Total taxes less subsidies on products	Taxes less subsidies on product uses
		Industries (NACE) 1 – 2 – 3 – 4 -
Products (CPA)	Taxes less subsidies on products for final uses:	Taxes less subsidies on intermediate consumption of products by industry
1	Final consumption	
2	(a) households	
3	(b) NPISH	
4	(c) government	
	Gross capital formation:	
	(d) gross fixed capital formation	
	(e) changes in valuables	
	(f) changes in inventories	
	Exports	

9.42 Table 9.8 on taxes less subsidies on products is simplified, in the following ways:

- (a) for the use of products, the different types of taxes on products are not distinguished and subsidies are not shown separately; for the supply of products, only three types of taxes on products and two types of subsidies are distinguished. In general, it is useful to show each major type of tax or subsidies on products separately, and then allocate the total to the various product groups;
- (b) different tax rates and subsidies can apply to different distribution channels; the latter should therefore also be distinguished when relevant and sufficient information exists.

9.43 Taxes and subsidies on products are the amounts due for payment only when evidenced by tax assessments, declarations, etc. or the amounts actually paid. In compiling supply and use tables, taxes and subsidies on products are usually estimated by product by applying the official tax or subsidy rates to the various demand flows. Afterwards an assessment should be made of the differences with the tax assessments or the amounts actually paid.

- (a) Some of these differences indicate that the initial estimate of taxes on products in the supply and use tables does not comply with the ESA definitions:
 - (1) in case of exemption the initial estimate of taxes on products is therefore lowered;

- (2) in case of hidden economic activities or evasion of the payment of taxes on products, such as when the payment of taxes is compulsory but there is no tax assessment, the estimate of taxes on products is therefore lowered.
- (b) In some instances, the differences may indicate that the initial estimate for taxes and subsidies on products erroneous, for example because the output of some product is underestimated. Modifications of the estimates of the flows of goods and services can then be made.

9.44 VAT may be deductible, non-deductible or not applicable:

- (a) deductible VAT applies to most of intermediate consumption, most of gross fixed capital formation and part of changes in inventories;
- (b) non-deductible VAT often applies to final consumption expenditure by households, part of gross fixed capital formation such as new owner-occupied dwellings, part of changes in inventories and part of intermediate consumption, for example intermediate consumption of government units and financial corporations;
- (c) VAT is in general not applicable to:
 - (1) exports to countries outside the EU;

- (2) the sale of any goods or services subject to a zero rate of VAT regardless of their use; however, a zero rate of VAT implies that the VAT paid on purchases can still be reclaimed; intermediate consumption and gross capital formation of these producers is therefore corrected by the amount of the VAT reclaimed;
- (3) any producers exempted from VAT registration, such as small businesses and religious organisations; in this situation, the right to claim back the VAT on purchases is generally restricted.

9.45 VAT is recorded net: all supplies are valued at basic prices, i.e. excluding invoiced VAT; intermediate and final uses are recorded at purchasers' prices, i.e. excluding deductible VAT.

Other basic concepts

9.46 In the supply and use tables, two adjustment items are used in reconciling the valuation of imports in the supply and use tables and the valuation found in the institutional sector accounts.

In the supply table, in order to achieve a comparable valuation with domestic production in the same product group, imports of goods are valued at CIF values. The CIF value includes the transport and insurance services provided by residents, such as own-account transport or transport by specialised resident carriers. In order to achieve a consistent valuation between imports and exports, exports of services should include this value.

In the institutional sector accounts, imports of goods are valued at FOB values, i.e. in line with the valuation for exports of goods. However, in the case of FOB valuation the value of transport and insurance services provided by residents, which is included in the export of services, will be smaller, since it only covers those services provided inside the exporting country. The result of employing different valuation principles is thus that net total imports are the same, but that both total imports and total exports are larger for CIF valuation.

The two valuation principles can be reconciled in the supply and use tables by introducing adjustment items for imports as well as exports. The adjustment items should be equal to the value of the transport and insurance services by residents incorporated in the CIF value but not in the FOB value, i.e. referring to the transport and insurance from the border of the exporting country to the border of the importing country. Such adjustment items, once incorporated in the supply and use tables, need no special treatment in the input-output calculations.

- 9.47 The transfer of existing goods is recorded in the use table as a negative expenditure for the seller and a positive expenditure for the purchaser. For the product group involved, the transfer of an existing good amounts to a reclassification among uses. Only the transaction costs are not treated as a reclassification: they are recorded as a use of services, for example business or professional services. For the purposes of description and analysis, it can be useful to show for some product groups the relative size of the transfer of existing goods separately, for example the importance of second-hand cars in the market for both new and second-hand cars, or the role of recycled paper in the supply of paper products.
- 9.48 For a good understanding of supply and use tables, it is helpful to recall some of the accounting conventions employed in the ESA:
- (a) industries constitute of a group of kind-of-activity units (KAUs) engaged in the same or similar kind-of-activity. An important feature of supply and use tables is that they record secondary activities separately. This implies that KAUs need not to be homogeneous in their production activities. The concept of KAUs is explained in more detail in Chapter 2. A completely homogeneous unit of production is used in a symmetric product by product input-output table;

- (b) if an establishment undertaking purely ancillary activities is statistically observable, in that separate accounts for the production it undertakes are readily available, or if it is in a geographically different location from the establishments it serves, it is recorded as a separate unit and allocated to the industrial classification corresponding to its principal activity, in both national and regional accounts. In the absence of suitable basic data being available, the output of the ancillary activity may be estimated by summing costs.

If neither of these two conditions is met, all inputs consumed by an ancillary activity such as materials, labour, and consumption of fixed capital, are treated as inputs to the principal or secondary activity which they support;

- (c) goods or services produced and consumed within the same accounting period and within the same local KAU are not separately identified. They are therefore not recorded as part of the output or intermediate consumption of that local KAU;
- (d) minor processing, maintenance, servicing or repair on behalf of other local KAUs is to be recorded net, i.e. excluding the value of the goods involved;

- (e) imports and exports occur when there is a change of ownership between residents and non-residents. Physical movement of goods across national borders does not by itself imply an import or export of these goods. Goods sent abroad for processing are not recorded as exports and imports. In contrast, buying and reselling goods with non-residents without the goods entering the merchant's economy are recorded as exports and imports in the accounts of the producer and final purchaser, and a net export of goods under merchanting is shown in the accounts of the merchant economy;
- (f) durable goods can be rented or be subject to operating leasing. In such instances, they are recorded as fixed capital formation and fixed capital stock in their owner's industry; in the industry of the user intermediate consumption by amount of the rental paid is recorded;
- (g) persons working via temporary agencies are recorded as being employed in the industry of those agencies and not in the industries in which they actually work. As a consequence, in the latter industries, the fees paid to the agency for the supply of labour are recorded as intermediate consumption and not as compensation of employees. Labour contracted out is treated as services provided;

- (h) employment and compensation of employees are broad concepts:
- (1) employment for social reasons is also counted as employment; this applies, for example, to work placements for disabled people, employment projects for people who have been unemployed for a long time and employment programmes for young people seeking jobs. As a consequence, the people involved are employees and receive employee compensation and not social transfers, though their productivity may be lower than that of other employees;
 - (2) employment includes cases where the persons involved are not expected to work at all, e.g. persons dismissed but receiving, for a given period, payments from their former employer. However, employment in terms of hours worked is not distorted by this convention, as no hours are actually worked.

Supplementary information

9.49 The use Table 9.6 contains supplementary information: gross fixed capital formation, stocks of fixed assets and employment by industry. A breakdown into employees and own-account workers is valuable additional information. The information on gross fixed capital formation and stocks of fixed assets by industry is needed to derive consumption of fixed capital by industry and for recording non-deductible VAT on gross fixed capital formation. Showing employment by industry is important for compilation purposes:

- employment figures are often used for grossing up values of output, compensation of employees, intermediate consumption and mixed income,
- key-ratios such as output, compensation of employees and mixed income per unit of labour such as hours worked, can be compared over time and by industry to check the plausibility of the estimates,
- it helps to ensure consistency between the values by industry and employment data by industry. For example, without an explicit link to employment data, the balancing process may result in changes in the values by industry without corresponding changes in the employment figures.

Adding information on employment by industry is also helpful for the analysis of employment and productivity.

DATA SOURCES AND BALANCING

- 9.50 For compiling output by industry and product, the major data sources are usually enterprise economic surveys, production surveys and annual reports or business accounts from major companies. The surveys are generally exhaustive for large companies while a sample survey is carried out for small size companies. For some specific activities, different data sources may be relevant, for example for supervisory bodies, accounts of local and central government or social security funds.
- 9.51 Such data are used to prepare a first incomplete set of supply and use tables. These are balanced in various steps. Balancing manually at a low level of aggregation provides important checks on the errors in data sources, system errors, and at the same time modifications of the basic data can be made, to correct for conceptual differences and missing units. If the reconciliation takes place at a higher level of aggregation, using an automatic balancing process or a very strict sequential balancing process, most of those checks are absent as errors cancel out and the causes of error cannot be traced.

TOOL FOR ANALYSIS AND EXTENSIONS

9.52 For analysis, three types of tables can be used:

- supply and use tables,
- symmetric input-output table industry by industry,
- symmetric input-output table product by product.

Symmetric input-output tables can be derived from the supply and use tables, in current prices, and also in previous years' prices.

9.53 Use Table 9.6 does not show to what extent the goods and services used have been produced domestically or imported. This information is necessary for analyses in which the link between supply and use of goods and services within the national economy plays a role. An example is the analysis of the impact of changes in exports or final consumption expenditure on imports, domestic production and related variables such as employment. The input-output framework, therefore, would benefit from separate use tables for imported products and domestically produced goods and services.

- 9.54 The use table for imported products is compiled by exploiting all information available on the uses of imports, for example for some products the major importing enterprises may be known and for some producers information on the amount of imports may exist. However, in general, direct statistical information on the use of imports is scarce. This information has therefore usually to be supplemented by assumptions over the allocation of product group to use.
- 9.55 The use table for goods and services produced domestically can then be obtained by deducting the use table for imported products from the use table for the whole economy.
- 9.56 In theory, four basic models exist for the transformation of a supply and use table to a symmetric input-output table. Those models are based on either technology or fixed sales structure assumptions. Most often used is the product technology assumption: each product is produced in its own specific way, irrespective of the industry where it is produced. This assumption is often used to derive a product-by-product input-output table. The second common model uses the fixed product sales structure assumption (market share assumption): each product has its own specific sales structure, irrespective of the industry which produces it; this approach is often used to derive an industry-by-industry input-output table. Hybrid models which mix these assumptions are possible. Models based on either industry technology or fixed industry sales structure assumptions are of less practical relevance due to their low probability of occurrence in practice. A discussion of the alternative models and transformation processes is given in Chapter 11 of *Eurostat Manual of Supply, Use and Input-output Tables (2008 edition)*¹.

¹ Eurostat, *Eurostat Manual of Supply, Use and Input-Output Tables (2008 edition)*, 2008, (available on: <http://epp.eurostat.ec.europa.eu>).

9.57 The choice of the best assumption to apply in each case is not an easy one. It depends on the structure of national industries, e.g. the degree of specialisation, and on the homogeneity of the national technologies used to produce products within the same product group and not the least on the level of detail of the basic data.

Simple application of the product technology assumption gives results that are unacceptable, insofar as the input-output coefficients sometimes generated are improbable or even impossible, in the form of negative coefficients. Improbable coefficients may be due to errors in measurement and to heterogeneity of product-mix in the industry of which the transferred product is the principal product. This can be tackled by making adjustments based on supplementary information or exploiting informed judgement to the fullest extent possible. Another solution is to apply the alternative assumption of fixed product sales structure. In practice, employing mixed technology assumptions combined with supplementary information has proven to be a useful approach for compiling symmetric input-output tables.

9.58 The symmetric input-output table can be broken down into two tables:

- (a) a matrix showing the use of imports; the format of this table is the same as that of the import table supporting the supply and use tables, except that a symmetric structure with the same classification on both axes is used;

(b) a symmetric input-output table for domestic output.

The latter table should be used in calculating the cumulated coefficients, i.e. the Leontief inverse. The Leontief inverse is the inverse of the difference between the identity matrix I and the matrix of technical input coefficients obtained from the matrix of domestic output used as intermediate consumption. The Leontief inverse can also be derived for imports. It should then be assumed that the imports have been produced in the same way as the competing domestic products.

- 9.59 Supply and use tables and symmetric input-output tables can be used as tools of economic analysis. Both types of tables have different merits. Symmetric input-output tables are readily available for calculating not only direct but also indirect and cumulative effects. They can also be of good quality when expert knowledge and various types of statistical information have been used in deriving the tables from the supply and use tables.
- 9.60 Industry-by-industry tables are well suited for analyses related to industries, e.g. tax reform, impact analysis, fiscal policy and monetary policy; they are also closer to the various statistical data sources. Product-by-product tables are well suited for analyses related to homogeneous production units, e.g. productivity, comparison of cost structures, employment effects, energy policy and environmental policy.

9.61 However, the analytical properties of product-by-product tables and industry-by-industry tables do not differ significantly. The differences between product-by-product tables and industry-by-industry tables are caused by the existence of a generally limited amount of secondary production. In practice, analytical uses of input-output tables implicitly assume an industry technology, no matter how the tables have originally been compiled. Furthermore, in practice, any product-by-product table is a manipulated industry-by-industry table, as it still contains all the institutional KAU and enterprise characteristics of the supply and use tables.

9.62 In general, many specific types of analysis are served by supply and use tables and symmetric input-output tables, for example:

- (a) analysis of production, cost structures and productivity;
- (b) analysis of prices;
- (c) analysis of employment;
- (d) analysis of the structure of capital formation, final consumption, exports, etc.;
- (e) analysis of economic growth by using the cumulated costs shares to allocate imports to the various final uses;
- (f) analysis of the contribution to economic growth and employment of exports to other (blocks) of countries;

- (g) analysis of imports of energy required;
- (h) analysis of the impact of new technologies;
- (i) analysis of the effects of changes in tax rates (e.g. VAT) or the introduction of a national minimum wage;
- (j) analysis of the relationship between domestic production and the environment, e.g. focusing on the use of specific products like fuel, paper and glass or the emission of pollutants.

A macro model may also only include the cumulated costs-shares calculated from the input-output tables. In this way, information from the input-output table on direct and indirect effects, e.g. the importance of labour costs or imports of energy for private consumption or exports, is incorporated in the macro model and can be used for analysis and forecasting.

9.63 In order to serve more specific purposes, the supply and use tables and symmetric input-output tables can be modified by introducing alternative and supplementary classifications. The most important examples are as follows:

- (a) more detailed product and industry classifications based on national classifications or to take account of specific purposes, e.g. for the analysis of the role of research and development in the national economy;

- (b) more detailed geographical breakdown of imports and exports, e.g. intra-EU trade sub classified by country and extra-EU trade sub classified by economic regions and some specific countries such as China, India, Japan and the United States;
- (c) classification of imports into:
 - (1) imports of products that are also domestically produced ('competitive imports');
 - (2) imports of products that are not domestically produced ('complementary imports').

Both types of imports can be expected to have a different relationship with and importance for the national economy. Competitive imports can be the subject of analysis and economic policy as they may be a substitute for domestic output; they could therefore be incorporated as a separate category of potential final use in the use tables. For complementary imports, for example in the case of a sudden rise in energy prices, analyses will mainly focus on the impact of changes in their prices and the national economy;

- (d) classification of compensation of employees by criteria such as level of education, part-time/full-time, age and gender. This classification could then also be applied to the supplementary information on employment. In this way, the supply and use tables can also be used for analyses of the labour market;

- (e) breakdown of compensation of employees into:
 - (1) wages and salaries, including social contributions by employees
 - (2) employers' social contributions.

This breakdown permits analysis of the role of social contributions for the price of labour inputs and the shifting of this burden towards gross operating surplus;

- (f) classification of final consumption by purpose, which for households is Coicop, for NPISH it is COPNI and for government it is COFOG. The functional classification of this expenditure enables the impact of each function of the rest of the economy to be assessed. For example, the importance of public and private expenditure on health care, transport and education can then be assessed.
