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User Guide: Canadian System of Macroeconomic Accounts

Chapter 4 Supply and use accounts

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Chapter 4 Supply and use accounts

What this chapter seeks to do

The purpose of this chapter is to explain the supply and use accounts (SUA) in terms of their internal structure, their relationship to the rest of the Canadian system of macroeconomic accounts and how these accounts are used to interpret economic developments. The core of the SUA consists of 'supply' and 'use' tables. The SUA also include symmetric 'input-output tables' derived from the supply and use tables.[1]

The supply table shows the supply of products sourced from domestic production and imports.[2] The use table shows the utilization of products by domestic industries (intermediate consumption) and final users (final consumption by households, NPISH and general government, capital formation and exports). In addition, the use table displays the value added by industries.

This chapter links to *System of National Accounts 2008* (SNA 2008) chapters 14, 15 and 28.

4.1 Introduction

The previous chapter outlined the dimensions of Canada's system of macroeconomic accounts. Those basic dimensions included most importantly the institutional sectors, whose activities include the production and consumption of output, and the classification systems that organize and make sense of the millions of products and producers in the economy.

Before all else, the national accounts are about the production of output and its consumption. This chapter is about output and consumption—what the terms mean, what kinds of output are produced and consumed and what classes of firms produce what kinds of output. Output has value, volume and price dimensions. The chapter focuses on the first of these initially and the second and third will get attention later in the chapter.

The chapter begins with a review of some key concepts, the understanding of which is critical. It then turns to the goods and services account, reflecting the fundamental identity of the national accounts. The production account and the generation of income account, which are the first and second in the sequence of accounts (the rest of the sequence is discussed in chapters 5 and 6), are also presented. From there the chapter moves on to explain the supply and use tables, the former including both domestic output and imports and the latter including both intermediate consumption and final demand. The decomposition of these tables into volume and price components is explained. Then the discussion turns from the supply and use accounts themselves, which are produced with a lag of almost three years, to more timely estimates of real gross value added by industry that are based on statistics in the supply and use tables. The chapter ends with a discussion of how the supply and use accounts are employed to better understand the workings of the Canadian economy.

4.2 Key concepts related to supply and use accounts

This chapter is mostly about the goods and services account and the supply and use accounts. They will be explained shortly. First though, a number of key concepts are reviewed.

4.2.1 Output, intermediate consumption and related concepts

The first concept is **output**. In the previous chapter, the notion of the production boundary was introduced to circumscribe what is and is not considered to be output in the SNA. As will be explained more fully later in this chapter, the supply and use accounts provide a very detailed, multi-dimensional picture of the output of the Canadian economy.

The value of a firm's output is essentially its sales and service revenue, although there are some exceptional cases—notably wholesaling and retailing, financial intermediation services, insurance, government services and situations where inventory change adjusts sales to production. These will be discussed in section 4.4.1.

As a simple example of the output concept, consider a power utility that buys natural gas from another producer for $100,000, burns the natural gas in a generator to produce electricity, pays $50,000 in wages to employees and sells the electricity for $260,000. The output of the power utility is $260,000. It is the total value of goods and services produced during the accounting period. Table 4.1 summarizes this and the rest of the example that follows.[3]

Output is a gross concept and the term 'gross' essentially means 'before deductions'. In effect, output includes some double-counting. In the example just cited, as far as the power utility is concerned its electricity output value is $260,000 because that is what the utility sells its power for. Similarly, the natural gas producer sees its output as including the $100,000 worth of gas sold to the power utility. However, the $100,000 is implicitly part of the value of the power utility's output as well, since it is part of the cost of producing that power output.

The products that an industry uses to produce an output are referred to as **intermediate consumption**. These products may come from domestic production or imports. The difference between the value of output and intermediate consumption is a balancing item[4] called **gross value added** which is, in effect, the contribution of the producer to the value of output and to the economy.

In the power utility example, the intermediate consumption is the $100,000 spent by the utility to purchase natural gas from another producer. The remaining portion of output, equal to $160,000, is gross value added.

Gross value added is a very important concept in the national accounts. It is a measure of output with double-counting removed.

Gross value added is the part of output that is used to pay the suppliers of labour and capital services. In the SNA, wages, salaries and employers' social contributions are referred to as **compensation of employees**. The compensation of the suppliers of capital services is the residual portion of output, a balancing item, and is called **gross mixed income** or **gross operating surplus**. The latter term is used if the producer is incorporated, while the former term is used if the producer is unincorporated.[5] Keep in mind in this example, taxes and subsidies on products and production are ignored.

In the example, assuming the utility company is incorporated, compensation of employees is $50,000 and the remaining part of gross value added, $110,000, is gross operating surplus.

Text box 4.1
Primary input incomes or expenses

In the context of the supply and use accounts, gross value added by industry at basic prices consists of the incomes of four **primary input expense** categories. These are:

- Compensation of employees
- Gross operating surplus
- Gross mixed income
- Other taxes less subsidies on production and on imports

Gross operating surplus (or gross mixed income) can be further divided into two portions. One compensates for the depreciation of capital assets as a result of the passage of time and the wearing out of buildings, equipment and intellectual assets. This part is called **consumption of fixed capital**. The remaining portion, which is a balancing item, is called **net operating surplus**. The term ‘net’ essentially means ‘after deductions’. When consumption of fixed capital is deducted from gross value added, the result is another balancing item, **net value added**.

For the power utility, suppose the consumption of fixed capital is $70,000. Then, net operating surplus is $40,000. Net value added is $90,000 and is comprised of $50,000 in compensation of employees and $40,000 of net operating surplus.

Table 4.1
Power utility example

Concept	Value
	dollars
Output	260,000
Of which:	
Intermediate consumption	100,000
Gross value added	160,000
Gross value added	160,000
Of which:	
Compensation of employees	50,000
Gross operating surplus	110,000
Gross operating surplus	110,000
Of which:	
Consumption of fixed capital	70,000
Net operating surplus	40,000
Gross value added	160,000
Of which:	
Consumption of fixed capital	70,000
Net value added	90,000

Source: Statistics Canada.

4.2.2 Products, establishments and industries

Output spans a wide variety of **goods and services**, also referred to as **products**.[6] In the supply and use accounts, as will be discussed later in this chapter, output by class of product for Canada and the individual provinces and territories is articulated using the Supply and Use Product Classification, a special aggregation of the North American Product Classification with 470 product classes at the most detailed level.[7]

Output is produced under the responsibility and control of institutional units—chiefly non-financial and financial business enterprises but also governments, non-profit institutions serving households (NPISHs) and households themselves. One institutional unit—a large business enterprise, for example—might be engaged in many different production processes at the same time, possibly spread over more than one province and territory. For this reason, it is useful to break large institutional units down into smaller units, called **establishments**.[8] Output and intermediate consumption for a given province or territory can then be calculated by adding up the output and intermediate consumption of all the establishments within that geographical area. In addition, establishments can be classified according to their principal kind of production activity—these kinds of production activity are referred to as **industries**[9]—using the supply and use industry classification system. It is then possible to analyze production activity not just by geographical location (province or territory), but also by industry. Canada's supply and use accounts include estimates of output and intermediate consumption for 233 distinct industries, defined by the Supply and Use Industry Classification (a special aggregation of the North American Industry Classification System).[10]

Sometimes there is a one-to-one relationship between an industry and the product classes of output it produces. More commonly, an industry will produce more than one class of products (as mentioned, there are 470 product classes but only 233 industry classes in the supply and use accounts). Also, a single class of products can be produced by more than one industry, so the relationship between industries and product classes is, in general, "many to many".

4.2.3 Taxes and subsidies on products and imports and other taxes and subsidies on production

Viewed from the perspective of those who buy it, output ultimately serves two purposes. One is intermediate consumption, as already discussed. The other is to satisfy **final demand**, which is comprised of three essential components: final consumption expenditure by households, NPISHs and governments, gross capital formation and exports of goods and services. The valuation of output, intermediate consumption and final demand is affected by a variety of taxes and subsidies which are discussed below.

4.2.3.1 Taxes on products and imports and other taxes on production

The SNA distinguishes between, on the one hand, taxes on income and wealth and on the other hand, taxes on products and imports and other taxes on production. **Taxes on income and wealth** are paid by institutional units to governments as a result of their receiving income or possessing wealth. These taxes have the effect of transferring income or wealth from the institutional units that are paying the taxes—typically households and corporations—to the governments that collect them. The governments then use the funds to provide public services. Examples include the personal income tax and the corporate income tax. **Taxes on products and imports and other taxes on production** are also collected to pay for the provision of public services, but they are different in that their effect is to influence the valuation of output. Taxes on income and wealth will not be further discussed in this chapter, instead being a focus of attention in chapter 5. Taxes on products and imports and other taxes on production, however, are an important focal point in this chapter.

Taxes on products and imports are collected from producers[11] or importers as a percentage of the price of the product when traded, or as a specific dollar amount per physical unit of the product traded. Examples of taxes on products and imports include the goods and services tax and harmonized sales tax, the provincial sales taxes charged by some provinces, import duties, export taxes, amusement taxes, air transportation taxes, municipal sales taxes, various environmental levies that can be directly associated with a unit of output and specific taxes such as those on tobacco, alcohol and gasoline. Typically these taxes are collected on behalf of a government and remitted to the government by the producer when the product is sold. If no products are sold in a given accounting period, for example due to a temporary plant closure, no taxes accrue.

Other taxes on production are collected from producers in a way that is not directly linked to product sales. Examples include land or property taxes levied on business premises, taxes on other assets or on labour employed in production, licence fees to carry on a business or a profession and taxes on pollution emissions that cannot be directly associated with a unit of output. These are taxes that must be paid regardless of whether the business enterprise is profitable or not and regardless of the level of its sales. Since these taxes are not payable per unit of output, they cannot be deducted from the producer's price. They are recorded as payable out of the producer's gross value added in the generation of income account.[12]

In sum, taxes on products and imports are regarded as part of the product price, since they are tied directly to sales of the product. Other taxes on production are part of production cost and as such they may influence the product price, but are not directly linked to it.

4.2.3.2 Subsidies on products and other subsidies on production

Subsidies are also important in the valuation of output. These payments are made by governments to enterprises based on their production activities or the quantities or values of the products they produce, sell, buy as inputs or import (see *SNA 2008*, page 148).[13] In other words, subsidies may be paid to businesses either with respect to their output or with respect to their intermediate consumption. The intent is generally to influence the effective price of the product, or the quantity produced, or the mix of factors of production, or the pollution externalities of production or the remuneration of the institutional units involved in production.

As with taxes, there are both **subsidies on products**, paid by the government to the producer based on the level of sales or output, and **other subsidies on production**, paid without regard to sales or output. Similar but opposite to taxes on products, subsidies on products are paid to the producer based on how much product is sold.[14] Other subsidies on production serve to compensate for some production costs, but have no direct or easily measured effect on any particular product's price. They might, for example, be subsidies on payroll or subsidies to reduce pollution.

4.2.4 Basic prices and purchasers' prices

SNA 2008 recommends that output be valued at **basic prices**. This means it is valued at the amount actually received by the producer from the purchaser for each unit of the good or service produced as output, before any taxes levied on products have been added and before any subsidies received on products have been subtracted. It also excludes any transportation or other margins that are invoiced separately by the producer. Basic prices are sometimes referred to as **factory gate prices**.[15, 16]

The SNA 2008 standard also recommends that intermediate consumption and final demand be measured at **purchasers' prices**, which are the actual costs incurred by users of the product. Purchasers' prices are measured after any taxes paid on products have been added[17] and after any subsidies on products have been deducted. They include any transportation or other margins paid separately by the purchaser to take delivery of the product.

Text box 4.2
Basic prices versus purchasers' prices

(see *SNA 2008*, p. 276)

Basic prices

minus subsidies on products resulting from production

plus taxes on products resulting from production excluding invoiced GST

plus non-deductible GST

plus transportation charges invoiced separately (transport margins)

plus wholesale and retail distribution margins (trade margins)

equals purchasers' prices

Many factors can make the effective price of a product received by its producer different from the effective price paid by a purchaser to obtain it. Taxes at different stages along the distribution chain may serve to raise the price while subsidies have the effect of lowering it. Wholesalers and retailers will add their margins. Transportation and storage costs may be incurred, influencing the effective purchase price. Accordingly, the difference between the basic price valuation for the producer and the purchasers' price valuation can be quite substantial.

Text box 4.3
An example of basic prices and purchasers' prices: Household final consumption of passenger cars (millions of dollars in 2009)

Household final consumption of passenger cars at basic prices	**12,107**
Minus: subsidies on products	0
Plus: Gas margins	0
Plus: Wholesale margins	950
Plus: Retail margins	2,490
Plus: Gas pipeline margins	0
Plus: Oil pipeline margins	0
Plus: Storage margins	0
Plus: Transport margins	123
Plus: Tax margins	1,908
Equals: Household final consumption of passenger cars at purchasers' prices	**17,578**

Canada's system of macroeconomic accounts includes estimates of output, by product class by industry, at basic prices only. However, the estimates of inputs, by product class by industry, and final demands, by product class by final demand category, are available both at basic prices and at purchasers' prices. A full breakdown of the various margins, as illustrated in Text box 4.3, is available to reconcile the estimates at basic prices with those at purchasers' prices.

4.2.5 Example with taxes and subsidies

In section 4.2.1 some of the basic concepts that are central to the supply and use accounts are explained with the aid of a simple power utility example. In that example, there are no taxes or subsidies on products and no other taxes or subsidies on production. In this section that example is expanded to include taxes and subsidies on products and on production.

The expanded example is set out in Table 4.2. The power utility produces and sells 2,600,000 kilowatt hours (kWh) of electricity at a price to the purchaser ('purchaser price') of $0.10 per kWh. Within this price is a federal government tax of $0.02 per kWh and a provincial government subsidy of $0.01 per kWh. Netting out this tax and subsidy from the purchaser price, the basic price is $0.09 per kWh. In addition, the power utility faces a local government tax on production of $10,000 and a provincial government subsidy of $5,000.

Table 4.2
Power utility example with taxes and subsidies

Concept	Quantity	Price	Value
	kilowatt-hours	dollars per kilowatt-hour	dollars
Purchaser price	...	0.10	...
Output in kwh	2,600,000	...	...
Output value at purchaser price	...	...	260,000
Purchaser price includes federal tax of	...	0.02	...
Purchaser price includes provincial subsidy of	...	0.01	...
Basic price	...	0.09	...
Local tax on production	...	...	10,000
Provincial subsidy on production	...	...	5,000
Output at basic price	...	...	234,000
Of which:			
Intermediate consumption at purchasers'prices	...	...	100,000
Gross value added at basic price	...	...	134,000
Gross value added at basic price	...	...	134 000
Of which:			
Compensation of employees	...	...	50,000
Other taxes on production (local tax on production)	...	...	10,000
Less: Provincial other subsidy on production	...	...	-5,000
Gross operating surplus at basic price	...	...	79,000
Gross operating surplus at basic price	...	...	79,000
Of which:			
Consumption of fixed capital	...	...	70,000
Net operating surplus at basic price	...	...	9,000
Gross value added at basic price	...	...	134,000
Of which:			
Consumption of fixed capital	...	...	70,000
Net value added at basic price	...	...	64,000

... not applicable
Source: Statistics Canada.

In this expanded example, output and gross value added are measured explicitly at basic price, which is the convention adopted in the supply and use accounts. Gross operating surplus differs from the previous example partly because gross value added is measured at basic price, but also because the local government tax on production and the provincial government subsidy on production are additional claims against gross value added. Note that net operating surplus and net value added are also measured at basic price.

4.2.6 Valuation of exports and imports

When goods are exported from one country to another, a question arises as to how the costs of Customs clearance, shipping and insurance are borne. Typically they are paid in part by the exporter and in part by the importer.

In the supply and use accounts, the value of exported goods is measured **free on board** (FOB) port of exit,[18] including all domestic freight and other costs incurred up until the moment the goods are placed on board an international carrier for export. FOB values exclude international insurance and transport costs.

For example, a Canadian exporter in Montreal might sell goods to an importer in London. If the price charged by the exporter covered all transportation and other costs up to the point where the goods left Montreal by ship or by air, the price would be described as FOB Montreal. The valuation of exports as FOB port of exit from Canada is comparable to the valuation of other final expenditures at purchasers' prices.

In the supply and use accounts, imports are valued CIF, at the Canadian border. The import valuation includes costs of freight and insurance in bringing the goods to Canada from the point of direct shipment. *SNA 2008* interprets this approach as equivalent to valuing imports at domestic basic prices.[19] In this respect, the supply and use accounts value imports differently from the Balance of International Payments (see chapter 8), which value them FOB the border of the country of direct shipment to Canada and include freight and insurance as part of imports of services.

4.3 Three accounts derivable from the supply and use accounts

4.3.1 Goods and services account

There is a fundamental identity in the national accounts stating that for a given accounting period, the total value of all goods and services **supplied** in the economy, at purchasers' prices, must be equal to the total purchasers' value of all goods and services **used**. The **total supplied** is equal to the economy's output, plus imports, plus taxes less subsidies on products. The **total used** is intermediate consumption, plus final consumption (represented by household, NPISH and government expenditures), plus capital formation, plus exports.

(4.1)

Total goods and services supplied (at purchasers' prices) = Total goods and services used (at purchasers' prices)

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

The identity holds true whether output is regarded as a single aggregate class encompassing all goods and services available in the economy, or as a multitude of different product classes reflecting the diversity of output in the real world. In the latter case separate fundamental identities can be formulated for each individual product class.

The most important element of total supply is without a doubt the economy's output of goods and services. It is the result of the activities of producers throughout the economy and will be a primary focus of attention in the rest of this chapter. It is measured at **basic prices**, which is to say at prices charged by producers before any taxes have been levied on products and including any applicable subsidies. Imported products, the second component of total supply, reflect the fact that a substantial portion of supplied goods and services come from other countries. They are measured CIF, at the Canadian border which is equivalent to basic prices. Finally, taxes on goods and services are a part of total supply because these elements, which are layered on top of the value of output and imports at basic prices, are reflected in the prices that purchasers pay for the goods and services supplied.[20]

The economy's total use of goods and services begins with intermediate consumption, representing the utilization of some of the goods and services supplied as inputs to the production of other goods and services in the current accounting period. Three other elements account for the remaining usage of total supply. One is final purchases of goods and services by household, NPISH and government institutional units for consumption. This element represents the ultimate purpose of economic activity. The second is capital formation, representing the use of some of the supplied goods and services to add to the economy's capital stock (including inventories), thereby increasing potential supply in future accounting periods. The final use element is exports of goods and services to other countries.

The 'supply = use' equation just described can also be reshuffled in the following form (including in parentheses the corresponding symbols often used in macroeconomics textbooks):

(4.2)

Output (Y) – intermediate consumption (IC) + taxes less subsidies on products (T) =

Final consumption (C + G) + fixed capital formation (I) + inventory change (ΔV) + exports (X) – imports (M)

This rearranged version of the fundamental identity states that gross value added plus taxes on products is equal to final domestic demand[21] plus inventory change plus exports less imports. The equation provides the basis for two of the three ways of arriving at **gross domestic product at market prices**, the best known aggregate of the national accounts. The left hand side of the identity shows the production approach to calculating gross domestic product (GDP) by adding up the output of all producers in the economy exclusive of double-counting—while the right hand side shows the final expenditure approach—adding up all of the final expenditures on goods and services within the economy and deducting imports.[22]

The fundamental relationship as presented in equation (4.1) constitutes what is known in SNA 2008 as the **goods and services account**. The account can also be portrayed in the form of a T-account, as in Table 4.3 below.

Table 4.3 Goods and services account, at 2009 purchasers' prices

Uses	millions of dollars	Resources	millions of dollars
Intermediate consumption	1,431,863	Output	2,887,918
Final consumption	1,248,239	Imports of goods and services	468,702
Gross capital formation	341,778	Taxes less subsidies on products	110,952
Exports of goods and services	445,692		
Total uses	3,467,572	Total resources	3,467,572

Source: Statistics Canada.

Text box 4.4
'Resources' and 'uses' in a T-account

(SNA 2008, p. 20)

"The SNA utilizes the term **resources** for transactions which add to the amount of economic value of a unit or a sector. For example, wages and salaries are a resource for the unit or sector receiving them. Resources are by convention shown on the right-hand side of the current accounts. The left-hand side of the accounts, which includes transactions that reduce the amount of economic value of a unit or sector, is termed **uses**. To continue the example, wages and salaries are a use for the unit or sector that must pay them."

Table 4.3 shows that total Canadian output, in 2009, was $2,887,918 million. To the total output of goods and services was added $468,702 million of imports. Both these figures are measured at basic prices, which mean they exclude taxes less subsidies on products. To calculate total resources (supply) at purchasers' prices, which is $3,467,572 million, taxes less subsidies on products of $110,952 million are added.

One the 'uses' side of Table 4.3, intermediate consumption is $1,431,863 million. This is the value of goods and services, at purchasers' prices, that is used by producers in creating their output. Final consumption is $1,248,239 million, representing expenditures by households, NPISH and governments on goods and services. Gross capital formation is $341,778 million, which is total investment outlays for new construction, machinery and equipment, intellectual property and changes in inventories. Finally, exports are $445,692 million. The sum of all these items, each measured at purchasers' prices, is the total use (sometimes referred to as 'absorption') of goods and services, $3,467,572 million.

While the discussion thus far has been about **total** supply and use, it is important to recognize that the fundamental national accounts identity also holds true individually for every class of products available in the economy. Thus, for example, if one considers a product class such as 'motor vehicles' it must be true, within any given accounting period, that total supply of that product class—output plus imports—is equal to total use of that product class—intermediate consumption plus final consumption plus gross capital formation plus exports. Canada's supply and use accounts make powerful and extensive use of "supply = use by product class" identity to validate the accuracy of the myriad kinds of source data that are used to compile the accounts.

Before leaving this topic, here is a notable quotation from SNA 2008 on the subject:[23]

> "The goods and services account is one of the most basic, if not the most basic, identity in the SNA. It captures the idea that all output from within the production boundary, plus imports, must be accounted for in one of the other two basic activities of the SNA, consumption of goods and services or accumulation of goods and services. Without the goods and services account, a supply and use table would not be fully articulated and exhaust all products available within the economy. The whole sequence of accounts can be viewed as built around the goods and services account by adding transactions relating to the generation, distribution and redistribution of income and saving. When these transactions are aggregated across all sectors and the rest of the world, total resources are equal to total uses. If these were to be 'consolidated' out of the sequence of accounts, only the goods and services account would be left."

The 'sequence of accounts' referred to in this quotation is central to SNA 2008. It begins with the **production account** and the **generation of income account**, which are explained in the immediately following sections, and then continues with 12 additional accounts. The 14 sequential accounts can be presented separately for each of the institutional sectors as well as, in the case of the first two accounts only, for each industry. The sequence of accounts is explained in chapters 3, 5 and 6.

4.3.2 Production account

The production account is the first in the sequence of accounts. Table 4.4 shows the production account for the Canadian economy as a whole for the year 2009. Similar accounts could be displayed for the production accounts of each of the institutional sectors (households, NPISH, financial and non-financial corporations and governments) individually.[24] The account shows output (the result of production) as a 'resource' on the right-hand side and intermediate consumption (the using up of goods and services during production) as a 'use' on the left-hand side. Gross value added is the account's balancing item and is another 'use'.

Table 4.4 Production account, at 2009 basic prices

Uses	millions of dollars	Resources	millions of dollars
		Output	2,887,918
Intermediate consumption	1,407,936		
Gross value added	1,479,982		
Minus: Consumption of fixed capital	274,639		
Equals: Net value added	1,205,343		

Source: Statistics Canada.

Intermediate consumption does not include consumption of fixed capital, which is more difficult to measure than many other variables in the SNA largely since it is not associated with any market transactions. However, given an estimate of consumption of fixed capital, it can be deducted from gross value added to obtain net value added.

Note the similarity between the production account for the economy as a whole and the accounting data for the power utility example in the first panel of Table 4.1. The supply and use statistics for Canada, discussed in section 4.4, are estimated by collecting this kind of accounting data from statistical samples of Canadian establishments.

4.3.3 Generation of income account

The generation of income account is the second in the sequence of accounts. Table 4.5 shows the account for the Canadian economy for the year 2009. As with the production account, generation of income accounts can also be displayed for each of the institutional sectors individually. The account shows gross value added, the balancing item from the production account, as the sole 'resource' on the right-hand side and compensation of employees and other taxes less subsidies on production and imports as 'uses' on the left-hand side. Gross operating surplus plus gross mixed income is the account's balancing item and final 'use'.

Table 4.5 Generation of income account, at 2009 basic prices

Uses	millions of dollars	Resources	millions of dollars
		Gross value added	1,479,982
Compensation of employees	812,983		
Other taxes less subsidies on production and imports	76,398		
Gross operating surplus plus gross mixed income	590,601		

Source: Statistics Canada.

Again, note the similarity between the generation of income account for the economy as a whole and the accounting data for the power utility example in Tables 4.1 and 4.2.

4.4 Canada's supply and use accounts

The CSMA basically compiles two kinds of tables: Supply (output) tables and use (disposition) tables. As noted, the supply and use tables can be used as a tool to check the consistency of statistics on the flow of goods and services, focussing on the principle that total supply of any product is equal to total use of that product.

In Canada, the use table embeds imports as a negative final demand category. Consequently, the supply table includes only domestic production of classes of products at basic prices plus all margins to transform domestic production to purchasers' prices.[25] An illustrative example of a small supply table with hypothetical numbers and imports shown as a negative use is shown in Annex 4.1.

Canadian users are presented on the Statistics Canada web site with a set of three large tables that fit together nicely to produce one even larger table.[26] One of these tables, called the output table at basic prices, shows the output of each industry in the columns, broken down by the classes of products produced in the rows. The second table, called the inputs table at basic prices, shows the intermediate consumption of each industry in the columns, broken down in the rows by the same classes of products that are displayed in the output table. Appended to the bottom of the inputs table are the primary input expenses of each industry. Finally the third table at basic prices, called the final demand table, shows the use of output by final demand categories in the columns, broken down in the rows by the same classes of products that are displayed in the output and inputs tables. When the three tables are lined up one after the other—which can be done because the product class row headings are the same for all three tables—the larger table thereby constructed is referred to as the supply and use table.

A key feature of the supply and use accounts is that when they are compiled the estimates must satisfy two important identities. One of these, the **industry balance identity**, states that the value of total industry output must be equal to intermediate consumption plus value added by that industry. This must be true for each industry individually as well as for the economy as a whole. The other, **the product balance identity**, states that for the total economy (as discussed in section 4.3.1) output plus imports plus taxes less subsidies on products is equal to intermediate consumption plus final demand. For individual classes of products after adding transportation, trade and tax margins to the value of output, the supply of each product class must be equal to the use of, or demand for, each product class. See an example of use tables (following the hypothetical supply table example mentioned above) at basic prices in Annex 4.1.

The supply and use tables compiled in Statistics Canada are said to be **rectangular** because the number of product rows (470 product classes) is different from the number of industry columns (233 industries). For some analytical purposes it is desirable that the tables be square, with equal numbers of rows and columns. **Symmetric** tables can

be produced either product-by-product or industry-by-industry by making certain assumptions about secondary products produced by industries.

The next three sections discuss the three components of Canada's supply and use accounts in detail and provide examples of the rows and columns in these tables. In addition, Annex 4.1 provides a miniature example of supply and use tables to better illustrate the interrelationships within the tables. Supply and use accounts have been produced at the national level for more than a half century and are available from 1961 to date. The tables from 1997 onward are based on SNA 2008, while those for prior years are consistent with SNA 1993. Distinct sub-national supply and use accounts, aggregating to the national supply and use accounts, have been produced for each of the provinces and territories for every year since 1997. The latter tables also include estimates of inter-provincial trade flows by product class.

4.4.1 Measuring output

4.4.1.1 The meaning of output

SNA 2008 describes the term 'output' in the following way:

"Output is defined as the goods and services produced by an establishment,

a. excluding the value of any goods and services used in an activity for which the establishment does not assume the risk of using the products in production; and
b. excluding the value of goods and services consumed by the same establishment except for goods and services used for capital formation (fixed capital or changes in inventories) or own final consumption." (page 106)

The point of the first exclusion is that if the establishment assumes no risk of using the products in production then it is effectively producing a service rather than a good and the materials to which the service are being applied should not be included as part of its output. For example, if a transportation establishment moves goods from point A to point B, the value of the goods transported are not considered to be part of that establishment's output. The second exclusion applies when an establishment is producing goods and services that are used as its own intermediate consumption. If this exclusion did not apply, the output of an establishment could become ridiculously large as each stage in the production process would be counted multiple times. For example, if the production of widgets involved three steps in which widgets were produced in a mold, then painted and then packaged, all within the same establishment, the value of output would be the value of the molded, painted and packaged widgets, not the value of the molded widgets plus the value of the molded and painted widgets plus the value of the molded, painted and packaged widgets. Note there is some dependency here on how detailed the industrial classification is and on how individual enterprises organize themselves.

Output is produced by institutional units. All of the main types of institutional units produce some Canadian output, with the exception of non-residents[27] which by definition do not produce Canadian output.[28] Most of Canada's output is produced by corporations, although governments also produce a substantial amount. Aside from imputed rents on owner-occupied dwellings,[29] households and non-profit organizations serving households produce only small amounts of output in comparison with corporations and governments. SNA 2008 recommends a cross classification of output by industry and institutional sectors, although this is not available for Canada at time of writing.

Output for a particular reference period is normally equal to sales plus the change in inventories during that period. Work in progress but not completed during that period is included as well as net additions of finished goods to inventory. Also included in output is the own account production of businesses for capital formation purposes. Agricultural production by farmers for own final consumption and imputed rents on owner-occupied dwellings are also considered part of total output, although there are no corresponding 'sales' transactions.

4.4.1.2 Special case no.1: Wholesale and retail trade

Wholesalers and retailers (distributors) purchase goods from suppliers and resell them to purchasers. They are considered to be providing a service to those purchasers by making the goods conveniently available to be bought. The output of wholesalers and retailers is considered to be the trade margins realized on the goods they buy for resale. These margins are defined as follows (*SNA 2008*, page 113):

> "A trade margin is defined as the difference between the actual or imputed price realized on a good purchased for resale and the price that would have to be paid by the distributor to replace the good at the time it is sold or otherwise disposed of."

The value of output produced by wholesalers and retailers is defined as:

> Value of output = value of sales + value of goods purchased for resale and used for intermediate consumption, compensation of employees (as remuneration in kind) or other such purposes—the value of goods purchased for resale + the value of net change to inventories of goods for resale—the value of recurrent losses due to normal wastage, theft and accidental damage.

Note that transport charges related to the goods purchased for resale, if invoiced separately, are treated as intermediate consumption by the wholesalers or retailers.

4.4.1.3 Special case no.2: Financial services

Some financial services are priced in the normal way and the output by producers of these services is simply the sales revenues generated. For example, if a bank charges a rental fee of $100 per year for the use of a safety deposit box, the output of that service would be the total revenue received by the bank from such charges.

Banks also provide financial intermediation services. Some customers have funds they wish to invest and the bank accepts these funds as deposits, paying interest at a specified rate. Other customers wish to borrow funds and the bank makes loans to them, charging another, higher, rate of interest. In effect, the bank is intermediating between the depositors and the borrowers. The latter two players, of course, have the option of arranging things directly between themselves. If they did so, the lender (that is, the customer who would otherwise be the depositor) could bargain for a higher interest rate than the bank is offering. Likewise the borrower could bargain to pay a lower interest rate for the loan than the bank is charging. The two could settle on an interest rate lying somewhere between the rate paid by the bank to the depositor and the higher rate charged to the borrower. However, there are costs involved in making such bilateral arrangements and as a result many transactors prefer to deal through a financial intermediary.

Financial intermediation services of this kind are provided without explicit charge. The net revenues of the bank are the interest it receives on loans minus the interest it pays on deposits. Some of these revenues represent an implicit service charge to depositors and the remainder are, in effect, a service charge to borrowers. These revenues are a financial services output referred to as financial intermediation services indirectly measured (FISIM).

The division of total FISIM between services to depositors and services to borrowers requires knowledge of the in-between rate of interest that lenders and borrowers would settle on in the absence of financial intermediation. This is referred to as the **reference rate** and it should contain no service element while properly reflecting the risk and maturity characteristics of the loan. Interest charges calculated using the reference rate are referred to as **SNA interest** while interest charges calculated with the bank's actual rates are referred to as **bank interest**.

One other category of financial services involves the purchase and sale of bonds, equities or currencies as a 'market maker'. The markets for financial assets of these kinds typically operate with the market maker offering assets for sale at an 'ask' price and offering to buy assets at a 'bid' price. The 'ask' and 'bid' prices are moved up or down in response to excess demand or supply. To calculate the output of the market maker, a 'mid' price is calculated as the average of the 'ask' and 'bid' prices. When assets are sold by the market maker at the 'ask' price, the output is the resulting revenues minus the revenues that would have resulted if the assets were sold at the 'mid' price. Similarly, when assets are bought by the market maker at the 'bid' price, the resulting revenues are calculated as the revenues it would earn by reselling at the 'mid' price minus the amount paid for the assets at the 'bid' price. For this category, the total financial services margins are considered to be the output.

4.4.1.4 Special case no. 3: Non-market goods and services

Non-market output is produced by government and NPISH institutional units and supplied free, or at prices that are not economically significant, to other institutional units (such as households) or to the community as a whole. Examples include defence and law enforcement services, public education, public health care and many services and some goods provided by charitable organizations. Clearly the value of such output cannot be valued by sales so instead, by convention, it is valued at production cost. These costs include intermediate consumption, compensation of employees, consumption of fixed capital and taxes less subsidies on production other than taxes or subsidies on

products. No imputed net return to capital is included in the value of non-market production. Similarly, production for own final use by non-market producers is also valued at cost.

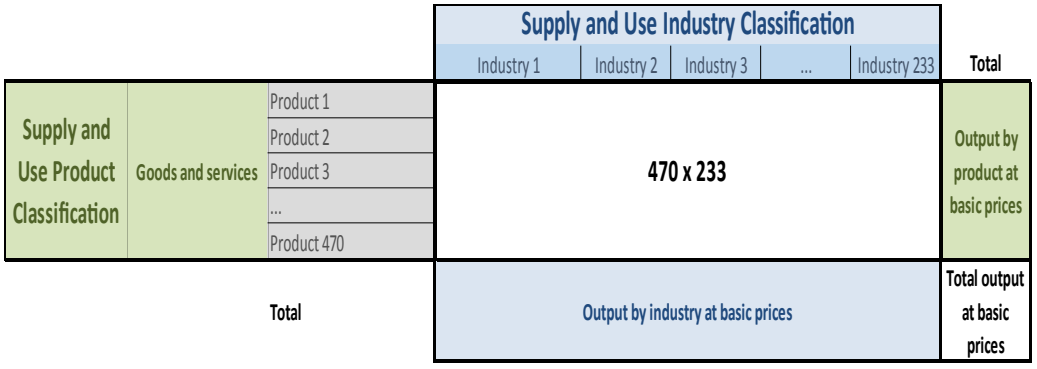
4.4.1.5 Structure of the supply or output table

The supply table includes estimates of the value of output during the reference year, broken down by product class (in the rows of the supply table) and by industry (in the columns). The estimates are obtained largely from surveys in which establishments are asked, in most cases, for the value of sales and inventory change, at basic prices, by type of product produced.

Figure 4.1 provides a schematic for the supply table. As can be seen, the full table is large with 470 rows and 233 columns. Since it is produced for each province and territory as well as for Canada as a whole, the supply table includes approximately 1.5 million cells (470 by 233 by 14)[30], many of which are zero. It is possible to work with smaller versions of the table in which rows and/or columns are aggregated into a reduced number of more aggregate classes.

The rows of the table show output for each of the 470 product classes, broken down by the industries that produce them. Products are classified according to the Supply and Use Product Classification (SUPC) which is a special aggregation of the North American Product Classification (NAPCS) highlighting the product classes important to the supply and use accounts. Any particular class of products might be produced by one, two or more industries. The total output of each product class appears in the last column of the table.

Figure 4.1
Supply table schematic



Source: Statistics Canada.

The columns show output from the entire economy, classified into the 233 industry classes that produce it, using the Supply and Use Industry Classification (SUIC) which is a special aggregation of the North American Industry Classification System (NAICS). Each column shows the values of the output of the different classes of products for a particular industry. As noted earlier, a typical industry might produce several different classes of products. At the bottom of each column is the total output for that particular industry. The grand total over all industry classes, or equivalently over all product classes, is total output for the economy as a whole.

When working with the most detailed version of the supply table, users will find that the reported row and column totals are sometimes greater than the actual row and column totals. This is attributable to data suppressions due to confidentiality restrictions. Sometimes a small number of producing establishments in a particular industry are dominant in the production of a particular commodity class. If the actual output number for such a cell was published, it might be possible to infer, either exactly or to a close approximation, the production of particular establishments. Statistics Canada is prohibited under the Statistics Act from releasing information about particular businesses. To deal with such cases, confidential data are suppressed by replacing the correct number with a zero.

To illustrate the contents of the supply table, a single row and column will be examined for reference year 2009. The row selected for this purpose is for the product class “vehicle seats and seat parts; interior trim for motor vehicles”. The chosen column is for the “motor vehicle seating and interior trim manufacturing” industry.

The total output of "vehicle seats and seat parts; interior trim for motor vehicles" in 2009 was $3,317 million. This is shown in the supply table for product class MPG336360. Of this amount, $2,699 million was attributable to the motor vehicle seating and interior trim manufacturing industry and $260 million to the rubber products manufacturing industry. The remainder, $358 million, is not shown as being attributed to any industry because this amount corresponds to one or more cells that have been suppressed due to confidentiality restrictions.

The motor vehicle seating and interior trim manufacturing industry is shown in the supply table with industry code BS336360. The output of establishments in this industry in 2009 was $2,888 million. Of this amount, the majority, $2,699 million or 93%, consisted of output of "vehicle seats and seat parts, plus interior trim for motor vehicles" as discussed in the previous paragraph. The other non-zero components of the industry's output are shown in Table 4.6.

Table 4.6
Outputs of the motor vehicle seating and interior trim manufacturing industry, 2009

Supply and use product classes	Output value
	millions of dollars
Vehicle seats and seat parts; interior trim for motor vehicles	2,699
Head office services (imputed)	63
Own-account research and development (except software development)	19
Custom work, other manufacturing production services	17
Own-account software design and development services	3
Other industry-specific machinery	1
Rooming and boarding services	1
Other products, unspecified due to confidentiality restrictions	85
Total output	2,888

Source: Statistics Canada.

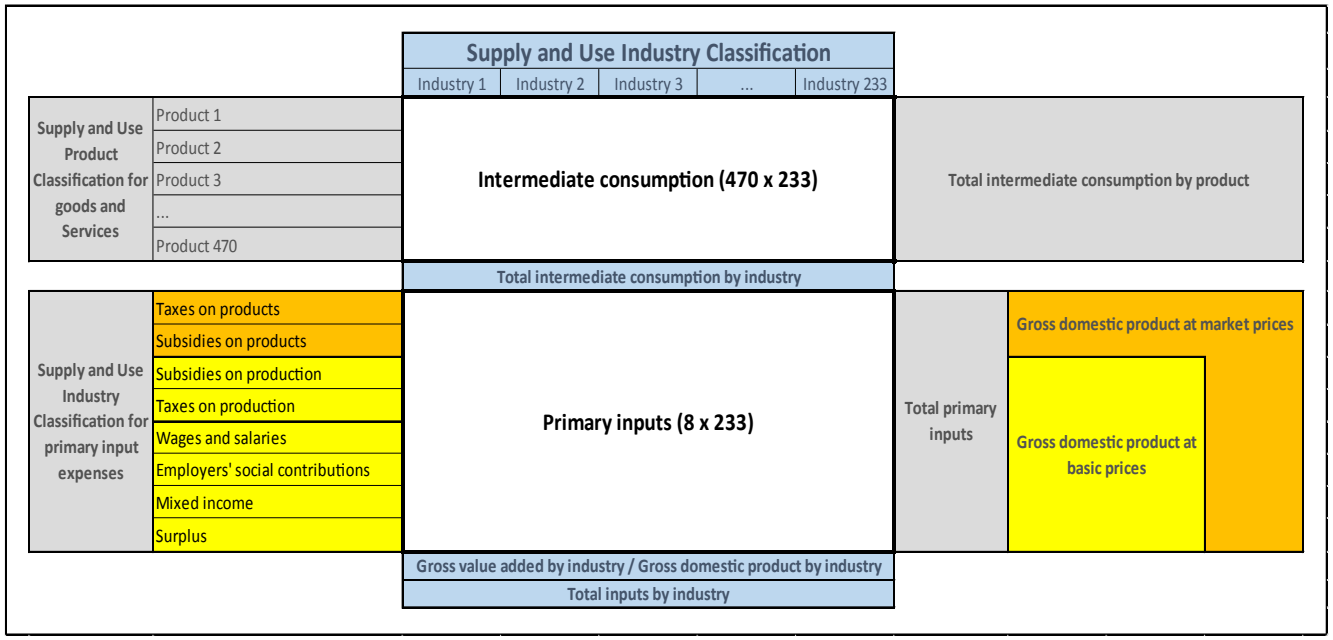
4.4.2 Measuring intermediate consumption and gross value added

As seen previously, businesses have two kinds of inputs to their production processes. One is intermediate consumption, consisting of the use of products purchased from other producers. The other is gross value added, consisting of the primary input expenses employee compensation, gross mixed income (for unincorporated businesses), gross operating surplus (for incorporated businesses) and other taxes and subsidies on production. The last of these components is also considered to be part of primary input expenses in this context because taxes and subsidies on production are part of the value of output at basic prices. When output is measured at market prices, taxes less subsidies on products are also included, but it is not possible to calculate industry gross value added at market prices since the taxes on products paid by final consumers cannot be allocated back to industries.

The intermediate consumption part of the use table, depicted in Figure 4.2, shows for each industry (in the columns) what product inputs are used to produce output (in the rows). Intermediate consumption is broken down into the same 470 product classes that are presented in the output table. Thereafter the primary inputs are shown. Total inputs for each industry, which is equal to the sum of intermediate consumption and primary input expenses, is displayed in the last row of the table. The total of all inputs in each industry is identical to the total output for that industry in the supply table, discussed in the previous section.

Since the use table, like the supply table, is produced for each province and territory as well as for Canada as a whole, the use table also includes approximately 1.5 million cells (478 by 233 by 14), many of which are zero. It is possible to work with smaller versions of the table in which rows and/or columns are aggregated into a reduced number of larger classes.

Figure 4.2
Intermediate consumption part of the use table schematic



Source: Statistics Canada.

The use table (intermediate and final demand) can also be used to calculate gross value added, or gross domestic product, by industry, since this is the sum of the primary input expense categories. In fact, as shown in Figure 4.2, the table allows total GDP to be calculated with the two alternative valuations: GDP at basic prices, being the sum of the primary inputs but excluding taxes less subsidies on products; and GDP at market prices, being GDP at basic prices plus taxes less subsidies on products. As noted earlier, GDP at market prices cannot be broken down by industry because it is not possible to allocate taxes less subsidies on products back to industries.

As an example, consider again the "vehicle seats and seat parts; interior trim for motor vehicles" product class, shown in the use table. The line in the input table for this product class shows these products are used by the industries shown in Table 4.7. Total intermediate consumption of this product class is $3,920 million.

Table 4.7
Intermediate consumption of the "vehicle seats and seat parts; interior trim for motor vehicles" product class by industry, 2009

Supply and use industries	Intermediate consumption value
	millions of dollars
Automobile and light-duty motor vehicle manufacturing	2,317
Motor vehicle seating and trim manufacturing	921
Repair and maintenance	556
Motor vehicle body and trailer manufacturing	29
Truck transportation	25
Travel, meetings and conventions	15
Non-conventional oil extraction	6
Urban transit systems	5
Agricultural, construction and mining machinery manufacturing	3
Conventional oil and gas extraction	2
Other transit and ground passenger transportation and scenic and sightseeing transportation	1
Support activities for forestry	1
Other industries, unspecified due to confidentiality restrictions	39
Total intermediate consumption	3,920

Source: Statistics Canada.

Not surprisingly, most of the output of this product (59%) is used in the automobile and light-duty motor vehicle manufacturing industry. An additional 23% of the output of this product is used by the motor vehicle seating and trim manufacturing industry. The repair and maintenance industry accounts for most of the remainder of the output of vehicle seats and seat parts, plus interior trim for motor vehicles.

The industry "motor vehicle seating and interior trim manufacturing" is also shown in the use table. For this industry, the intermediate and primary inputs are shown in Table 4.8. This table, in effect, shows a snapshot view of the production function for this industry—the intermediate consumption and primary input expenses that were used by the industry to produce its output in 2009 and the relative importance of each in dollar terms.

Vehicle seats and seats parts, plus interior trim for motor vehicles constituted 32% of total inputs to the motor vehicle seating and interior trim manufacturing industry in that year. A wide range of other purchased inputs also contributed, each less substantially, to the industry's output. Wages, salaries and employers' social contributions accounted for 24% of the inputs to the industry, while gross operating surplus was equivalent to just 2% of total output. Accordingly, the industry's gross value added at basic prices was 26% of its total output.

Note how in this table taxes and subsidies on production are isolated and shown in the gross value added segment of the table. Likewise, trade and transport margins are isolated from within intermediate consumption and shown in separate rows.

Table 4.8
Inputs to the motor vehicle seating and interior trim manufacturing industry, at basic prices, 2009

Input product class	Value
	millions of dollars
Goods	
Vehicle seats and seat parts, interior trim for motor vehicles	921
Motor vehicle plastic parts	106
Threaded metal fasteners and other turned metal products	91
Hardware	88
Other textile products	37
Rolled and drawn steel products including wire	24
Iron and steel basic shapes and ferro-alloy products	21
Electricity	14
Motor vehicle metal stamping	12
Natural gas	4
Paperboard containers	4
Commercial and industrial machinery and equipment	4
Office supplies	3
Wood containers and pallets	1
Operating supplies	1
Services	
Wholesale margins	161
Rights to non-financial intangible assets	82
Head office services – imputed	36
Transportation margins	35
Repair and maintence	33
Holding company serv. and other financial investment and rel. services	31
Freight transportation arrangement and customs brokering services	22
Deposit intermediation services indirectly measured	16
Holding company services – imputed	13
Security brokerage and securities dealing services	9
Architectural, engineering and related services	7
Facilities and other support services	7
Rental of non-residential real estate	6
Business support services	6
Office administrative services	5
Employment services	5
Travel, meetings and conventions	5
Coating, engraving, heat treating and similar metal processing services	4
Computer systems design and related services	4
Wired telephone services	4
Repair construction services	3

Table 4.8
Inputs to the motor vehicle seating and interior trim manufacturing industry, at basic prices, 2009

Input product class	Value
	millions of dollars
Custom work, other manufacturing production services	3
Motor vehicle rental and leasing services	3
Investment banking services	3
Banking and other depository credit intermed. serv. – explicit charges	2
Non-depository credit intermediation services – explicit charges	2
Other loan intermediation services indirectly measured	2
Legal services	2
Management, scientific and technical consulting services	2
Other professional, scientific and technical services	1
Natural gas distribution	1
Wholesale trade commissions	1
Rail freight transportation services	1
General freight truck transportation services	1
Specialized freight truck transportation services	1
Transportation of natural gas by pipeline	1
Postal, courier, parcels and messenger delivery services	1
Data processing, hosting and related services	1
Portfolio management services	1
Property insurance services	1
Liability and other property and casualty insurance services	1
Accounting and related services	1
Sales of other government services	1
Gross value added = Primary input expenses	
Wages and salaries	472
Employers' social contributions	220
Gross mixed income	0
Gross operating surplus	59
Taxes on production	10
Less: Subsidies on production	0
Totals	
Total inputs = output	2,886
Total intermediate consumption	2,125
Gross value added, at basic prices	761

Source: Statistics Canada.

Together the supply and use tables show, by product class, both the outputs and the full set of inputs of all industries in the Canadian economy. The picture of the economy they portray is detailed and comprehensive, revealing which industries are the largest and which are relatively small, as well as the combination of inputs that each industry requires. This articulation of the complete structure of the economy is extremely useful for a wide range of policy and other analytical purposes.

4.4.3 Measuring final demand within the use table

As has been seen, the supply table presents the **goods and services produced**, by product class at basic prices, by each industry in the economy. The use table, using the same breakdown of product classes and industries, shows the **usage** of each class of products for intermediate consumption by each industry, along with the usage of primary inputs. But what about the other uses of output beyond intermediate consumption? This is where the third table comes into play, the **final demand** table.

Figure 4.3 provides a schematic for this table. Its rows are the same as those in the use table, showing the 470 product classes and the eight primary input categories. However, while the columns of the supply and use tables were the industry classes, showing the value of output produced and used as inputs by establishments at basic prices, the columns of the final demand table show the components of final expenditure by institutional sector at purchasers' prices. These components are as follows:

Final consumption expenditure

- Household final consumption expenditure (PEC), broken down into functional categories
- Non-profit institutions serving households' final consumption expenditure (CEN)
- Government final consumption expenditure (CEG) broken down by level of government and with categories for education and health services

Gross fixed capital formation

- Residential structures expenditure (COH)
- Construction of business non-residential structures (COB) broken down into industry groups
- Construction of non-residential structures by non-profit institutions serving households (CON)
- Construction of non-residential structures (COG) by level of government and with categories for education and health services
- Machinery and equipment business expenditures (MEB) broken down into industry groups
- Used cars and equipment and scrap expenditures (MEU)
- Machinery and equipment expenditures by non-profit institutions serving households (MEN)
- Machinery and equipment expenditures (MEG) by level of government also with categories for education and health services
- Intellectual property products business expenditure (IPB) broken down into industry groups
- Sales of intellectual property assets by business (IPU)
- Intellectual property products expenditure by non-profit institutions serving households (IPN)
- Intellectual property products expenditure (IPG) by level of government also with categories for education and health services

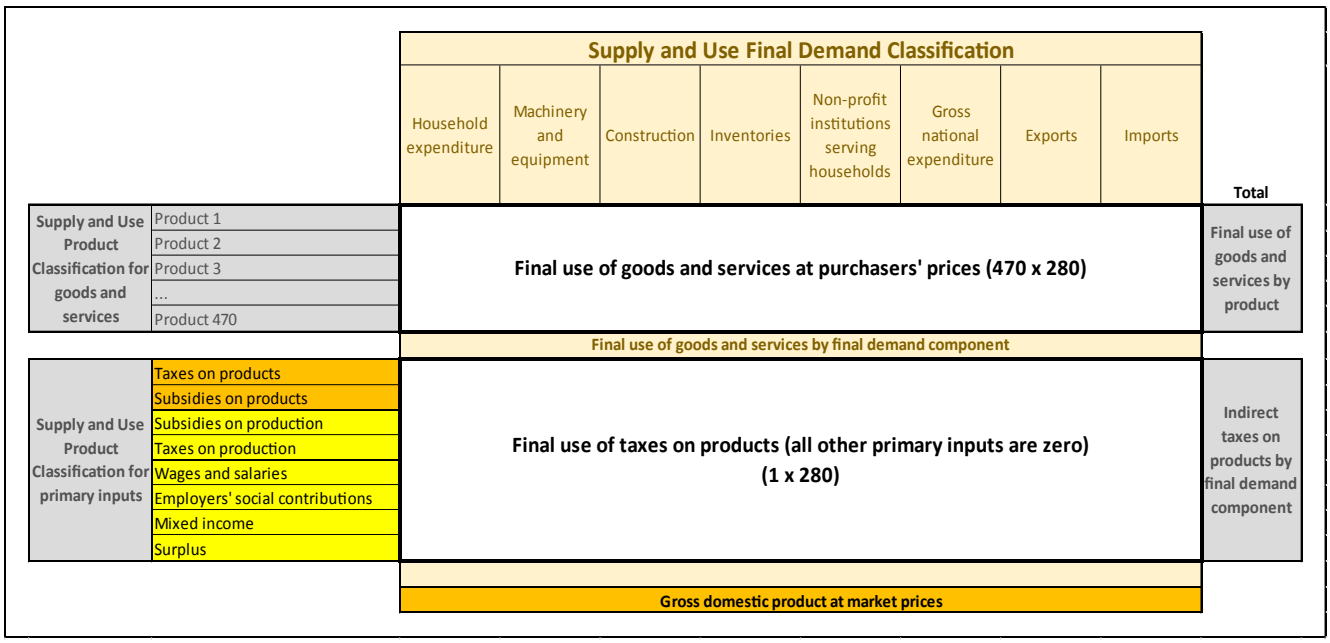
Inventory investment

- Inventory additions of finished goods and goods in process (INVAF)
- Inventory withdrawals of finished goods and goods in process (INVWF)
- Inventory additions of raw materials and goods purchased for resale (INVAR**)**
- Inventory withdrawals of raw materials and goods purchased for resale (INVWR)

Exports and imports

- International exports (INTEX)
- International re-exports (INTRX)[31]
- International imports (INTIM), recorded as negative values

Figure 4.3
Final demand table schematic



Source: Statistics Canada.

The final demand categories are those of the usual macroeconomics textbook. They can be readily aggregated to the five major components of that relationship—consumption by households and non-profit organizations serving households (C), business investment (I), government expenditure (G), exports to (X) and imports from (M) non-residents—which are the final demands of the institutional sectors.

The last eight rows of the table, showing the primary input expenses, are mostly zeros because by definition primary inputs are purchased by industries, not final demand categories. However, two kinds of taxes on products are exceptions. While most taxes on products appear as margins in the industry columns of the input table and are zero in the final demand columns, the land transfer tax (which is assigned to the construction final demand categories) and import duties (which are assigned to the imports column) nevertheless appear in the final demand table. These tax categories appear here for historical, technical reasons. At some point in the future they will be treated in the same manner as other taxes on products, in the input table.

The final demand table is also produced for each province and territory as well as for Canada as a whole, so it also includes approximately 1.5 million cells (470 × 280 × 14), many of which are zero.[32] As with the output and input tables, it is possible to work with smaller versions of the final demand table in which rows and/or columns are aggregated into a reduced number of classes.

As an example of a final demand category distributed by product class, consider the final demand component for “clothing materials, other articles of clothing and clothing accessories” (PEC031A0). This includes the product classes shown in Table 4.9.

Table 4.9
Product classes in the final demand category "clothing, materials, other articles of clothing and clothing accessories", 2009

Supply and use product class	Value
	millions of dollars
Clothing accessories	1,847
Fabrics	902
Fiber, yarn and thread	140
Artificial and synthetic fibers and filaments	138
Other miscellaneous goods	113
Infant and baby clothing	89
Total	3,228

Source: Statistics Canada.

As an example of a product class (row) distributed by final demand categories (columns), consider the product class "infant and baby clothing" (MPG31B0002). This product class is included in the final demand categories shown in Table 4.10.

Table 4.10
Final demand categories that include the product class "infant and baby clothing", 2009

Supply and use product class	Value
	millions of dollars
Garments	1,350
Clothing materials, other articles of clothing and clothing accessories	89
Expenditure by Canadians abroad	86
Expenditure by non-residents in Canada	-40
Inventory additions, finished goods and goods in process	3
Inventory withdrawals, raw materials and goods purchased	-36
International exports	51
International re-exports	5
International imports	-517
Total	990

Source: Statistics Canada.

The final demand category "garments" is the largest, accounting for most of the final use of the product class "infant and baby clothing". Table 4.10 also includes three negative final demand entries. Expenditures on this product class by non-residents visiting Canada are a negative item here in order to subtract these expenditures from the other final demand categories in this table. Inventory withdrawals are a negative final demand category since they do not reflect production in the current accounting period. Finally international imports of infant and baby clothing are also recorded as a negative item in this table since they are not part of Canadian output.

4.4.4 Balancing the tables

As pointed out earlier, the supply, use and final demand tables together can also be thought of as a single, much larger table.

Looked at in this combined way, the industry balance and supply-use identities, referred to at the beginning of this section, are readily apparent. For each industry, total output of all product classes at basic prices must equal intermediate consumption plus primary input expenses at basic prices. Supply of each product class must also equal use of that product class, that is, intermediate consumption plus final demand. Note again that for the supply-use identity to be valid, supply and use must be expressed at the same valuation, either at basic prices or at purchasers' prices.

The supply and use accounts are estimated each year using a wide range of data sources. However, when the large table is first compiled from the raw source data, the accounting identities just mentioned inevitably do not hold, for many reasons—differences in timing or valuation, classification differences, coverage differences, sampling errors, etc. In order to produce a set of tables wherein these identities do hold, they must be **balanced**. The balancing of supply and use is done at purchasers' prices. In other words, for any product class, supply (output including margins plus imports) must equal use (intermediate consumption plus final use).

The balancing is done through an iterative process. Adjustments are made based on a thorough analysis of the underlying source data combined with general economic intelligence.

4.5 Supply and use tables at constant prices

Chapter 3 mentioned that the national accounts provide a decomposition of the product value series into distinct price and volume (or 'quantity' or 'real' or 'constant price') components. The fact that product prices are in continual flux complicates the interpretation of national accounts, so these decompositions help considerably with the interpretation of value time series. Indeed, perhaps the single most important time series aggregate in the national accounts, real gross domestic product, is the result of the price-volume decomposition.

The volume estimates of supply, use and final demand reveal the pace of 'real' growth in the production and use of products, as well as the volume growth of the industries that produce value added. The industry output and gross value added estimates are instrumental in the calculation of labour and multifactor productivity. In addition, as explained later in this chapter, the volume estimates are the benchmark for the monthly estimates of real GDP by industry at the Canada level, as well as the annual estimates of real GDP by province and territory.

Much of the earlier discussion has been about three tables: the supply, use and final demand tables. For a given time period, each table displays nominal value statistics in two dimensions, one of which is the 'product class' dimension that is common to all three tables. The nominal value of products is a reflection of the prices and volumes of those products and it is this fact that opens the door to the price-volume decomposition.

Chapter 7 provides a fuller discussion of the price-volume decomposition.[33]

The elements of the output, input and final demand tables discussed in section 4.4 are decomposed each year into price and volume components by deflation, using various price indexes produced by Statistics Canada, and these deflated elements are then aggregated using the chain Laspeyres, Paasche and Fisher index number formulas. The deflation process is rather complex because (i) there are many product classes to deal with, (ii) distinct product price indexes are required, but not always available in practice, for output, imports, exports, intermediate consumption and the components of final domestic demand, (iii) the balancing constraints of the supply and use system must be respected and (iv) price indexes for the outputs of the industries that typically distribute their products free of charge or at economically insignificant prices (such as public administration and most NPISH-related industries) are not available. The deflation process and methodology is quite complex and will not be discussed here in detail.[34] Rather, they will be only briefly described using the tables for 2010 as an example.

The 2010 supply and use accounts record values at current prices, by product class, for outputs, inputs and final demands in that year. These values can be readily compared to the corresponding values in the 2009 tables, yielding annual percentage changes, however it is important for analytical reasons to decompose these changes into price and volume components.

To address this question, a large set of price indexes is first assembled, mostly from the Producer Price Indexes, the Services Producer Price Indexes, the Consumer Price Indexes and the International Trade Price Indexes.[35] There are 470 product classes and for each one, price indexes are required for output, inputs, imports, exports and final domestic demand. The 'supply = use' identity implies that one or some combination of these can be determined residually.

Given the set of price indexes, a price-volume decomposition can be accomplished for all 470 product classes by dividing the corresponding nominal value relative change for the year by the price index relative change for the year to derive the corresponding volume component of the decomposition. For example, if the nominal value change for output of a particular product class in 2010 compared to 2009 was 10.0% and the change in the corresponding price index was 3.0%, then the associated volume change would be $(100.0 \times 110.0 \div 103.0) - 100 = 6.8\%$. These price and volume components can then be aggregated to higher-level series using the chain Laspeyres, Paasche and Fisher formulas as explained in chapter 7. Industry gross value added, for which there are no directly applicable price indexes, is deflated by the **double deflation method**, also explained in chapter 7.

For the non-business industries, price indexes are generally unavailable for output so the double deflation method cannot be used. Instead, the volume of each primary input is estimated using a related volume indicator and price indexes are calculated implicitly thereafter. For compensation of employees, employee hours worked are used as the volume indicator. The volume of gross operating surplus and consumption of fixed capital is projected via estimates

of the capital stock at constant prices. Taxes on products and production at constant prices are calculated by applying tax rates from the (base) prior year.

Deflation is done at basic prices. Since the outputs of the margin product classes (retailing, wholesaling, transportation) are also deflated, estimates at purchasers' prices can also be calculated: the volume estimates at purchasers' prices are equal to the volume estimates at basic prices plus the volume estimates for the margin product classes. The price estimates at purchasers' prices are calculated as implicit indexes by dividing the value change by the volume change.

Finally, once the price-volume decompositions have been done using the Laspeyres, Paasche and Fisher formulas for all elements in the output, input and final demand tables, the remaining step is to link those decompositions to the corresponding ones for previous years by compounding them, producing chained Laspeyres, Paasche and Fisher price and volume index time series.

4.6 More timely estimates of real GDP by industry

So far this chapter has explained how the concepts of output, intermediate consumption and gross value added are defined and measured. It has also discussed how the statistical estimates at current prices are deflated to reveal the distinct contributions of price and volume changes.

All of the statistics discussed in this chapter so far are annual in frequency and are produced with a lag of up to 3 years after the reference year. It takes this much time to assemble the large and detailed database that is used to compile the supply and use tables.[36] Public accounts, tax data, annual survey statistics and other data series all involve lengthy processes to prepare. Once available, further time is required to bring together and balance the supply and use estimates in current prices and then to deflate them.

However, while it is unavoidable that the full supply and use tables are available only after a three-year time lag, estimates of gross value added at constant basic prices are released on a monthly basis, just two months after the reference month. In addition, annual estimates of real GDP by industry by province are released just 4 and, with revisions, 10-11 months after the reference year.

4.6.1 Monthly real GDP by industry

Monthly gross domestic product by industry at basic prices in chained dollars from a specified base year, or more simply **monthly real GDP** by industry, provides a timely and quite detailed picture of economic growth by industry in Canada. These statistics are an indispensable short-term indicator of the overall development of and relative industrial trends within the Canadian economy. The estimates are released in Statistics Canada Table 36-10-0434-01. There are 273 industry aggregates and sub-aggregates within the table.

The estimates represent a blend of information from, on the one hand, a diverse collection of monthly output volume indicators and, on the other hand, the annual Fisher chain volume estimates of gross value added from the supply and use accounts.

For each lowest-level industry, a related monthly output volume indicator is selected. The indicators are chosen based on their close annual correlation and theoretical relationship with gross value added at constant prices in the industry in question.[37] Thereafter, the monthly estimates of real GDP by industry are calculated in two parts: the first being the set of years for which annual supply and use estimates of gross value added are available ('the benchmark years') and the second being the years that follow, up to and including the current year ('the projection years').

In the benchmark years, for each industry a set of Laspeyres output volume time series are calculated from the corresponding monthly output indicator. Each of the series is twelve months in length and uses current dollar gross value added weights from the preceding year. These Laspeyres indexes are then linked together to form a chain Laspeyres output volume index spanning all of the benchmark years, for that industry.

The next step in the methodology is to adjust the monthly industry output volume indexes just calculated so that their corresponding annual values are equal to the annual Fisher chain volume estimates of gross value added by industry in the supply and use accounts. This adjustment process is called **benchmarking**. The resulting industry

series thus represent a distribution of the annual supply and use gross value added volume estimates over the twelve months of each year.

The **benchmarking** is accomplished in a manner that ensures the corresponding annual values of the derived monthly series are equal to those from the annual chained Fisher volume supply and use estimates of gross value added, while the month-to-month movements of the derived series correspond as closely as possible to those of the chain Laspeyres output volume indexes. Essentially this involves creating a new monthly series by minimizing the sum of squared deviations of its month-to-month changes from those of the chain Laspeyres series, subject to the constraint that the annual values of the newly created series are equal to those of the annual chained Fisher volume supply and use estimates. In other words, while the estimated monthly series is made to follow as closely as possible the movements of the chain Laspeyres monthly series, it is also benchmarked to the corresponding annual supply and use series using a **quadratic minimization** method.[38]

The benchmarking process is done independently for each industry aggregate and sub-aggregate. Accordingly, the resulting series are not consistent in aggregation, though they may be considered approximately so.[39]

As a final step, each of the calculated series is scaled to equal gross value added at current prices in the base year 2007.

Next the monthly series so derived for each industry are extended forward into the projection years based on the movement of the corresponding monthly output volume indicators in those years. These projected monthly gross-value-added-by-industry volume series are aggregated to higher levels, including the total economy level, using a Laspeyres fixed-weight averaging approach. The fixed gross value added weights for the projection years are taken from the last available annual supply and use accounts.

To recap, the monthly real GDP by industry estimates are based on the intertemporal movement of related monthly output volume series and are calculated in two parts. The first of these parts is for the years up to and including the last year for which supply and use estimates are available. The estimates for this part are calculated by **interpolating** the annual supply and use estimates over the twelve months of the year based on movement of the related series. The second of the two parts is for the years beyond those for which supply and use estimates are available. In this case the estimates are calculated by **projecting** the monthly series forward based on the movement of the related series and aggregating the results using a fixed-weight (not chain) Laspeyres index.

For example, consider the reference month May 2014 when it was released at the end of July 2014. At that time, supply and use accounts were available for the period up to and including 2010. In this instance, the monthly real GDP by industry estimates for the period 1997 to 2010, when time-aggregated to annual, were equal to the corresponding Fisher annually chained volume estimates of gross value added from the supply and use accounts. The monthly movements of the chained Fisher were approximated by those of the associated monthly production volume indicators. Continuing with the period January 2011, the lowest-level industry estimates were projected forward based on the growth of the related indicators. These projected estimates were then aggregated by annually chaining fixed-weight Laspeyres volume indexes to the December 2010 estimates. In other words, the weights for aggregating the 2011 monthly estimates were from the 2010 supply and use accounts, the weights for aggregating the 2012 monthly estimates were from the 2011 annual estimates, the weights for aggregating the 2013 monthly estimates were 2012 annual estimates and the weights for aggregating the 2014 monthly estimates were 2013 annual estimates. All of the monthly estimates, from 1997 to date, are scaled to equal gross value added in 2007, the reference year.

The final step in the production of the monthly real GDP by industry estimates is their ongoing reconciliation with the quarterly estimates of real GDP coming from the income and expenditure accounts.[40] The two are quite different since the former measures gross value added based on the industry that produces it while the latter gauges gross value added by adding up final expenditures on goods and services by the institutional sectors.[41,42] The full reconciliation of these two bodies of statistics is not possible until the supply and use estimates are available 2-3 years later. However, the two sub-annual GDP series are always compared and reconciled on an ongoing basis, to the extent possible.

The comparison is most direct at the level of total GDP, where quarterly movements of the two series should be closely aligned. If a divergence is observed at this level when the estimates are being compiled,[43] the analysts from the two programs investigate and take steps jointly to bring the two series into alignment. Some of the component

series within the two programs can be fairly easily compared. For example, the estimates of residential construction work-put-in-place are fully reconciled between the two programs. Another good example is some consumer services, where the production and final expenditure estimates should, in principle, be very similar.

There is an important limitation underlying the monthly real GDP by industry methodology. Since gross value added is being projected forward, beyond the years for which supply and use accounts are available, using indicators of output, there is an implicit assumption that gross value added and output are proportional—or equivalently, that the outputs to inputs ratio remains constant. While this may be a good approximation over relatively short periods of time, production technologies often change as the years go by and with them the relationship between output and gross value added can shift. It would clearly be preferable to use direct indicators of gross value added instead of output indicators, but no such direct indicators are available.

4.6.2 Annual real GDP by industry by province and territory

Timely estimates of real GDP at basic prices by industry are also produced for each province and territory, although these estimates are available only at the annual frequency. The statistics are compiled in a manner that is similar, in some ways, to that of the monthly real-GDP-by-industry national estimates. However, the methodology for the provincial and territorial estimates is also quite different from that of the monthly estimates in a number of respects.[44] The statistics are built up from provincial and territorial supply and use estimates of output and gross value added by industry at current prices and are projected forward to the most recent reference year using related indicators.

The first step in the calculation of these estimates is to deflate output-by-product-class in the provincial and territorial supply and use accounts. Since provincial and territorial product price indexes are not generally available, this deflation is done using the national price indexes. This is considered a reasonable approximation since markets are generally competitive in Canada and for many product classes annual price trends are similar across the country.

Constant dollar output-by-product-class is calculated using prices of the preceding year, starting from the base year 2007 forward. Real output-by-product-class calculated in this manner is then aggregated by industry within each province and territory. These real industry-output-by-province estimates are then linked for successive years and scaled by nominal gross value added in 2007 to produce estimates of chained GDP at 2007 basic prices for each lowest-level industry. This embodies the assumption that real output and real gross value added are proportional. The chained lowest-level real GDP-by-industry-by-province is then balanced to the national equivalents and summed to produce the various provincial and territorial industry aggregates. These estimates are produced for all years for which supply and use accounts are available.

As noted, estimates of gross value added at constant prices are calculated by assuming a fixed proportional relationship between real gross value added and real output. More specifically, the ratio of nominal gross value added to nominal output in an arbitrary base year, 2007 at time of writing, is assumed to apply to the corresponding real series for all periods moving forward. In effect, this means the yearly growth in real gross value added is assumed equal to that of real output. Since estimates of real output are available as described in the previous paragraph, this proportionality relationship allows estimates of real gross value added to be calculated for all lowest-level industries. All of the provincial and territorial estimates are then adjusted on a **pro rata** basis (a process referred to as **normalization**) to ensure they aggregate to the same national totals of real gross value added.

With provincial and territorial estimates of real output and real gross value added having been produced for each industry in the years for which supply and use accounts are available, the next step is to project these estimates forward, beyond the last year for which supply and use accounts are available, using related industry output indicators. Separate indicators are selected for nominal and real output, within each province and territory.

Once real output has been projected, the fixed ratios referred to in a previous paragraph are applied to calculate estimates of lowest-level real gross value added. These estimates in turn are aggregated to produce higher-level aggregate estimates of real gross value added (in other words, GDP) by industry by province and territory. The weights in this aggregation process are the projected estimates of nominal output. Finally, the projected provincial and territorial estimates of real GDP by industry are adjusted so they sum to the corresponding annual national estimates from the monthly GDP by industry program.

In effect, price indexes and volume measures (constant dollar GDP) are calculated which share a common base year, 2007 at time of writing. These two series are used to derive estimates of current dollar GDP and subsequently Paasche and Laspeyres GDP measures for all lowest-level industries. All aggregates are calculated using series with common base years before chaining and deriving the Fisher measure. The Fisher GDP measure is calculated from the chained Paasche and chained Laspeyres GDP estimates for each industry and aggregate individually.

For the supply and use years, current dollar GDP is obtained from the supply and use tables. The volume measure is the constant dollar GDP on base year 2007 derived as described above by deflating the gross output by product class and summing to the lowest-level detail then applying a GDP-to-output ratio in the base year to yield a constant dollar GDP series.

For the post-supply and use years, estimates of current dollar GDP are derived using the constant dollar GDP and the estimates of GDP prices indexes both based on the same 2007 base year. The estimates of current dollar GDP are used in the Fisher method to weight the contribution of each working level industry in any given aggregate.

The industry real GDP estimates for each province and territory are evaluated analytically before they are released, by identifying important trends in the estimates and comparing the picture they portray with regional information from a variety of sources. The estimates are also compared with the picture emerging in the estimates of the provincial and territorial income and expenditure accounts. Adjustments are made when they are judged to be necessary.

For example, consider the reference year 2013 when it was released in November 2014. At that time, supply and use accounts were available for the period up to and including 2011. In this instance, the annual real GDP by industry estimates for the period 1997 to 2011 were equal, at the national level, to the corresponding Fisher annually chained volume estimates of gross value added from the supply and use accounts. Beginning with the period 2012, the estimates were projected forward by chaining quasi-Fisher volume indexes to the 2011 estimates. All of the chained estimates, from 1997 to 2011, were scaled to equal gross value added in 2007, the reference year.

4.7 Uses of the supply and use accounts

As seen in the previous sections, the supply and use accounts provide a very detailed picture of the Canadian economy and its provincial and territorial sub-economies. The supply and use tables are recompiled every year, in all their product, industry, final demand category and regional detail, revealing how that picture changes incrementally over time. These accounts play a central role in Canada's statistical system. This section will explain the principal uses of the supply and use accounts.

4.7.1 Structural analysis and productivity studies

The supply and use accounts are used for all manner of structural economic studies. These include, for example, analyses of the likely effects of economic policy options (changes in tax policy, external and internal trade liberalization, monetary policy, industrial policy, social policy, environmental policy) on industries and/or regions of the country or the impact of specific economic events, such as commodity price shocks, natural disasters or international financial crises. Long-term economic projections are done using the supply and use accounts as a framework to ensure consistency and coherence of the projections.

The supply and use accounts are especially useful in relation to productivity studies. The estimates of outputs, inputs and gross value added at constant prices, by industry, that the accounts provide are vital to these studies, which also make use of labour market and capital stock statistics from other sources.

4.7.2 Supply and use modelling

4.7.2.1 Overview

Closely related to their use in structural analyses, the supply and use accounts are also used in a dynamic economic modelling context.

The year-to-year changes in the supply and use tables can be thought of as being of two types. On the one hand, the economy as a whole grows and contracts, affecting the output of all industries, products and regions. Changes of this kind are variations in scale and they can occur, in principle, without there being any changes in the **structure** of the tables. By the term 'structure' is meant the shares of the different inputs required to produce a given output, the

market shares of different product outputs in total output and the interprovincial and international trade shares. On the other hand, the supply and use accounts can also vary from year to year as a result of changes in the structure itself. Actual year-to-year differences are always a combination of the two types of change.

The year-to-year evolution of the structure of the supply and use accounts reveals how technologies are changing within the economy. For example, some industries in some regions use relatively more of some inputs and relatively less of other inputs.[45] The tables also show how the different components of final demand are changing, as households, non-profit organizations, businesses, governments and non-residents buy relatively more of some products while reducing their demands for other products.[46] The interprovincial supply and use accounts also show how the role of interprovincial trade in products varies from year to year.

Supply and use models are characterized by assumptions about the future evolution of the structure of the tables. They allow the analyst to explore "what if?" questions at a fairly detailed level, exploring the impact of exogenous changes in final demand on output while taking account of the interdependencies between different industries and regions of the economy and the leakages to imports and taxes. For example, such models might be used to study the question: If Canadian oil and gas exports doubled, what industries would be most affected and in which provinces? The use of a supply and use model to address such a question would permit the indirect, and possibly also some of the induced effects of a demand shock of this nature to be estimated and the corresponding **multipliers**[47] to be calculated.

Supply and use models were originally developed in the 1930s by Wassily Leontief,[48] a Russian-American who earned the Nobel Prize in Economics for this work in 1973.[49] His models were inspired by earlier studies by François Quesnay on the *"Tableau économique"* in 1758 and Léon Walras on general equilibrium theory in 1874. Leontief's models simplified earlier formulations by assuming that the proportions of industry inputs to industry outputs are fixed in the short-term, with no substitutability among any of the intermediate or factor inputs.

The supply and use model begins with the fundamental national accounts identity, discussed in section 4.3, stating that total supply of a class of products equals total use of that product class. The model brings together all of the individual product class identities (recall there are 470 of them in the most detailed supply and use account) in matrix notation. Substitutions are made, reflecting the assumptions that input proportions are fixed, trade shares are also fixed and final demand is exogenous. The final step is to manipulate the resulting matrix equation, solving alternatively for the vector of product outputs or the vector of industry outputs.[50]

It is also possible to expand upon the basic supply and use model in a number of ways. In Canada, there are two basic versions of the model, a national version for Canada as a whole that ignores regional variations and an interprovincial version that combines the 14 provincial and territorial supply and use accounts in a way that allows interprovincial trade flows to be taken into account. In addition to the direct and indirect effects of a demand shock that are captured in the most basic model, induced effects can also be tracked by assuming some fixed proportion of any incremental income paid (presently measured by wages alone) are reflected in increased final demand by households. The employment effects of a demand shock can also be included in the model by assuming a direct relationship between person-years of employment and output by industry. The effects of a demand shock on energy use and greenhouse gas emissions can be simulated in a similar manner.

Finally, it must be recognized that supply and use models, like all models, have their limitations. No relative price changes and associated behavioural responses are generally allowed for in such models. The effects of economies of scale and technological change are generally ignored. Recognizing these and other weaknesses, the models have nevertheless been found very useful the world over. The Canadian supply and use models can be accessed and utilized by contacting the Industry Accounts Division at Statistics Canada.[51]

4.7.2.2 An example

A wide variety of analyses can be done with supply and use models. However, the characteristics of any particular analysis, or 'shock', are constrained by the amount of detail that can be provided by the analyst. Here are some broad categories of question that can be addressed, all relating to the effect of the specified exogenous change of some kind on GDP and other economic variables:

- What happens if the output of one or more industries changes?
- What happens if the output of one or more product classes changes?
- What happens if households or governments change their spending on one or more final demand categories?
- What happens if exports of one or more product classes change?
- What happens if the cost structure of one or more industries changes?
- What happens if a particular investment expenditure is made?

Results from a shock are grouped under three headings:

- **Direct impacts**, being the effects directly attributable to the shock.
- **Indirect impacts**, being the inter-industry economic activities associated with supplying intermediate inputs to the directly and indirectly affected industries.
- **Induced impacts**, being an estimate of the production and imports associated with spending of incremental wages flowing from the direct and indirect impacts on consumer goods and services.

The sum of direct and indirect impacts is referred to as the **open model** total impact, while the sum of all three impacts is called the **closed model** total impact.

To illustrate how the supply and use simulation model can be used, consider a simple infrastructure investment shock. The shock assumes a $1 billion exogenous expenditure by the government sector in the product class "Highways, roads, streets, bridges and overpasses". Table 4.11 summarizes the results of this shock.

Table 4.11
Impact on GDP of a $1 billion infrastructure shock

GDP components	Total impact, open model	Induced	Total impact, closed model
	thousands of dollars		
Expenditure-based GDP			
GDP at market prices	**823,314**	**308,494**	**1,131,808**
Final domestic expenditures	1,000,000	389,947	1,389,947
Exports	0	0	0
Imports, final expenditures	0	-47,704	-47,704
Imports, intermediate inputs	-176,686	-33,749	-210,435
Income-based GDP			
GDP at market prices	**823,314**	**308,494**	**1,131,808**
Taxes on products (final expenditures)	4,842	33,414	38,256
Taxes on products (intermediate inputs)	19,788	4,546	24,334
Taxes on products (import duties)	397	1,088	1,485
Subsidies on products (intermediate inputs)	-5,925	-4,537	-10,463
GDP at basic prices	**804,212**	**273,983**	**1,078,195**
Subsidies on production	-906	-589	-1,496
Taxes on production	21,650	21,255	42,905
Wages and salaries	445,304	105,898	551,202
Employers' social contributions	50,129	14,482	64,611
Labour income of unincorporated sector	51,204	10,532	61,736
Gross operating surplus	236,832	122,405	359,237

Source: Statistics Canada.

As shown in the first line of the table, the impact on GDP estimated in the open model is an increase of $823,314 thousand, which is somewhat less than the $1 billion shock. The difference is accounted for by imports of $176,686 thousand that are required in support of the infrastructure investment. The closed model shows the total impact to be greater than the shock, at $1,131,808 thousand, reflecting an additional $389,947 thousand of induced final domestic expenditures net of $81,453 thousand of induced imported goods and services. The remainder of the table shows how the impacts on GDP at market prices differ from those on GDP at basic prices.

Users of the supply and use simulation model receive a detailed report showing the effects of the specified shock on output and intermediate consumption by industry and by product class. The estimated impacts on employment, emissions and energy use are also reported. Multipliers are also recorded for output, GDP and compensation of employees.

4.7.3 Harmonized sales tax revenue allocation

In April 1997 the Government of Canada and participating provinces introduced the Harmonized Sales Tax (HST) as a replacement for the Goods and Services Tax (GST) and provincial retail sales taxes (RSTs). The Canada Revenue Agency collects the HST and distributes the resulting revenue among the participating governments. This collection arrangement is less expensive than the alternative of having each government collect its own sales tax. It is also less burdensome on the wholesalers and retailers who must apply the tax when sales are made to purchasers, since they have just one government collection authority to deal with. However, calculating the appropriate shares to which the individual governments are entitled is by no means a simple matter, because of the multi-stage nature of the tax.

The HST, like the GST, is a value added tax. Businesses must pay the tax on their intermediate consumption and households must also pay the tax when they purchase consumer goods and services. In most instances businesses are entitled to rebates of the tax they pay, which can be deducted from the tax they themselves collect on behalf of the governments when they are selling their output. In almost all instances households are not entitled to rebates.[52]

The HST applies to most goods and services, although some specific product classes are ‘exempt’ and others are ‘zero rated’. Sellers of exempt products (health services, child care services, educational services and several other classes of products) charge **no** HST and also **are not** entitled to rebates of the HST they pay on their intermediate consumption. In contrast, sellers of zero-rated products (basic groceries, prescription drugs, exports and some other classes of products) also charge **no** HST, but **are** entitled to rebates of the HST they pay on their intermediate consumption.

When the HST was designed in 1996 the participating governments took the decision to base the revenue allocations on a formula that is driven primarily by statistics from the supply and use accounts. The accounts are ideal for this purpose because of the considerable product-class and tax detail they provide, the breakdown they make available between intermediate consumption and final demand, and their general reliability. At the time, the supply and use accounts were only produced at the national level, so additional funding was provided to Statistics Canada to implement a full provincial and territorial supply and use statistics program. As a result, a wide range of Statistics Canada survey programs were expanded to yield improved provincial and territorial breakdowns. Since 1997 the provincial and territorial supply and use accounts have been estimated on an annual basis.

4.7.4 Data confrontation

Canada’s statistical system assembles a wide range of information using an equally wide range of collection vehicles. Those vehicles include numerous monthly, quarterly, annual, biennial and quinquennial surveys conducted by Statistics Canada, using common classification systems and statistical methods. They also include surveys conducted by other agencies including federal and provincial government departments and various private sector organizations, public accounts records released by all levels of government, detailed international trade data from the Canada Border Services Agency, income and taxation data from the Canada Revenue Agency and various other administrative data sources. Each of these collection vehicles has its own raison d’être and methodology. They vary greatly in terms of concepts, coverage (regional, industrial, demographic, etc.), valuation and timing. Statistical information collected by these different vehicles needs to be carefully compared and reconciled.

Perhaps the most fundamental role of the supply and use accounts is to confront the data collected by these various vehicles, to check for coherence and to take steps to resolve inconsistencies when they are found. In this respect, the 'supply = use' identity is a key asset. Recall that supply includes output and imports while use includes intermediate consumption, final domestic demand and exports. In compiling the supply and use statistics, data from production surveys, wholesale and retail trade surveys, international trade records and other sources are lined up against one another to assess how well the identity holds, for a wide range of product classes. Where conflicts are detected, the supply and use statisticians assess the sources of discrepancy and make appropriate adjustments to align the supply and use statistics. In short, the supply and use accounts bring coherence to the wide range of economic statistics that are available to Canadians.

4.7.5 Benchmarking

The development of national accounts estimates involves trade-offs between timeliness and statistical accuracy. Early estimates are often (though not always) produced using sub-annual (monthly and quarterly) sources of information and these tend to be derived from relatively small statistical samples. They usually offer relatively little detail, whether by product class, by industry or by geographical region. Their advantage is that they can be made available to users with a comparatively short lag relative to the reference period. With the passage of time, however, better sources of information typically become available. In some cases these sources are annual statistical surveys, with larger samples and a lot more subject matter detail. In others they are administrative data, such as public accounts or taxation statistics, and these tend to have census coverage. These annual sources tend to be both more accurate and more detailed than the early data sources, although they are available only with a longer lag.

The process of **benchmarking** is the means by which early sub-annual estimates—or in some cases preliminary annual estimates—are improved by making use of more accurate annual sources of information that become available with a longer lag. The process most often aims to produce revised, or 'benchmarked' sub-annual estimates that, when time-aggregated to the annual frequency, correspond to the latest available (and more accurate) annual estimates while retaining, as much as possible, the sub-annual pattern of change that is evident in the early estimates.

Benchmarking is important for the monthly national estimates of real GDP by industry, the quarterly income and expenditure accounts estimates, the annual provincial and territorial estimates of real GDP by industry and the productivity statistics program. These programs are built from the ground up using supply and use statistics.

So the supply and use accounts are truly the anchor of the macroeconomic accounts, tying them together as a coherent set and providing the 'full information' estimates upon which they are based.

Annex 4.1 Supply and use tables example

In this annex a hypothetical example of supply and use tables is presented. The goal is to help the reader understand the basic structure of the tables and the relationships among their different parts.

Table A.4.1 shows the 'make' (or 'production' or 'output') table. In this simple example, there are seven industries and eight product classes. All of the industries, with one exception, produce just one class of products. The exception is the transportation industry that produces two product classes: transportation of people and transportation of freight. Total industry output is, for each industry, the sum of the outputs of all product classes produced by that industry. Total output, or domestic supply, for the economy as a whole is 3,095 at basic prices.

The right-hand side of the table, labelled 'valuation margins', shows how total domestic supply at basic prices is converted to total domestic supply at purchasers' prices. This is done by distributing the output of the margin industries (trade services and transportation services in this example) across the other product classes according to where those margins are earned and adding in as well all taxes less subsidies on products. Thus, for example, while output of agriculture products at basic prices is 335 in the example, output of this product class at purchasers' prices is 365, reflecting the addition of 50 in trade margins and 30 in transportation margins and the deduction of 50 in subsidies. Total supply at purchasers' prices is 3,180 which is 85 more than total supply at basic prices, reflecting the inclusion of taxes less subsidies on products (140 minus 55).

Note that imports do not appear as a source of supply in Table A.4.1. Rather, as will be seen shortly, they appear in Table A.4.2 as a negative source of final demand. Imports could be shown, in an alternative presentation, as an added column in the supply table, thereby shifting the total in that table from 'domestic supply' to 'total supply'. Imports would then not be included in Table A.4.2.

Table A.4.2 shows the use table at purchasers' prices. The industries and product classes are the same ones that are in the supply table. The left-hand part of the table shows the industries' uses of the different products, which is to say their intermediate consumption measured at purchasers' prices. It also shows, in the rows immediately following, the primary input expenses of the industries: compensation of employees, other taxes less subsidies on production and mixed income/other operating surplus. At the bottom is total industry output at basic prices, copied from Table A.4.1. Subtracting total intermediate consumption from total industry output at basic prices yields gross value added at basic prices. Observe that gross value added at basic prices can also be calculated by summing the three primary input expense categories.

Table A.4.1
Supply table at purchasers' prices

	Industries							Total domestic supply at basic prices
	Agriculture	Manufacturing	Utilities	Trade	Transportation	Other services	Public administration	
Product classes	billions of dollars							
Agriculture goods	335	...	...	...	...	...	...	335
Manufacturing goods	...	1,200	...	...	...	...	...	1,200
Utilities	...	...	200	...	...	...	...	200
Trade services	...	...	...	300	...	...	...	300
Transportation of people	...	...	...	...	400	...	...	400
Transportation of freight	...	...	...	...	110	...	...	110
Other services	...	...	...	...	...	300	...	300
Public administration	...	...	...	...	...	...	250	250
Total	335	1,200	200	300	510	300	250	3,095

	Valuation margins				Total domestic supply at purchasers' process
	Total margins	Transportation margins	Taxes on products	Subsidies on products	
Product classes	billions of dollars				
Agriculture goods	50	30	...	-50	365
Manufacturing goods	250	80	120	...	1,650
Utilities	...	...	...	...	200
Trade services	-300	...	...	...	...
Transportation of people	...	...	...	-5	395
Transportation of freight	...	-110	...	...	...
Other services	...	...	20	...	320
Public administration	...	...	...	...	250
Total	0	0	140	-55	3,180

... not applicable

Source: Statistics Canada

Table A.4.2
Use table at purchasers' prices in billions of dollars

	Industries' uses at purchasers' prices							
	Agriculture	Manufacturing	Utilities	Trade	Transportation	Other services	Public administration	Total
	billions of dollars							
Product classes								
Agriculture goods	12	80	...	...	...	...	...	92
Manufactured goods	40	493	18	10	110	60	40	771
Utilities	10	45	5	30	20	15	25	150
Trade services	...	...	...	...	...	...	...	...
Transportation of people	8	7	6	10	5	10	30	76
Transportation of freight	...	...	...	...	...	...	...	...
Other services	20	60	44	30	40	65	28	287
Public adminstration	...	5	7	...	...	...	...	12
Total	90	690	80	80	175	150	123	1,388
Primary input expenses								
Compensation of employees	105	400	100	60	220	130	120	1,135
Other taxes less subsidies on production	10	30	10	20	15	5	2	92
Mixed income/gross operating surplus	130	80	10	140	100	15	5	480
Gross value added at basic prices	245	510	120	220	335	150	127	1,707
Total industry output at basic prices	335	1,200	200	300	510	300	250	3,095

	Final uses at purchasers' prices							
	Household consumption	Government consumption	Fixed capital formation	Changes in inventories	Exports (FOB)	Imports (CIF)	Total final use	Total use
	billions of dollars							
Product classes								
Agriculture goods	112	...	...	5	156	...	273	365
Manufactured goods	538	...	350	-9	800	-800	879	1,650
Utilities	50	...	...	...	...	...	50	200
Trade services	...	...	...	...	...	...	...	...
Transportation of people	254	...	...	...	115	-50	319	395
Transportation of freight	...	...	...	...	...	...	...	...
Other services	50	...	...	...	3	-20	33	320
Public adminstration	...	238	...	...	...	...	238	250
Total	1,004	238	350	-4	1,074	-870	1,792	3,180
Primary input expenses								
Compensation of employees	...	...	...	...	...	...	...	...
Other taxes less subsidies on production	...	...	...	...	...	...	...	...
Mixed income/gross operating surplus	...	...	...	...	...	...	...	...
Gross value added at basic prices	...	...	...	...	...	...	...	...
Total industry output at basic prices	...	...	...	...	...	...	...	...

... not applicable

Note: GDP at market prices = Value added at basic prices (1,707) + taxes on products (140) – subsidies on products (-55) = 1,792.

Source: Statistics Canada

Table A.4.3
Use table at basic prices

	Industries' uses at basic prices							
	Agriculture	Manufacturing	Utilities	Trade	Transportation	Other services	Public administration	Total
	billions of dollars							
Product classes								
Agriculture goods	11	75	...	...	...	...	...	86
Manufacturing goods	35	437	13	9	91	47	35	667
Utilities	10	45	5	30	20	15	25	150
Trade services	3	40	2	...	10	10	4	69
Transportation of people	8	7	6	10	5	10	30	76
Transportation of freight	3	11	1	1	5	3	1	25
Other services	20	56	41	28	38	61	26	270
Public administration	...	5	7	...	...	...	...	12
Taxes less subsidies on products	...	14	5	2	6	4	2	33
Total	90	690	80	80	175	150	123	1,388
Primary input expenses								
Compensation of employees	105	400	100	60	220	130	120	1,135
Other taxes less subsidies on production	10	30	10	20	15	5	2	92
Mixed income/gross operating surplus	130	80	10	140	100	15	5	480
Gross value added at basic prices	245	510	120	220	335	150	127	1,707
Total industry output at basic prices	335	1,200	200	300	510	300	250	3,095

	Final uses at basic rices							
	Household consumption	Government consumption	Fixed capital formation	Changes in inventories	Exports (FOB)	Imports (CIF)	Total final use	Total use
	billions of dollars							
Product classes								
Agriculture goods	86	...	...	5	158	...	249	335
Manufacturing goods	369	...	275	-9	698	-800	533	1,200
Utilities	50	...	...	...	...	...	50	200
Trade services	111	...	30	...	90	...	231	300
Transportation of people	259	...	...	...	115	-50	324	400
Transportation of freight	37	...	15	...	33	...	85	110
Other services	47	...	...	...	3	-20	30	300
Public administration	...	238	...	...	...	...	238	250
Taxes less subsidies on products	45	...	30	...	-23	...	52	85
Total	1,004	238	350	-4	1,074	-870	1,792	3,180
Primary input expenses								
Compensation of employees	...	...	...	...	...	...	...	...
Other taxes less subsidies on production	...	...	...	...	...	...	...	...
Mixed income/gross operating surplus	...	...	...	...	...	...	...	...
Gross value added at basic prices	...	...	...	...	...	...	...	...
Total industry output at basic prices	...	...	...	...	...	...	...	...

... not applicable

Note: GDP at market prices = Value added at basic prices (1,707) + taxes on products (140) – subsidies on products (-55) = 1,792.

Source: Statistics Canada

The right-hand side of Table A.4.2 shows the other component of the use table which is final uses at purchasers' prices. In this simple example there are six final uses: household consumption, government consumption, fixed capital formation, changes in inventories, exports and imports (a negative entry). The second-to-last column shows total final use at purchasers' prices, which is equal to gross domestic product at market prices. The final column is total use at purchasers' prices, which is the sum of total intermediate consumption at purchasers' prices and total final use at purchasers' prices.

Observe that gross domestic product at market prices (or equivalently, total final use at purchasers' prices) is equal to total value added by industries at basic prices plus taxes less subsidies on products (the latter are shown in Table A.4.1).

The remaining table, Table A.4.3, is the use table at basic prices. Thus Table A.4.3 is similar to Table A.4.2 except that the valuation is in basic rather than purchasers' prices. This means the margin industries—trade services and transportation of freight in this example—are broken out separately from the other product classes. Total intermediate consumption by industries (1,388) and total final uses (3,180) are the same in Table A.4.3 as in Table A.4.2.

Annex 4.2 The calculation of output at basic prices

In Canada output is measured in a manner that deviates slightly from the *SNA 2008* standard. It is valued before any taxes levied on products have been added **but after any subsidies received on products have been subtracted**. In effect, subsidies are recorded not as a component of the producer's revenue, but as a negative input cost entry for the producer.[53] Gross value added is unaffected and is defined in basic prices as per the *SNA 2008* standard. The rationale for this deviation from the standard is essentially that were the recommended basic prices to be used, with subsidies being added back, the resulting prices would not correspond to any observable transactions and would be difficult to deflate properly.[54] In addition, when this valuation approach is adopted and the use table is transformed to a uniform valuation basis (section 4.4), there is no need to allocate product subsidies to each user.

The electrical utility example discussed in section 4.2.5 assumed that the $260,000 of electricity sales revenue was the result of a price of $0.10 per kilowatt hour (kWh) and sales of 2,600,000 kWh. The price included the impact of a federal government specific tax of $0.02 per kWh and a provincial government specific subsidy of $0.01 per kWh. The valuation of output as per the international standard is:

Output at basic prices = ($0.10 – $0.02 + $0.01) × 2,600,000 = $234,000,

and the valuation as calculated in the Canadian System of Macroeconomic Accounts is:

Output at modified basic prices = ($0.10 – $0.02) × 2,600,000 = $208,000.

In practice, the difference between output valued at basic prices and output valued at modified basic prices is typically small in Canada, since subsidies on most products are comparatively small in this country, with negligible effect in most industries.[55] Elsewhere in this volume, when the term 'output at basic prices' is used it should be understood to mean output at basic prices as modified in the manner described here.

Annex 4.3 Fictive products and industries

The most detailed, publicly available supply and use accounts for Canada and the provinces record information for 470 product classes and 233 industry groups, as well as for 8 primary input categories and 280 final demand categories. Of the 470 product classes, six are characterized as 'fictive'. Similarly, six of the 233 industry classes are also 'fictive'. These six product and industry classes correspond one-to-one and have the same names, as shown in Table A.4.4.

Table A.4.4
Fictive product and industry classes

Product class code	Name	Industry class code
FIC110000	Repair and maintenance	FC110000
FIC120000	Operating supplies	FC120000
FIC130000	Office supplies	FC130000
FIC210000	Advertising, promotion, meals and entertainment	FC210000
FIC220000	Travel, meetings and conventions	FC220000
FIC300000	Transportation margins	FC300000

Source: Statistics Canada.

This annex explains the nature of these fictive product and industry classes. Fundamentally, the use of these classes is a technique for routing groups of heterogeneous products, used in a relatively minor way as inputs, into industries when the precise product content is not known.

Establishments are asked to report their product inputs on Statistics Canada questionnaires, by product class. The product classes are designed to be as homogeneous as possible. However, some of the products that establishments use are diverse and minor in nature, in terms of the total amount expended on them as a proportion of total establishment intermediate consumption. It would be burdensome on establishments to require that they report expenditures on each of these products individually, and it would also be of little practical value analytically, so instead they are grouped together as baskets of diverse products. The products in these baskets are already represented in other product classes, but it would be too much to ask of establishments that they break them out separately in these various product classes.

Consider, for example, the fictive product class ‘operating supplies’. This basket of products includes such items as tires, batteries, cleaning and scouring powders, paints and a variety of other such products. All of these products belong to other product classes. For example, tires belong in the product class MPG326201, called ‘tires’, and batteries are found in the product class MPG335901, called ‘batteries’. In view of the fact that only minor quantities of these products are used by most industries, in such instances establishments are asked to report them instead as a basket total for all such minor products, as ‘operating supplies’.

It is important to recognize, though, that establishments which use any of these products more intensively in their production process are expected to report their use separately. Thus, for example, the ‘automobile and light-duty motor vehicle manufacturing’ industry uses a substantial quantity of tires in its production process and accordingly is asked to report them separately in the ‘tires’ product class rather than in the ‘operating supplies’ class. Even then, to the extent the automobile industry also uses tires as ‘operating supplies’ to keep its own vehicles moving, it might also, at its option, report that comparatively minor portion of its usage of tires in that fictive category, while reporting most of its usage of tires as ‘tires’.

Fictive industries are defined as those producing the output of the fictive products. Thus, for example, the ‘operating supplies’ fictive industry is defined as that producing the total output of ‘operating supplies’ used by all other industries. There is no need to estimate the product composition of output within each of the fictive product classes. However, it is still necessary to estimate the composition of product inputs of each of the fictive industries. This is accomplished by routing appropriate values of the relevant product classes (tires, batteries and so on) to the fictive industries.

There are no primary inputs in the fictive industries and accordingly these industries do not account for any part of gross domestic product. Moreover, the fictive product classes are not purchased by final demand categories. Rather, returning to the ‘operating supplies’ example used previously, any tires, batteries and so on that are acquired by final demand sectors are purchased from the corresponding non-fictive product classes.

Notes for chapter 4

1. In the past, in Canada, the term 'input-output accounts' was used interchangeably with the term 'supply and use accounts'. However, in SNA 2008 and elsewhere the term 'input-output tables' refers to a squared transformation of the use table where either the rows and columns are both industries, or are both product classes. See SNA 2008, pages 512 to 518.

2. The domestic supply table excludes imports, whereas the total supply table includes imports.

3. The example assumes no taxes or subsidies on electricity. Later in this chapter the example will be extended to include taxes and subsidies.

4. 'Balancing items' are determined residually rather than being measured directly. The term is explained more fully in chapter 5.

5. When a business is incorporated, the distinction between compensation of employees and gross operating surplus is clear. However, for an unincorporated business the distinction between the labour services provided by the owner and the entrepreneurial or capital services also provided by him or her is arbitrary. Accordingly, the owner's compensation as an employee and his/her gross operating surplus are merged as one form of income called **gross mixed income**.

6. In the past, the term 'commodities', was generally used as the alternative to 'goods and services'. However, SNA 2008 uses the term 'products' instead of 'commodities', citing this as being more reflective of recent usage (see page 271), and this is also the practice in this volume.

7. Supply and use product statistics are also available in time series from 1997 to date for 466 product classes, and in time series from 1961 to date for 246 product classes. They are also available in a more highly aggregated summary table with 74 product classes.

8. SNA 2008 defines an establishment as "an enterprise, or part of an enterprise, that is situated in a single location and in which only a single productive activity is carried out or in which the principal productive activity accounts for most of the value added" (page 89). Recall from chapter 3 that the defining characteristics of an institutional unit are that it can own goods and assets, can incur liabilities and can engage in economic activities and transactions with other units in its own right. An establishment, therefore, may or may not be an institutional unit. Establishments can be thought of as factories, plants, office buildings, stores, clinics or other such units.

9. SNA 2008 states that "An industry consists of a group of establishments engaged in the same, or similar, kinds of activity" (page 87).

10. Supply and use industry statistics are also available in time series from 1997 to date for 187 industry aggregates, and in time series from 1961 to date for 111 industry aggregates. They are also available in a more highly aggregated summary table with 35 industry aggregates.

11. They are collected from producers in the sense that it is they who are responsible for securing and paying the tax to the government. The way in which the producer and the purchaser share the burden of these taxes is an analytical question that is not easily answered. It involves the comparison of the real world outcome where the tax exists with a hypothetical situation in which there is no tax. The national accounts do not directly address questions of **tax incidence** such as this.

12. See *SNA 2008*, pages 143 and 144. The generation of income account is explained in section 4.3.3.

13. Note that government grants to enterprises to assist in the financing of capital formation or to compensate for damage to capital assets are not considered to be subsidies. Assistance payments of this kind are referred to as **capital transfers**. They will be discussed in chapter 5.

14. Again, the incidence of subsidies on producers and purchasers—the extent to which they result in lower prices paid by purchasers compared to the hypothetical situation in which there are no subsidies—is not what is being referred to here.

15. SNA 2008 also uses the term **producers' prices**, but the Canadian SNA generally avoids use of this phrase. "The preferred method of valuation of output is at basic prices, although producers' prices may be used when valuation at basic prices is not feasible. The distinction is related to the treatment of taxes and subsidies on products. Basic prices are prices before taxes on products are added and subsidies on products are subtracted. Producers' prices include, in addition to basic prices, taxes less subsidies on products other than value added type taxes." See *SNA 2008*, page 22. In earlier versions of the SNA an additional valuation, referred to as 'factor cost', was also employed. This valued a product based on the cost of its factors of production without regard to taxes on production, taxes on products and subsidies.

16. Canada adheres to the SNA 2008 concept of value added at basic prices. However, for convenience this concept is modified slightly in the valuation of output, although the derived value added is at basic prices. For an explanation, see Annex 4.1.

17. If the purchaser is another producer, acquiring the product for purposes of intermediate consumption, the deductible portion of GST and HST is excluded from the purchasers' price since that part of these taxes, while paid initially, is fully compensated subsequently.

18. Sometimes FOB stands for "freight on board" rather than "free on board". The two terms mean the same thing. The alternative to FOB valuation is referred to as "cost, insurance, freight" (CIF) which means that the value of the traded goods includes insurance, freight and other costs for delivering the goods to the border of the importing country.

19. SNA 2008, page 279.

20. In this portrayal of the fundamental identity, margins for transportation, wholesaling, retailing and the like are included in output as production from the corresponding margin industries.

21. **Final domestic demand** is equal to final consumption expenditures by households, NPISHs and governments plus gross fixed capital formation expenditures. Note that the term 'capital formation' includes changes in inventories whereas the term 'fixed capital formation' excludes changes in inventories.

22. In the final expenditure approach, expenditures by households, governments, businesses and non-residents on goods and services actually involves expenditure on imported goods and services as well as domestically produced ones, since these are embedded within the measured expenditures. Since the imported goods and services are not part of Canadian production, they are subtracted in aggregate.

23. See paragraph 14.11, page 272. "Consolidation may cover various accounting procedures. In general, it refers to the elimination from both uses and resources of transactions which occur between units that are grouped together and to the elimination of financial assets and the counterpart liabilities." SNA 2008, page 22.

24. There is no production account for the non-resident sector because it is a non-producing sector from Canada's perspective. At time of writing, the production accounts for the Canadian institutional sectors had not yet been developed, although this is planned.

25. The traditional supply table shows imports as a positive source of supply and includes all the margins to allow the valuation of supply at purchasers' prices.

26. Each of the three tables contains over 1.5 million cells and the three tables combined contain about 5 million cells, many with zero values.

27. As mentioned in chapter 3, non-residents are institutional units residing outside the boundaries of the domestic economy that transact with or have other economic links with institutional units residing within the territory of the economy.

28. Although establishments located in Canada may be owned by non-residents, their output is considered to be domestic Canadian output, **not** non-resident output.

29. Imputed rents on owner-occupied dwellings are discussed in chapter 5.

30. There are 14 regions in the domestic economy: 10 provinces, 3 territories and "outside Canada". The latter is a small region encompassing embassies and military bases abroad.

31. Re-exports consist of the export of goods that were previously imported.

32. Supply and use final demand statistics are also available in time series from 1997 to date for 261 final demand categories, and in time series from 1961 to date for 145 final demand categories. They are also available in a more highly aggregated summary table with 25 final demand categories.

33. An excellent reference book on the subject of price and volume indexes, available free online, is *Consumer Price Index Manual*: *Theory and Practice*, published jointly by the International Labour Organization, the International Monetary Fund, the Organization for Economic Cooperation and Development, Eurostat, the United Nations and the World Bank in 2004.

34. A manual explaining this methodology was published in 2001 and is available without charge on the Statistics Canada Internet site. See *A Guide to Deflating the Input-Output Accounts: Sources and Methods*, catalogue number 15F0077G.

35. The machinery and equipment price indexes, the housing price indexes and the farm input price indexes are also used. Average weekly earnings are used to deflate some service products for which price indexes are unavailable. In a few cases, physical quantity projectors are used to estimate the volume component and the price change component is calculated residually.

36. Recall that the supply, use and final demand tables each have over 1.5 million cells to estimate.

37. For example, in the case of manufacturing industries, output as measured by the Monthly Survey of Manufacturing is deflated by the corresponding producer price index and this volume series is used as the gross value added projector. For many government services industries hours worked by employees are the projector. For more information see ***Gross Domestic Product by Industry: Sources and Methods with Industry Details***, 2006, catalogue number 15-548-XIE.

38. For further discussion of benchmarking methods see Bloem, Adriaan, J. Dippelsman and N. Maehle, *Quarterly National Accounts Manual: Concepts, Data Sources and Compilation*, International Monetary Fund, Washington D.C., 2001, chapter VI.

39. This lack of consistency in aggregation is true for all chain indexes.

40. The income and expenditure accounts are explained in chapter 5.

41. Real GDP by industry is calculated at basic prices while real GDP derived from final expenditures by the institutional sectors is calculated at market prices. This difference in valuation affects the dollar levels of the two GDP series but typically has a negligible impact on the difference in quarterly growth rates of the two series.

42. The quarterly income-based estimates of GDP at market prices have an industry dimension like that of the real GDP by industry estimates, but the former are not available at constant prices. See chapter 5.

43. That is to say, when the real GDP by industry estimates for the third month of a quarter are being prepared.

44. Perhaps the most important difference between the methodology of the annual provincial and territorial estimates and that of the monthly national estimates is that while the latter uses fixed weights from the most recent supply and use benchmark year to aggregate the contribution of any lowest-level industry to any higher-level industry at constant prices, the former produces estimates of gross value added at current prices for each lowest-level industry for the years following the most recent supply and use benchmark year and uses these estimates to weight the contributions of those industries to higher-level aggregates at constant prices using the Fisher index number formula. The two approaches sometimes yield very different national results, before benchmarking.

45. For example, by looking at the year-to-year changes in the shares of energy-related inputs in the total inputs of industries, after allowing for relative price changes, it is possible to draw conclusions about the extent to which energy-efficiency is improving over time.

46. An example in this case is the rise and fall of the shares of consumer-discretionary products in total consumer demand over the course of the business cycle.

47. A multiplier measures how much an endogenous variable changes in response to a change in an exogenous variable. If exports of oil and gas were treated as exogenous and they increased by $1.0 billion, while as a result the output of oil and gas in the domestic economy increased by $1.5 billion, then the multiplier would be 1.5/1.0 = 1.5. See Statistics Canada, *National and Provincial Multipliers*, catalogue number 15F0046X.

48. Leontief spent most of his life (1906-1999) working on this general topic. See, in particular, his publication *Input-Output Economics*, 2nd edition, New York: Oxford University Press, 1986.

49. Leontief was evidently a great teacher as well since three of his doctoral students have also been awarded the prize: Paul Samuelson in 1970, Robert Solow in 1987 and Vernon Smith in 2002.

50. The structure of the basic Canadian supply and use model is explained in detail in Ziad Ghanem, "The Canadian and Inter-Provincial Input-Output Models: The Mathematical Framework," Statistics Canada, April 2010. See also "User's Guide to the Canadian Input-Output Model," Statistics Canada, June 2009.

51. A paper entitled "The guide to using the input-output simulation model" is available free of charge upon request. Both the national and the interprovincial models can be obtained on electronic media for a fee. See *Input-Output Model Simulations (National Model)*, catalogue number 15F0004X and *Input-Output Model Simulations (Interprovincial Model)*, catalogue number 15F0009X.

52. Low-income households are entitled to HST tax credits, but these are not related to household expenditures and accordingly are not called 'rebates'. Rebates of HST paid on the purchase of new residential housing can also be claimed under some circumstances, which vary by province.

53. For a full explanation of the 'modified basic prices' concept and a discussion of the pros and cons of this approach, see Y.M. Siddiqi and M. Salem, "Implementing the 1993-SNA Recommendation on Valuation in Canadian Input-Output Accounts," paper presented at the 12th International Conference on Input-Output Techniques, May 18-22, 1998, New York, N.Y. This paper is available on the Internet at www.iioa.org/conferences/12th/pdf/siddsale.pdf.

54. Around the world, most countries do not deflate their supply and use tables. For them, this complication is not relevant and there is no need to modify the way basic prices are defined.

55. The reader is cautioned, though, that this is not true in all cases. Notable exceptions are some food items produced by the agriculture industry.