CHAPTER 2: THE MEASUREMENT AND STRUCTURE OF THE CANADIAN ECONOMY

LEARNING OBJECTIVES

I. Goals of Chapter 2
   A. National income accounts; relationships between key macroeconomic variables (Sec. 2.1)
   B. Gross domestic product—the main measure of output (Sec. 2.2)
   C. Saving and wealth—private and government (Sec. 2.3)
   D. Real GDP, Price indexes, and inflation—macroeconomic variables not in the national income accounts (Sec. 2.4)
   E. Interest rates – real versus nominal interest rates (Sec. 2.5)

II. Notes to Sixth Edition Users
   A. Figures, Tables, and their corresponding text have been updated.
   B. Answers for analytical problems #5 are updated.

TEACHING NOTES

I. National Income Accounting: The Measurement of Production, Income, and Expenditure (Sec. 2.1)
   A. Three alternative approaches give the same measurements
      1. Product approach: the amount of output produced
      2. Income approach: the incomes generated by production
      3. Expenditure approach: the amount of spending by purchasers
   B. Juice business example shows that all three approaches are equal
      1. Important concept in product approach: value added = value of output minus value of intermediate inputs
   C. Why are the three approaches equivalent?
      1. They must be, by definition
      2. Any output produced (product approach) is purchased by someone (expenditure approach) and results in income to someone (income approach)
      3. The fundamental identity of national income accounting: total production = total income = total expenditure (Note in Chapter 5 an open economy is considered in which a country's spending need not equal its production in every period.)
      4. A Closer Look 2.1: The Canadian system of national economic accounts
         (a) In Canada, most of the data macroeconomists use to test their theories are produced by Statistics Canada (www.statcan.gc.ca)
         (b) The most important source of data is the Canadian System of National Economic Accounts (CSNEA)
         (c) The World Bank, IMF, OECD and the UN all provide data describing the economies of many countries

II. Gross Domestic Product (Sec. 2.2)
   A. The product approach to measuring GDP
      1. GDP is the market value of final goods and services newly produced within a national boundary during a fixed period of time

Data Application

The *period* referred to here is either a quarter or a year. You may want to show your students what some of the tables from the National Income and Expenditure Accounts look like, or send them to the library to find the accounts in the *Canadian Economic Observer.* Alternatively, you could direct your students to www.statscan.gc.ca (the homepage for Statistics Canada) or CANSIM I (for historical data) and II (for current data) if your institution subscribes to it. Students may also be interested in seeing what happens in the financial markets and to public opinion on the day a new national income and expenditure accounts release (especially the advance release) comes out.

2. Market value: allows adding together unlike items by valuing them at their market prices
   a. Problem: misses nonmarket items such as homemaking, the value of environmental quality, and natural resource depletion Analytical Problems 1 and 4 both discuss difficulties in counting nonmarket items for GDP, including the important idea that GDP is not the same as welfare.
   b. There is some adjustment to reflect the underground economy
   c. Government services (that aren't sold in markets) are valued at their cost of production
3. Newly produced goods and services: counts only things produced in the given period; excludes things produced earlier
4. Final goods and services
   a. Don't count intermediate goods and services
   b. Capital goods (goods used to produce other goods) are final goods since they aren't used up in the same period that they are produced
   c. Inventory investment (the amount that inventories of unsold finished goods, goods in process, and raw materials have changed during the period) is also treated as a final good

Data Application

People are often surprised to see how large inventory swings may be from quarter to quarter. For example, in the last quarter of 1990 real inventories fell by over $3.6 billion (1986 dollars), around half the total decline in real GDP of about $7 billion in that recession quarter.

   d. Adding up value works well, since it automatically excludes intermediate goods
5. GNP vs. GDP
   a. GNP = output produced by domestically owned factors of production
      GDP = output produced within a nation
   b. GDP = GNP – NFP (net factor payments from abroad)
   c. NFP = payments to domestically owned factors located abroad minus payments to foreign factors located domestically

Analytical Problem 2 has students see the relationship between GDP and GNP.

Data Application

While the use of GDP as a measure of production has been conventional in Canada and Europe, prior to December 1991, the United States used GNP as its main measure of production; after that time GDP became the main concept. The main reasons for the switch were that GDP is more relevant to production in an open economy (though GNP is more relevant for income), and GDP is more precise than GNP in the advance estimate, since net factor payments are difficult to measure quickly.

d. Example: Engineering revenues for a road built by a Canadian company in Saudi Arabia is part of Canadian GNP (built by a Canadian factor of production), not Canadian GDP, and is part of Saudi GDP (built in Saudi Arabia), not Saudi GNP
e. Difference between GNP and GDP is less than 2% for Canada, while it is less than 1% for the United States.

6. A Closer Look 2.2: Natural resources, the environment, and the national income accounts
   (a) A good deal of Canada's economic well-being is due to its substantial stocks of natural resources
   (b) The exploitation of natural resources produces costs that are difficult to measure accurately
   (c) In the early 1990s, Statistics Canada developed a system of environmental and resource accounts – it provides inflation on the stock of natural resources, the use of those resources and the pollutants produced by their exploitation
   (d) The accounts also report the production of pollutants by industry and by sector of the economy – these help policy makers to focus attention on environmental issues and to design effective mechanisms to price natural resources appropriately

Data Application

The timeline for national income and product amount releases is generally:

Advance release	Last week of month following end of quarter
Preliminary release	Last week of second following month
Final release	Last week of third following month

Revisions occur every July for the following three years, then every fifth year for a new benchmark release. Each new release contains either additional new data that was not available before, or a change in seasonal factors, or a correction of errors made previously.

B. The expenditure approach to measuring GDP
   1. Measures total spending on final goods and services produced within a nation during a specified period of time
   2. Four main categories of spending: consumption (C), investment (I), government purchases of goods and services (*G*), and net exports (*NX*)
   3. $Y = C + I + G + NX$, the income-expenditure identity

4. Consumption: spending by domestic households on final goods and services (including those produced abroad)
    a. About 60% of Canadian GDP
    b. Four categories
        (1) Consumer durables (examples: cars, TV sets, furniture, major appliances)
        (2) Semi-durables (examples: clothing)
        (3) Nondurable goods (examples: food, utilities, fuel)
        (4) Services (examples: education, health care, financial services, transportation)
5. Investment spending for new capital goods (fixed investment) plus inventory investment
    a. About 1/6 of Canadian GDP
    b. Business (or non-residential) fixed investment, spending by businesses on structures and equipment

Data Application

Note that the consumption category in the national income and expenditure accounts does not correspond to economists' concept of consumption, because it includes the full value of durable goods. When economists study consumption behaviour, they must account for this; one way to do so is to assume that durable goods provide services that are proportional to their existing stock. Total consumption is this fraction of the stock of consumer durables, plus nondurables and services.

    c. Residential fixed investment: spending on the construction of houses and apartment buildings
    d. Machinery and equipment investment: spending on machines, tools and vehicles
6. Government purchases of goods and services: spending by the government on goods or services
    a. About 1/5 of Canadian GDP
    b. Most by provincial and local governments, not federal government
    c. Not all government expenditures are purchases of goods and services
        (1) Some are payments that are *not* made in exchange for current goods and services

Data Application

People often don't realize how large transfer programs are relative to federal government purchases.

For example, in 2009 government purchases were $337.7 billion out of total government expenditures (including the Canadian Pension Plan) of $631.3 billion. Federal government expenditures included $72.0 billion of transfers payments to individuals and businesses, $29.2 billion in grants to provincial and local governments, and $28.98 billion in interest payments.

(2) One type is transfers, including public pension payments, welfare, and unemployment benefits.
(3) Another type is interest payments on the government debt

7. Net exports: exports minus imports
   a. Exports: goods produced in the country that are purchased by foreigners
   b. Imports: goods produced abroad that are purchased by residents in the country
   c. Imports are subtracted from GDP, as they represent goods produced abroad, and were included in consumption, investment, and government purchases

C. The income approach to measuring GDP
   1. Adds up income generated by production (including profits and taxes paid to the government)
      a. Net National income = labour income + corporate profits + interest and investment income + unincorporated business income
      b. Net National income + indirect taxes-subsidies = net domestic product
      c. Net domestic product + depreciation = gross domestic product (GDP)
      d. GDP + net foreign income (NFP) = GNP
   2. Private sector and government sector income
      a. Private disposable income = income of the private sector = private sector income earned at home (*Y* or GDP) and abroad *(NFP*) + payments from the government sector (transfers *TR,* and interest on government debt, *INT*) – taxes paid to government (*T*) = *Y + NFP + TR + INT – T (2.4)*
      b. Net government income = taxes – transfers – interest payments *= T – TR – INT (2.5)*
      c. Private disposable income + net government income = GDP + *NFP* = GNP

Numerical Problems 1,2, 3, and 4 give practice in working with the national income and product accounts.

III. Saving and Wealth (Sec. 2.3)
   A. Wealth
      1. Household wealth = a household's assets minus its liabilities
      2. National wealth = sum of all households', firms', and governments' wealth within the nation
      3. Saving by individuals, businesses, and government determine wealth
   B. Measures of aggregate saving
      1. Saving = current income – current spending
      2. Saving rate = saving / current income
      3. Private saving = private disposable income – consumption
         S_{pvt} = (Y + NFP – T+ TR + INT) – C (2.6)
      4. Government saving = net government income – government purchases of goods and services

S_{govt} = (T – TR – INT) – G (2.7)

a. Government saving = government budget surplus = government receipts – government outlays
b. Government receipts = tax revenue (*T*)
c. Government outlays = government purchases of goods and services (*G*) + transfers (*TR*) + interest payments on government debt (*INT*)
d. Government budget deficit = $-S_{govt}$

5. National saving
   a. National saving = private saving + government saving
   b. $S = S_{pvt} + S_{govt}$
      = [Y + NFP – T+ TR + INT – C] + [T – TR – INT – G]
      = Y + NFP – C – G = GNP – C – G (2.8)

C. The uses of private saving
1. S = I+ (NX + NFP) = I + CA (2.9 and 2.10)
   Derived from S = Y+ NFP – C – G and Y= C + I+ G + NX
   CA = *NX* + *NFP* = current account balance
2. S_{pvt} = I+ ($-S_{govt}$) + CA (using $S = S_{pvt} + S_{govt}$)
   The uses-of-saving identity—saving is used in three ways:
   a. investment (I)
   b. government budget deficit ($-S_{govt}$)
   c. current account balance *(CA)*

D. Application: Uses of savings and the government budget deficit in Canada
1. Text Fig. 2.1 illustrates the uses-of-saving identity for Canada, plotting private saving, investment, the government deficit, and the current account balance for Canada from 1961 to 2009

Analytical Problem 3 has students consider the effect of a price change on spending. Numerical Problem 5 provides practice in calculating consumption, net exports, GDP, net factor payments from abroad, private saving, government saving, and national saving.

E. Relating saving and wealth
1. Stocks and flows
   a. Flow variables: measured per unit of time (GDP, income, saving, investment)
   b. Stock variables: measured at a point in time (quantity of money, value of houses, capital stock)
   c. Flow variables often equal rates of change of stock variables
2. Wealth and saving as stock and flow (wealth is a stock, saving is a flow)
3. National wealth
   a. Country's domestic physical assets (capital goods and land)
   b. Country's net foreign assets = foreign assets (foreign stocks, bonds, and capital goods owned by domestic residents) minus foreign liabilities (domestic stocks, bonds, and capital goods owned by foreigners)
   c. Changes in national wealth

(1) Changes in value of existing assets and liabilities (change in price of financial assets, or depreciation of capital goods)
(2) National saving ($S = I + CA$) raises wealth

IV. Real GDP, Price Indexes, and Inflation (Sec. 2.4)
A. Real GDP
1. Nominal variables (in dollar terms)
2. Problem: Do changes in nominal values reflect changes in prices or quantities?
3. Real variables: adjust for price changes; reflect only quantity changes
4. Example Table 2.4
5. Alternative price indexes
B. Real vs. nominal GDP

Data Application

The distinction between nominal and real GDP can be very important in practice. Between 1981 and 1982 nominal GDP rose by 5.2%, but real GDP fell by 3.2%.

Numerical Problem 6 provides practice in calculating real and nominal GDP and price indexes given several goods with different prices and quantities in two years.

C. Price indexes
1. GDP deflator = nominal GDP/real GDP, where real GDP is calculated by deflating each component of GDP separately; variable-weight index
2. Variable-weight index P = value of current output at current prices/value of current output at base-year prices; example: GDP deflator
3. Fixed-weight price index P = value of fixed basket at current prices/value of fixed basket at base-year prices; example: CPI

Data Application

There are two price indexes available for consumption expenditures: the implicit price deflator' for personal expenditures, and the consumer price index (CPI). The first is available only quarterly, while the CPI is available monthly.

4. Note that base year $P = 1$ or $P = 100$
5. Some problems with both types of indexes
a. Variable-weight index: Current output may include goods that didn't exist or were of different quality than in base year
b. Fixed-weight index: reflects basket of goods purchased in base year instead of current year

6. A Closer Look 2.3: The computer data revolution and chain-weighted GDP
(a) It is a compromise between using the current period as the base period and using the previous period as the base period
(b) It was introduced to solve the problem of choosing a given year as a base year in calculating GDP
7. A Closer Look 2.4: Does CPI inflation overstate increases in the cost of living?
(a) One reason is the difficulty that government statisticians face in trying to measure change in the quality of goods

(b) Another problem is that CPI based on the assumption that consumers purchase a basket of goods and services that is fixed over time

Data Application

The fact that it is difficult to handle new goods or goods whose quality has changed makes it especially difficult to compute price indexes. If you use a recent year as the base year, for example, it gives a large weight to the prices of computers; yet it would have cost a fortune 30 years ago to get the same computing power that is now available on a desktop PC costing $1000 today. This fact can lead to distortions in price indexes that use a particular base year. Because of this problem, Statistics Canada uses indexes that do not rely on a fixed base year. One is a chain-weighted index, in which the weights change each benchmark: year (about once every five years). These indexes are especially valuable when studying the economy over long periods of time, when there have been substantial changes in relative prices (so that the fixed-base-year index is misleading).

D. Inflation

1. Calculate inflation rate: $\pi_{t+1} = (P_{t+1} - P_t)/P_t = \Delta P_{t+1}/P_t$

Text Fig. 2.2 shows the Canadian inflation rate for 1945–2009.

Data Application

There are many problems with price indexes; they are imperfect measures of price changes. What do the indexes do when new goods are introduced? What happens as more efficient stores replaces stores that had higher intermediate costs? How do We account for the fact that people substitute cheaper goods for higher-priced goods? Inadequate treatment of these questions means the measures of prices give an overestimate of the inflation rate of perhaps 0.5%. So a measured inflation rate of 0.5% might really mean that the true average price level is constant. See A Closer Look 2.4

Numerical Problems 6, and 7 give practice in calculating inflation rates.

V. Interest rates (Sec. 2.5)

1. Real vs. nominal interest rates
   a. Real interest rate: real return to an asset
   b. Nominal interest rate: nominal return to an asset
   c. Real interest rate = $i - \pi$ (2.12)

      Figure 2.3 plots nominal and real interest rates for Canada from 1951 to 2009.
2. The expected real interest rate
   a. $r = i - \pi^e$ (2.13)
   b. If $\pi = \pi^e$, real interest rate = expected interest rate

Numerical Problem 8 provides practice in calculating nominal and real interest rates.

ADDITIONAL ISSUES FOR CLASSROOM DISCUSSION

1. How Much Do GDP Comparisons Tell Us?

National income accounting data are used to compare production and prices between very different countries and within the same country over long periods of time. What problems does this involve? Are there any alternatives?

Making comparisons of prices or GDP over long periods of time or from county to country is difficult because the underlying economies vary. For example, if you compare GDP in the 2000s with estimate of GDP in the 1950s, you will find that the increase in output per capita may not give a good indication of a change in welfare of the population. For example, in 1950 few convenience foods were available in the grocery store. One purchases chicken or peas or potatoes. There were no frozen french fries or microwave fried chicken. The productive activity that takes place in the individual kitchen is not counted in GDP. If you make your own french fries, GDP is lower than if you pay to have them made. Similar difficulties occur when you attempt to compare figures across countries, especially when the countries have very different expectations or productive situations. For example, the GDP of many developing countries will tend to be low, in part because those who live on the land raise their own food and its value is imperfectly included in GDP. In a country like Canada, farmers specialize, growing wheat or raising pigs for market, and buying flour and bacon at the supermarket. Although the amount of food consumed by the average citizen may or may not be similar, the amount included in GDP is larger in the second case.

What other ways can we use to compare well-being that are not subject to these problems? There are many other statistics that can give us a view of economic welfare across different societies.

Figures on life expectancy, caloric intake, hours of work per week, energy consumption, availability of education, and infant mortality are among those that have been used to see how people in various societies fare. Students can discuss how effective they think these measures would be in determining the welfare of those living in different societies, e.g. the well-publicized UN comparisons.

2. Does It Make a Difference Which Type of Price Index One Chooses?

Price indexes generally move together. As long as the basket of goods that people consume doesn't change too much, then fixed-weight and variable-weight price indexes give similar measures of inflation.

Different methods of calculation usually give answers that vary by only small amounts. For example, let's assume that we have an economy producing only three commodities: jeans, haircuts, and textbooks. The quantities and prices of each good produced in year 1 and year 2 are given below.

	Year 1		Year 2	
	Number	Price	Number	Price
Jeans	1000	$25	1200	$30
Haircuts	5000	5	4000	5
Textbooks	3000	50	3000	55

If we use a fixed-weight price (like the CPI), and year 1 is the base year, the total cost of the goods

in year 1 is 1000 × $25 = $25 000 (market value of jeans in year 1) + 5000 x $5 = $25,000 (market value of haircuts in year 1) + 3000 x $50 = $150 000 (market value of textbooks in year 1) for a total of $200 000. In year 2, the same market basket will cost $220,000 calculated as follows: 1000 x $30 = $30 000 (year 1 sales of jeans at year 2

prices) + 5000 × $5 = $25 000) year 1 sales of haircuts at year 2 prices) + 3000 x $55 = $165,000 (year 1 sales of textbooks at year 2 prices). Our price index for year 2 is the cost of the year 1 quantities in year 2 divided by the cost of year 1 quantities in year 1 = $220 000/$200 000 − 1.1. On average, prices rose 10%.

Note that the price of jeans rose 20%, that of haircuts was unchanged, and that of textbooks rose 10%. Not all prices must rise for the price index to rise. Also the average price increase for the economy is close to the rise in the price of textbooks, the largest part of the economy.

A variable-weight index (like the GDP deflator) is calculated by dividing the value of current outl3ut at current prices by the value of current output at base-year prices. In our example in year 2 the value of current output at current prices is 1200 x $30 = $36 000 (market value of jeans in year 2) + 4000 × $5 = $20 000 (market value of haircuts in year 2) + 3000 × $55 = $165 000 (market value of textbooks in year 2) for a total of $221 000. The value of current output at base-year prices is 1200 × $25 = $30 000 (value of quantity of jeans bought in year 2 in year 1 prices) + 4000 × $5 = $20 000 (value of quantity of haircuts bought in year 2 in year 1 prices) + 3000 × $50 = $150 000 (value of quantity of textbooks bought in year 2 in year 1 prices) for a total of $200 000. The index is calculated as $221 000/$200 000, or 1.105. On average, prices rose 10.5%.

However, if the basket changes radically between periods, the answers can be quite different, the fixed-weight basket weights the most-consumed goods in the base year most heavily. A variable-weight emphasizes changes in prices of the most-consumed goods in the current year.

3. Does Greater GDP Always Mean Greater Human Welfare?

Most nations wish to improve the well-being of their populations. Although economists often articulate the need for a steady increase in economic output, low unemployment, and minimal inflation, people also have a variety of other goals. Students can be asked to think about the importance of such environmental issues as clean air, safe water, and the survival of wild rivers.

People desire an adequate supply of goods and services, employment for all, and stable prices. They also want to live in an area that is safe, pleasant, and in which they can freely follow the activities that appeal to them. These goals are interrelated, but not always in positive ways. An increase in output is likely to result in additional employment. However, the need for additional raw materials to produce that output may interfere with the enjoyment of nature and outdoor sports. Additional logging may reduce the availability of forests and other wilderness areas for recreation, or threaten wildlife. Extraction of minerals may result in unsightly holes in the countryside and mine tailings that pollute rivers, but on the positive side may provide many opportunities for work at good wages. Though factories provide jobs, they may be undesirable neighbours in residential areas. Thus economic goals must be considered along with environmental ones.

ANSWERS TO TEXTBOOK PROBLEMS

Review Questions

1. The three approaches to national income accounting are the product approach, the income approach, and the expenditure approach. They all give the same answer because they are designed that way; any entry based on one approach has an entry in the other approaches with the same value. Whenever output is produced and sold, its production is counted in the product approach, its sale is counted in the expenditure approach, and the funds received by the seller are counted in the income approach.
2. Goods are measured at market value in GDP accounting so that different types of goods and services can be added together. Using market prices allows us to count up the total dollar value of all the economy's output. The problem with this approach is that not all goods and services are sold in markets, so we may not be able to count everything. Important examples are homemaking and environmental quality.
3. Intermediate goods and services are used up in producing other goods in the same period (year) in which they were produced, while final goods and services are those that are purchased by consumers or are capital goods that are used to produce future output. The distinction is important, because we want to count only the value of final goods produced in the economy, not the value of goods produced each step along the way.
4. The four components of spending are consumption, investment, government purchases, and net exports. Imports must be subtracted, because they are produced abroad and we want GDP to count only those goods and services produced within the country. For example, suppose a car built in Japan is imported into Canada. The car counts as consumption spending in Canadian GDP, but is subtracted as an import as well, so on net it does not affect Canadian GDP. However, it is counted in Japan's GDP as an export.
5. Private saving is private disposable income minus consumption. Private disposable income is total output minus taxes paid plus transfers and interest received from the government. Private saving is used to finance investment spending, the government budget deficit, and the current account. National saving is private saving plus government saving.
6. National wealth is the total wealth of the residents of a country, and consists of its domestic physical assets and net foreign assets. Wealth is important because the long-run economic well-being of a country depends on it. National wealth is related to national saving because national saving is the flow of additions to the stock of national wealth.
7. Real GDP is the useful concept of figuring out a country's growth performance. Increases in nominal GDP may be due simply to increase in prices rather than growth in output.
8. The GDP deflator is a variable-weight index. It takes the value of current output at current prices divided by the value of current output at base-year prices to arrive at an index value. The CPI is a fixed-weight index, using the value of a fixed set of consumer goods and services at current prices divided by the value of the fixed set at base-year prices. The GDP deflator covers all the output of the economy, while the CPI uses only a fixed set of consumer goods and services, including imported as well as domestically produced goods and services.

9. The nominal interest rate is the rate at which the nominal (or dollar) value of an asset increases over time. The real interest rate is the rate at which the real value or purchasing power of an asset increases over time, and is equal to the nominal interest rate minus the inflation rate. The expected real interest rate is the rate at which the real value of an asset is *expected* to increase over time. It is equal to the nominal interest rate minus the expected inflation rate. The concept that is most important to borrowers and lenders is the expected real interest rate, because it affects their decisions to borrow or lend.

Numerical Problems

1. GDP is the value of all final goods and services produced during the year. The final output of coconuts is 1000, which is worth 500 fish, because two coconuts are worth one fish. Of the 500 fish caught during the year, the 100 fish used as fertilizer are an intermediate good, so the final output is 400 fish. So in terms of fish, GDP consists of 500 fish worth of coconuts plus 400 fish, with a total value of 900 fish.

   To find consumption and investment, we must find out what happens to all the coconuts and fish. Gilligan consumes all his 200 coconuts (worth 100 fish) and 100 fish, so his consumption is worth 200 fish. The Professor stores 100 coconuts with a value of 50 fish. In an ideal accounting system, these stored coconuts would be treated as investment. However, in the national income accounts, because it is so difficult to tell when durable goods are consumed and when they are saved, they are counted as consumption. So the Professor's consumption consists of 800 coconuts (value 400 fish) and 300 fish, for a total of 700 fish. Thus the economy's total consumption is valued at 900 fish and investment is zero.

   In terms of income, Gilligan's income is clearly worth 200 fish (100 fish plus 200 coconuts worth 100 fish). The Professor's income is less easily calculated, because he uses 100 fish to fertilize the coconut trees. These 100 fish are therefore not income to him. Thus the Professor's income is 800 coconuts (1000 coconuts minus the 200 coconuts paid to Gilligan) plus 300 fish (500 fish minus 100 fish paid to Gilligan and minus 100 fish used as fertilizer). In terms of fish, the Professor's income is 700 fish.

   This question illustrates some of the nuances of national income accounting. Many difficult choices and measurement issues are involved in constructing the accounts. Here, for example, it is clear that what we call consumption really isn't just the amount of goods consumers use up during the year, but also includes consumption goods that are purchased but saved for the future. Since there is no way to measure when goods are used after they are purchased, the accounts are unable to distinguish consumption from storage of goods.

   Another subtlety is the treatment of the fish used as fertilizer. If the fertilizer increases *future* output rather than current output, then the fertilizer is not used up during the year and represents investment of 100 fish. In this case, GDP would equal 1000 fish, consumption is 900 fish, investment is 100 fish, the Professor's income is 800 fish, and Gilligan's income is 200 fish.

2. a. Furniture made in Quebec that is bought by consumers counts as consumption, so consumption increases by $600 million, investment is unchanged, government purchases are unchanged, net exports are unchanged, and GDP increases by $600 million.

   b. Furniture made in Sweden that is bought by consumers counts as consumption and imports, so consumption increases by $600 million,

investment is unchanged, government purchases are unchanged, net exports fall by $600 million, and GDP is unchanged.

c. Furniture made in Quebec that is bought by businesses counts as investment, so consumption is unchanged, investment increases by $600 million, government purchases are unchanged, net exports are unchanged, and GDP increases by $600 million.

d. Furniture made in Sweden that is bought by businesses counts as investment and imports, so consumption is unchanged, investment increases by $600 million, government purchases are unchanged, net exports decline by $600 million, and GDP is unchanged.

3. a. ABC produces output valued at $2 million and has total expenses of $1.3 million ($1 million for labour, $0.1 million interest, $0.2 million taxes). So its profits are $0.7 million. XYZ produces output valued at $3.8 million ($3 million for the three computers that were sold, plus $0.8 million for the unsold computer in inventory) and has expenses of $3.2 million ($2 million for components, $0.8 million for labour, and $0.4 million for taxes). So its profits are $0.6 million.

According to the product approach, the GDP contributions of these companies are $3.8 million, the value of the final product of XYZ. ABC's production is of an intermediate good, used completely by XYZ, and so is not counted in GDP.

According to the expenditure approach, the GDP contribution is also $ 3.8 million, with $3 million (of sold computers) adding to the capital stock (as investment spending), and $0.8 million (the unsold computer) as inventory investment.

The income approach yields the same GDP total contribution. The amounts are:

	ABC	XYZ	Total
Labour	$1.0 million	$0.8 million	$1.8 million
Profit	$0.7 million	$0.6 million	$1.3 million
Taxes	$0.2 million	$0.4 million	$0.6 million
Interest	$0.1 million	$0.0 million	$0.1 million

Total of all incomes = $3.8 million

b. If ABC pays an additional $.5 million for computer chips from abroad, the results change slightly. The correct answer is easiest to see using the expenditure approach. As in part a, there is $3.8 million expenditure on final goods, but not there are also net exports of –$5 million. So the total expenditure on domestically produced goods is only $3.3 million. The product approach gets the same answer if it is realized that the $.5 million is a contribution to GDP of the country in which the chips were made, and so must be deducted from the GDP of Canada. The value added in Canada is only $3.3 million. Finally, the income approach gives the same answer as in part a, except that the cost of importing the chips reduces ABC's profits by $.5 million, so the sum of the incomes is only $3.3 million.

4. a. Product approach: $50 = lumber store's value added = $200 product minus $150 value of product produced in the previous year. Expenditure approach:

$200 consumption spending plus inventory investment of –$150. Income approach: $50 paid to the factors of production at the lumber store (wages of employees, interest, taxes, profits).

b. Product approach: $60 000 broker's fee for providing brokerage services.

Expenditure approach: $60 000 counts as residential investment made by the home buyer. The important point here is that the transfer of an existing good, even at a higher value than that at which it was originally sold, does not add to GDP. Income approach: $60 000 income to the broker for wages, profits, etc.

c. Product approach: $20 000 salary plus $8000 child care equals $28 000. Note that there is a sense in which the child care is an intermediate service and should not be counted, because without it the homemaker would not be able to work. But in practice there is no way to separate such intermediate services from final services, so they are all added to GDP Expenditure approach: $28 000 ($8000 consumption spending on child care services plus $20 000 in categories that depend on what job the homemaker has). Income approach: $28 000 ($20 000 compensation of homemaker plus $8000 income to the factors producing the child care: employees' wages, interest, taxes, profits).

d. Product approach: $100 million of a capital good. Since it is produced with local labour and materials, and assuming no payments go to Japanese factors of production, this is all added to Canadian GDP. Expenditure approach: $100 million net exports, since the plant is owned by the Japanese. (It is not part of gross domestic investment because the plant is not a capital good owned by Canadian residents.) Income approach: $100 million paid to Canadian factors of production.

e. Product approach: $0 because nothing is produced. Expenditure approach: $0 because this is a transfer, not a government purchase of goods or services. Income approach: $0, because this is not a payment to a factor of production, just a transfer.

f. Product approach: $5000 worth of advertising services. Expenditure approach: $5000 of government purchases. Income approach: $5000 compensation of employees.

g. Product approach: $120 million composed of $100 million of new cars produced plus $20 million of sales services provided by the consortium ($60 million sales price minus $40 million cost). Expenditure approach: $100 million by Discount Car Rentals as investment plus $60 million by the public for consumption of the used cars minus $40 million of investment goods sold by Discount Car Rentals, for a total of $120 million. Income approach: $100 million to the factors of production of GM plus $20 million in payments to the factors of production and profits for the consortium.

5. Given data: $I = 40$, $G = 30$, $GNP = 200$, $CA = -20 = NX + NFP$, $T = 60$, $TR = 25$, $INT = 15$, $NFP = 7 - 9 = -2$. Since $GDP = GNP - NFP$, $GDP = 200 - (-2) = 202 = Y$. Since $NX + NFP = CA$, $NX = CA - NFP = -20 - (-2) = -18$. Since $Y = C + I + G + NX$, $C = Y - (I + G + NX) = 202 - (40 + 30 + (-18)) = 150$.

$S_{pvt} = (Y + NFP - T + TR + INT) - C = (202 + (-2) - 60 + 25 + 15) - 150 = 30$. $S_{govt} = (T - TR - INT) - G = (60 - 25 - 15) - 30 = -10$. $S = S_{pvt} + S_{govt} = 30 + (-10) = 20$.

a. Consumption = 150

b. Net exports = −18

c. GDP = 202

d. Net factor payments from abroad = −2

e. Private saving = 30

f. Government saving = −10

g. National saving = 20

6. Base-year quantities at current-year prices: at base-year prices:

Apples	3 000 x $3 =	$ 9 000	3000 x $2 =	$ 6 000
Bananas	6 000 x $2 =	$12 000	6000 x $3 =	$18 000
Oranges	8 000 x $5 =	$40 000	8000 x $4 =	$32 000
Total		$61 000		$56 000

Current-year quantities at current-year prices: at base-year prices:

Apples	4 000 x $3 =	$ 12 000	4 000 x $2 =	$ 8 000
Bananas	14 000 x $2 =	$ 28 000	14 000 x $3 =	$ 42 000
Oranges	32 000 x $5 =	$160 000	32 000 x $4 =	$128 000
Total		$200 000		$178 000

a. Nominal GDP is just the dollar value of production in a year at prices in that year.

Nominal GDP is $56 000 in the base year and $200 000 in the current year.

Nominal GDP grew 257% between the base year and the current year: [($200 000 /$56 000) − 1] x 100% = 257%.

b. Real GDP is calculated by finding the value of production in each year at base-year prices. Thus, from the table above, real GDP is $56 000 in the base year and $178,000 in the current year. In percentage terms, real GDP increases from the base year to the current year by [($178 000 / $56 000) − 1] x 100% = 218%.

c. The GDP deflator is the ratio of nominal GDP to real GDP. In the base year, nominal GDP equals real GDP, so the GDP deflator is 1. In the current year, the GDP deflator is $200 000 / $178 000 = 1.124. Thus the GDP deflator changes by [(1.124 / 1) −1] x 100% = 12.4% from the base year to the current year.

d. Nominal GDP rose 257%, prices rose 12.4%, and real GDP rose 218%, so most of the increase in nominal GDP is because of the increase in real output, not prices.

Notice that the quantity of oranges quadrupled and the quantity of bananas more than doubled.

7. Calculating inflation rates:

   1929–30: [(14.0 / 14.2) – 1] x 100% = –1.4%
   1930–31: [(12.7 / 14.0) – 1] x 100% = –9.3%
   1931–32: [(11.5 / 12.7) – 1] x 100% = –9.4%
   1932–33: [(10.9 / 11.5) – 1] x 100% = –5.2%

   These all show deflation (prices are declining over time), whereas recently we have had nothing but inflation (prices rising over time).

8. The nominal interest rate is [(545 / 500) – 1] × 100% = 9%. The inflation rate is [(214 / 200) – 1] x 100% = 7%. So the real interest rate is 2% (9% nominal rate – 7% inflation rate). Expected inflation was only [(210 / 200) – 1] × 100% = 5%, so the expected real interest rate was 4% (9% nominal rate – 5% expected inflation rate).

9. a. The annual rate of inflation from January 1, 2010 to January 1, 2012, is 10%. This can be found by calculating the constant rate of inflation that would raise the deflator from 200 to 242 in two years. This gives the equation $(1 + \pi) \times (1 + \pi) = 242 / 200$, which has the solution $\pi = 10\%$·

      An easy way to think about this question is this. A constant inflation rate of π raises the deflator from 200 on January 1, 2010, to 200 x $(1 + \pi)$ on January 1, 2011, and to 200 × $(1 + \pi) \times (1 + \pi) = 242$ on January 1, 2012. So we need to solve the expression $(1 + \pi)^2 = 242 / 200$.

   b. By similar reasoning, the inflation rate over the three-year period is $(1 + \pi)^3 = 266.2 / 200$, or $\pi = 10\%$.

   c. We can derive a general expression in the same way:

      $1 + \pi = P_1 / P_0$
      $1 + \pi = P_2 / P_1$
      . . .
      . . .
      . . .
      $1 + \pi = P_n / P_{n-1}$
      Multiplying all these lines together, we get:
      $(1 + \pi)^n = (P_1 / P_0) \times (P_2 / P_1) \times \ldots \times (P_n / P_{n-1}) = P_n / P_0$

Analytical Problems

1. To be included in GDP work must be paid employment. If Paula provides care to her child herself, the value of that work is not included in GDP. If, however, Paula pays someone else to mind her child, then the value of that work is included in GDP.

2. Canada's GNP is the market value of final goods and services newly produced by factors of production owned by Canadians. Since ABC Inc. is a Canadian firm, the market value of goods it produces, regardless of where it is produced, is included in Canada's GNP. Canada's GDP, on the other hand, is the market value of final goods and services newly produced within the geographic boundaries of Canada. Since the widgets are produced in Mexico, the value of this production is not included in Canada's GDP.

3. National saving does not rise because of the switch to CheapCall because although consumption spending declines by $2 million, so have total expenditures (GDP), which equal total income. Since income and spending both declined by the same amount, national saving is unchanged.

4. a. The problem in a planned economy is that prices do not measure market value. When the price of an item is too low, then goods are really more expensive than their listed price suggests—we should include in their market value the value of time spent by consumers waiting to make purchases. Because the item's value exceeds its cost, measured GDP is too low.

   When the price of an item is too high, goods stocked on the shelves may be valued too highly, This results in an overvaluation of firms' inventories, so that measured GDP is too high.

   A possible strategy for dealing with this problem is to have GDP analysts estimate what the market price should be (perhaps by looking at prices of the same goods in market economies) and use this "shadow" price in the GDP calculations.

   b. "Homework" is not calculated in the GDP accounts because it is not sold on the market, making it difficult to measure. One way to do it might be to look at the standard of living relative to a market economy, and estimate what income it would take in a market economy to support that standard of living.

5. Example from Statistics Canada, CANSIM II or www.statscan.gc.ca:

   Current account balance for year 2008 is $ 5 276million and for year 2009 is -$45 236 million.

   Source: Statistics Canada, CANSIM II, tables 376-0001 and 376-0002.

   Government saving or the government surplus (consolidated federal, provincial, territorial and local government revenue and expenditure based) for fiscal year 2008 is $ 31 461million and for fiscal year 2009 is $2 421 million.

   Source: Statistics Canada, CANSIM II, table 385-0001.

   Investment spending for year 2008 is $314 580 million and investment spending for year 2009 is $268 864 million.

   Source: Statistics Canada, CANSIM II, table 380-0002 and Catalogue no. 13-001-XIB.

   Assuming the above data we can compute the following:

   For the year 2008:

   $S_{pvt} = I + CA + (-S_{govt}) = \$314\,580 + \$5\,276 + (-31\,461) = \$288\,395$ million

   For the year 2009:

   $S_{pvt} = I + CA + (-S_{govt}) = \$268\,864 - \$45\,236 + (-\$2\,421) = \$221\,207$ million