CHAPTER 2
Measurement

KEY IDEAS IN THIS CHAPTER

1. Measurements of key macroeconomic variables such as gross domestic product (GDP), the price level, inflation, unemployment, and so on motivate macroeconomists to build economic models that can organize our thinking about how the economy works.

2. GDP can be measured using the product approach, the expenditure approach, or the income approach. Absent measurement errors, all three approaches yield the same estimate of GDP.

3. There are two approaches to measuring real GDP: choosing a base year and chain-weighting. The latter corrects for the bias that arises in real GDP calculations when a base year is used and relative prices change over time.

4. Three key labour market variables are the unemployment rate, the participation rate, and the employment/population ratio. The unemployment rate is sometimes used as a measure of labour market tightness.

NEW IN THE FIFTH EDITION

1. All data and graphs have been updated.

TEACHING GOALS

Students must understand the importance of measuring aggregate economic activity. Macroeconomics hopes to produce theories that provide useful insights and policy conclusions. To be credible, such theories must produce hypotheses which evidence could possibly refute. Macroeconomic measurement provides such evidence. Without macroeconomic measurements, macroeconomics could not be a social science, and would rather consist of philosophizing and pontificating. Market transactions provide the most simple and direct measurements. Macroeconomists' most basic measurement is Gross Domestic Product (GDP), the value of all final goods and services produced in an economy during a given period of time.

In Canada, Statistics Canada's National Income and Expenditure Accounts provide the official estimates of GDP. These accounts employ their own set of accounting rules to ensure internal consistency and to provide several separate estimates of GDP. These separate estimates are provided by the product accounts, the expenditure accounts, and the income accounts. The various accounting conventions may, at first glance, be rather dry and complicated. However, students can only easily digest the material in later chapters if they have a good grounding in the fundamentals.

GDP changes through time because different amounts of goods and services are produced, and such goods and services are sold at different prices. Standards of living are determined by the amounts of goods and services produced, not by the prices they command in the market. While GDP is relatively easy to measure, the decomposition of changes in real GDP into quantity and price components is much more difficult. This kind of problem is less pressing for microeconomists. It is easy to measure separately the number of apples sold and the price of each apple. Because macroeconomics deals with aggregate output, the differentiation of price and quantity is much less apparent. It is important to emphasize that, while there may be more or less reasonable approaches to this problem, there is no unambiguous best approach. Since many important policy discussions involve debates about output and price measurements, it is important to understand exactly how such measurements are produced.

CLASSROOM DISCUSSION TOPICS

As the author demonstrates in the textbook, much of this material is best learned by example. Rather than simply working through the examples from the text or making up your own, the material may resonate better if students come up with their own examples. They can start by picking a single good, and by the choice of their numbers, provide their own implied decomposition of output into wage and profit income. Later on, encourage them to suggest intermediate input production, inventory adjustments, international transactions, and a government sector. Such an exercise may help assure students that the identities presented in the text are more than simply abstract constructions.

Canada Pension Plan benefits are indexed to the Consumer Price Index. Explain with an example exactly how these adjustments are made. Ask the students if they think that this procedure is "fair." Another topic for concern is the stagnation in the growth of measured real wages. Real wages are measured by dividing (for example) average hourly wages paid in manufacturing by the consumer price index. Ask students if measured changes in real wages confirm or conflict with their general beliefs about whether the typical worker is better or worse off than ten or twenty years ago. How does possible mismeasurement of prices reconcile any apparent differences between casual impressions and statistical evidence?

Economic welfare measures the nation's overall state of economic well-being. The text discusses several reasons why real GDP is not a perfect measure of economic welfare. One of the reasons is that real GDP does not include household production, that is, productive activities done in and around the house by members of the household. Point out to students that in Canada (as well as in many other industrialized countries) many children receive day care from commercial providers. In many countries in Asia and Africa, this is unknown; children are almost all cared for by relatives. Then ask: how would this affect comparisons of GDP per capita? Would this difference have any implication for welfare levels?

The text discusses why unemployment may or may not be a good measure of labour market tightness. Another interpretation of the unemployment rate is that it has an inverse relationship with economic welfare. Ask the students if they agree with this interpretation. Does the unemployment rate allow for considerations such as equal distribution of income? How can the unemployment rate factor in considerations such as higher income per employed worker? Discuss possible pros and cons of using unemployment rather than per capita real GDP as a measure of well-being. Can unemployment be too low? Why or why not?

OUTLINE

1. **Measuring GDP: The National Income and Expenditure Accounts**
   a) What Is GDP and How Do We Measure It?
      i) GDP: Value of Final Output Produced Domestically
      ii) Statistics Canada's National Income and Expenditure Accounts
   b) The Product Approach to Measuring GDP
      i) Value Added
      ii) Intermediate Goods Inputs
   c) The Expenditure Approach
      i) Consumption
      ii) Investment
      iii) Government Expenditures
      iv) Net Exports
   d) The Income Approach
      i) Wage Income
      ii) After-Tax Profits
      iii) Interest Income
      iv) Taxes
      v) The Income–Expenditure Identity
   e) An Example with Inventory Investment
   f) An Example with International Trade
   g) Gross National Product (GNP)
      i) Treatment of Foreign Income
      ii) GNP = GDP + Net Foreign Factor Payments from Abroad
   h) What Does GDP Leave Out?
      i) GDP and Economic Welfare
         (1) Income Distribution
         (2) Non-Market Activity
      ii) Measuring Market Activity
         (1) The Underground Economy
         (2) Valuing Government Expenditures

i) The Components of Aggregate Expenditure
   i) Consumption
      (1) Durable Goods
      (2) Semi-Durable Goods
      (3) Non-Durable Goods
      (4) Services
   ii) Investment
      (1) Fixed Investment: Nonresidential and Residential
      (2) Inventory Investment
   iii) Net Exports
      (1) Exports
      (2) Imports
   iv) Government Expenditures
      (1) Government Consumption
      (2) Government Investment
      (3) Treatment of Transfer Payments

2. Nominal and Real GDP and Price Indices

a) Impact of Price Changes
   i) Price Index versus Inflation Rate
   ii) Real and Nominal Changes
b) Real GDP
   i) Output Valued at Base Year Prices
   ii) Chain-Weighted Real GDP
c) Measures of the Price Level
   i) Implicit GDP Price Deflator
   ii) Consumer Price Index (CPI)
d) Problems with Measuring Real GDP and the Price Level
   i) Substitution Biases
   ii) Accounting for Quality Changes
   iii) Treatment of Newly-Introduced Goods
e) Price Indices and Monetary Policy in Canada (Macroeconomics in Action 2.1)

3. Savings, Wealth, and Capital

a) Stocks and Flows
b) Private Disposable Income and Private Sector Saving
   i) $Y^d = Y + NFP + TR + INT - T$
   ii) $S^p = Y^d - C$
c) Government Surpluses, Deficits, and Government Saving
   i) $S^g = T - TR - INT - G$
   ii) $D = -S^g$
d) National Saving:
   i) $S = S^p + S^g = Y + NFP - C - G$
e) Saving, Investment, and the Current Account
   i) $S = I + NX + NFP$
   ii) $CA = NX + NFP \Rightarrow S = I + CA$

f) The Stock of Capital
   i) $S \Rightarrow \Delta$Wealth
   ii) $I \Rightarrow \Delta K$
   iii) $CA \Rightarrow \Delta$Claims on Foreigners

4. Labour Market Measurement

a) Statistics Canada's Categories
   i) Employed
   ii) Unemployed
   iii) Not in the Labour Force

b) The Unemployment Rate

$$\text{Unemployment Rate} = \frac{\text{Number unemployed}}{\text{Labor force}}$$

c) The Participation Rate

$$\text{Participation Rate} = \frac{\text{Labor force}}{\text{Total working age population}}$$

d) The Employment/Population Ratio = (Total employed)/(Total working age population)

e) Unemployment and Labour Market Tightness
   i) Discouraged Workers
   ii) Job Search Intensity

TEXTBOOK QUESTION SOLUTIONS

Problems

1. Product accounting adds up value added by all producers. The wheat producer has no intermediate inputs and produces 3 million tonnes at $30/tonne for $90 million. The bread producer produces 100 million loaves at $3.50/loaf for $350 million. The bread producer uses $75 million worth of wheat as an input. Therefore, the bread producer's value added is $275 million. Total GDP is, therefore, $90 million + $275 million = $365 million.

   Expenditure accounting adds up the value of expenditures on final output. Consumers buy 100 million loaves at $3.50/loaf for $350 million. The wheat producer adds 0.5 million tonnes of wheat to inventory. Therefore, investment spending is equal to 0.5 million tonnes of wheat valued at $30/tonne, which costs $15 million. Total GDP is, therefore, $350 million + $15 million = $365 million.

2. **Coal producer, steel producer, and consumers.**

   a) i) Product approach: Coal producer produces 15 million tonnes of coal at $5/tonne, which adds $75 million to GDP. The steel producer produces $10 million tonnes of steel at $20/tonne, which is worth $200 million. The steel producer pays $125 million for 25 million tonnes of coal at $5/tonne. The steel producer's value added is, therefore, $75 million. GDP is equal to $75 million + $75 million = $150 million.

   ii) Expenditure approach: Consumers buy 8 million tonnes of steel at $20/tonne, so consumption is $160 million. There is no investment and no government spending. Exports are 2 million tonnes of steel at $20/tonne, which is worth $40 million. Imports are 10 million tonnes of coal at $5/tonne, which is worth $50 million. Net exports are, therefore, equal to $40 million − $50 million = −$10 million. GDP is, therefore, equal to $160 million + (−$10 million) = $150 million.

   iii) Income approach: The coal producer pays $50 million in wages and the steel producer pays $40 million in wages, so total wages in the economy equal $90 million. The coal producer receives $75 million in revenue for selling 15 million tonnes at $5/tonne. The coal producer pays $50 million in wages, so the coal producer's profits are $25 million. The steel producer receives $200 million in revenue for selling 10 million tonnes of steel at $20/tonne. The steel producer pays $40 million in wages and pays $125 million for the 25 million tonnes of coal that it needs to produce steel. The steel producer's profits are, therefore, equal to $200 million − $40 million − $125 million = $35 million. Total profit income in the economy is therefore $25 million + $35 million = $60 million. GDP is therefore equal to wage income ($90 million) plus profit income ($60 million). GDP is therefore $150 million.

   b) There are no net factor payments from abroad in this example. Therefore, the current account surplus is equal to net exports, which is equal to (−$10 million).

   c) As originally formulated, GNP is equal to GDP, which is equal to $150 million. Alternatively, if foreigners receive $25 million in coal industry profits as income, then net factor payments from abroad are −$25 million, so GNP is equal to $125 million.

3. **Wheat and Bread**

   a) Following the product approach, value added by firm A is total revenue from wheat sales (note that the inventory accumulation is treated as if the firm sold the wheat to itself), or $150 000. For firm B, value added is revenue from sales of bread minus the value of wheat purchased from firm A, or $100 000 – $60 000 = $40 000. Therefore, total GDP = $150 000 + $40 000 = $190 000.

b) For the expenditure approach, consumption expenditure on bread, C = \$100 000 + \$15 000 = \$115 000 (note that imports of bread are included), investment in inventories is I = \$15 000, and net exports are NX = \$75 000 – \$15 000 = \$60 000. Government expenditures are G = 0. Therefore,
GDP = $C + I + G + NX$ = \$115 000 + \$15 000 + 0 + \$60 000 = \$190 000.

c) For the income approach, in this case GDP is the sum of profits and wage income. Profits for firm A are \$150 000 – \$50 000 = \$100 000 (revenue minus wage costs, where inventory accumulation is included as a positive amount) and profits for firm B are \$100 000 – \$20 000 – \$60 000 = \$20 000 (revenue minus wage costs minus the cost of the intermediate input). Total wages are \$50 000 + \$20 000 = \$70 000. Therefore, GDP = profits + wages = \$100 000 + \$20 000 + \$70 000 = \$190 000.

4. Price and quantity data are given as the following:

Year 1

Good	***Quantity***	***Price***
Computers	20	\$1000
Bread	10 000	\$1.00

Year 2

Good	***Quantity***	***Price***
Computers	25	\$1500
Bread	12 000	\$1.10

a) Year 1 nominal GDP = 20 × \$1000 + 10 000 × \$1.00 = \$30 000.
Year 2 nominal GDP = 25 × \$1500 + 12 000 × \$1.10 = \$50 700.

b) With year 1 as the base year, we need to value both years' production at year 1 prices. In the base year, year 1, real GDP equals nominal GDP equals \$30 000. In year 2, we need to value year 2's output at year 1 prices. Year 2 real GDP = 25 × \$1000 + 12 000 × \$1.00 = \$37 000. The percentage change in real GDP equals [(\$37 000 – \$30 000)/\$30 000] × 100 = 23.3%.

We next calculate chain-weighted real GDP. At year 1 prices, the ratio of year 2 real GDP to year 1 real GDP equals g_1 = (\$37 000/\$30 000) = 1.2333. We must next compute real GDP using year 2 prices. Year 2 GDP valued at year 2 prices equals year 2 nominal GDP = \$50,700. Year 1 GDP valued at year 2 prices equals (20 × \$1500) + (10 000 × \$1.10) = \$41 000. The ratio of year 2 GDP at year 2 prices to year 1 GDP at year 2 prices equals g_2 = (\$50 700/\$41 000) = 1.2367. The chain-weighted ratio of real GDP in the two years therefore is equal to

$g_c = \sqrt{g_1 g_2} = 1.23496$. The percentage change chain-weighted real GDP from year 1 to year 2 is therefore approximately 23.5%.

If we (arbitrarily) designate year 1 as the base year, then year 1 chain-weighted GDP equals nominal GDP equals \$30 000.Year 2 chain-weighted real GDP is equal to (1.23496 × \$30 000) = \$37 049, approximately.

Alternatively, we could use the average price method. To perform a calculation using this method, we first compute average prices. The average price for computers equals (\$1000 + \$1500)/2 = \$1250. The average price for bread equals (\$1.00 + \$1.10)/2 = \$1.05. Year 1 output valued at average prices equals 20 × \$1250 + 10 000 × \$1.05 = \$35 500. Year 2 output valued at average prices equals 25 × \$1250 + 12 000 × \$1.05 = \$43 850. The percentage change in chain-weighted GDP is therefore equal to [(\$43 850 − \$35 500)/\$35 500] × 100 = 23.5%.

c) To calculate the implicit GDP deflator, we divide nominal GDP by real GDP, and then multiply by 100 to express GDP deflator as an index number. With year 1 as the base year, base year nominal GDP equals base year real GDP, so the base year implicit GDP deflator is 100. For year 2, the implicit GDP deflator is (\$50 700/\$37 000) × 100 = 137.0. The percentage change in the deflator is equal to 37.0%.

With chain weighting, the base year is now the midpoint between the two years. The year 1 GDP deflator equals (\$30 000/\$30 000) × 100 = 100. The chain-weighted deflator for year 2 equals (\$50 700/\$37 049) × 100 = 136.9. The percentage change in the chain-weighted deflator equals [(136.9 − 100)/100] × 100 = 36.9%.

d) Let us consider the possibility that year 2 computers are twice as productive as year 1 computers. As one possibility, let us define a "computer" as a year 1 computer. In this case, the 25 computers produced in year 2 are the equivalent of 50 year 1 computers. Each year 1 computer now sells for \$750 in year 2. We now revise the original data as:

Year 1

Good	***Quantity***	***Price***
Year 1 Computers	20	\$1000
Bread	10 000	\$1.00

Year 2

Good	***Quantity***	***Price***
Year 1 Computers	50	\$750
Bread	12 000	\$1.10

First, note that the change in the definition of a "computer" does not affect the calculations of nominal GDP. We next compute real GDP with year 1 as the base year. Year 2 real GDP, in year 1 prices is now 50 × \$1000 + 12 000 × \$1.00 = \$62 000. The percentage change in real GDP is equal to [(\$62 000 − \$30 000)/ \$30 000] × 100 = 106.7%.

We next revise the calculation of chain-weighted real GDP. From above, g_1 equals (\$62 000/\$30 000) = 2.07. The value of year 1 GDP at year 2 prices equals \$26 000. Therefore, g_2 equals (\$50 700/\$26 000) = 1.95. The chain-weighted ratio of real GDP in the two years therefore is equal to $g_c = \sqrt{g_1 g_2} = 2.0075$. The percentage change chain-weighted real GDP from year 1 to year 2 is therefore 100.8%.

If we (arbitrarily) designate year 1 as the base year, then year 1 chain-weighted GDP equals nominal GDP equals \$30 000. Year 2 chain-weighted real GDP is equal to (2.0075 × \$30 000) = \$60 225. The chain-weighted deflator for year 1 is automatically 100. The chain-weighted deflator for year 2 equals (\$50 700/\$60 225) × 100 = 84.2. The percentage rate of change of the chain-weighted deflator equals −15.8%.

When there is no quality change, the difference between using year 1 as the base year and using chain weighting is relatively small. Factoring in the increased performance of year 2 computers, the production of computers rises dramatically while its relative price falls. Compared with earlier practices, chain weighting provides a smaller estimate of the increase in production and a smaller estimate of the reduction in prices because the relative price of the good that increases most in quantity (computers) is much higher in year 1. Therefore, the use of historical prices puts more weight on the increase in quality-adjusted computer output.

5. Price and quantity data are given as the following:

Year 1

Good	***Quantity (million kgs.)***	***Price (per kgs.)***
Broccoli	1500	\$0.50
Cauliflower	300	\$0.80

Year 2

Good	***Quantity (million kgs.)***	***Price (per kgs.)***
Broccoli	2400	\$0.60
Cauliflower	350	\$0.85

a) Year 1 nominal GDP = Year 1 real GDP
= 1500m. × \$0.50 + 300m. × \$0.80 = \$990m.
Year 2 nominal GDP = 2400m × \$0.60 + 350m. × \$0.85 = \$1737.5m.
Year 2 real GDP = 2400m. × \$0.50 + 350m. × \$0.80 = \$1480m.

Year 1 GDP deflator equals 100.
Year 2 GDP deflator equals (\$1737.5/\$1480) × 100 = 117.4.
The percentage change in the deflator equals 17.4%.

b) Year 1 production (market basket) at year 1 prices equals year 1 nominal GDP = \$990m. The value of the market basket at year 2 prices is equal to \$900 + \$255 = \$1155.
Year 1 CPI equals 100.
Year 2 CPI equals (\$1155/\$990) × 100 = 116.7.
The percentage change in the CPI equals 16.7%.

The relative price of broccoli has gone up. The relative quantity of broccoli has also gone up. The CPI attaches a smaller weight to the price of broccoli, and so the CPI shows less inflation.

6. If some goods are subject to price controls and these price controls are binding, then current GDP will tend to be biased downward: the official price of a good subject to price controls is less than the price which measures the true value of the good. As well, the inflation rate will tend to be biased downward if price controls are held over a long period of time and controlled prices rise by less than the market prices for these goods that would hold in the absence of price controls. For example, the inflation rate will be biased downward if the controlled prices rise at a slower rate than black market prices for these goods. The black market price is a measure of the actual economic value of a good subject to price controls.

7. What we know is the quantity of Canadian currency outstanding. A safe assumption is that essentially all of this currency is held by residents of Canada. What we need is an estimate of the average quantity of currency that the average Canadian holds for use in market (non-underground) transactions. Given that estimate, we can infer how much currency is used in Canada exclusively for underground transactions. With some assumptions about how fast this currency circulates, we can then estimate what the total value of illegal transactions is in Canada. In our calculation of underground GDP, we would have to worry about value added (some of the underground currency is spent on intermediate goods), and we may be concerned that some underground transactions use barter – exchanges of goods and services for goods and services, without currency.

8. **Corn producer, consumers, and government**.

a) i) Product approach: There are no intermediate goods inputs. The corn producer grows 3 million tonnes of corn. Each tonne of corn is worth \$50. Therefore, GDP equals \$150 million.

ii) Expenditure approach: Consumers buy 2 million tonnes of corn, so consumption equals $100 million. The corn producer adds 0.5 million tonnes to inventory, so investment equals $25 million. The government buys 0.5 million tonnes of corn. Consequently, government spending equals $25 million. GDP equals $150 million.

iii) Income approach: Wage income is $60 million, paid by the corn producer. The corn producer's revenue equals $150 million, including the value of its addition to inventory. Additions to inventory are treated as purchasing one's own output. The corn producer's costs include wages of $60 million and taxes of $20 million. Therefore, profit income equals $150 million − $60 million − $20 million = $70 million. Government income equals taxes paid by the corn producer, which equals $20 million. Therefore, GDP by income equals $60 million + $70 million + $20 million = $150 million.

b) Private disposable income equals GDP ($150 million) plus net factor payments (0) plus government transfers ($5 million in Canada Pension Plan benefits) plus interest on the government debt ($10 million) minus total taxes ($30 million), which equals $135 million. Private saving equals private disposable income ($135 million) minus consumption ($100 million), which equals $35 million. Government saving equals government tax income ($30 million) minus transfer payments ($5 million) minus interest on the government debt ($10 million) minus government spending ($5 million), which equals $10 million. National saving equals private saving ($35 million) plus government saving ($10 million), which equals $45 million. The government budget surplus equals government saving ($10 million). Since the budget surplus is positive, the government budget is in surplus. The government deficit is, therefore, equal to (−$10 million).

9. "Questionable financial activity" is essentially theft. If someone steals, there is no contribution to GDP as something is simply transferred from one individual to another. Possibly worse, the time and effort of the thief is pure waste for society, as that time and effort could be used in producing goods and services. Some financial activity could be wasteful in the same way. If workers in financial firms spend their time and effort in designing financial products for the purpose of hiding malfeasance, or to convince ill-informed consumers that such products are something they are not, that time and effort is counted as contributing to GDP, when it should not be.

10. The dollar value of a transaction need not all be a contribution to GDP. Indeed, typically only a fraction of any given transaction in the economy actually represents something we should add to GDP. For example, the production of a given good could involve many stages, with each stage of production done in a different firm. At each stage of production, the intermediate good gets passed on to the next firm in the production process, and a transaction takes place. From this chapter, we know that we only count the value-added at each stage of production toward GDP. Similarly, the financial sector contributes to GDP, but the dollar value of every financial transaction is not counted toward GDP, and rightly so. If the Bank of Montreal makes a payment

of $10 million to the Toronto Dominion Bank, that payment represents the settlement of a debt between the two institutions. What is actually provided, in terms of financial goods and services, could be very small when measured correctly.

11. The answers to parts (a) and (b) are in the table.

Year	Capital when initial capital = 80	Capital when initial capital = 100
0	80	100
1	82.0	100
2	83.8	100
3	85.4	100
4	86.9	100
5	88.2	100
6	89.4	100
7	90.4	100
8	91.4	100
9	92.3	100
10	93.0	100

In the first case, where the initial quantity of capital was 80, with a constant quantity of investment each period, the quantity of capital increases over time, but at a decreasing rate (note the increment to the capital stock gets smaller each period). This happens because, as the capital stock grows, the total amount of capital that depreciates each period increases. The quantity of capital appears to be converging to some quantity, but what is this quantity? When the quantity of capital is initially 100, then the capital stock stays at 100 indefinitely, as long as investment is 10 each period. This is because, when the capital stock is 100, the total quantity of depreciation each period when the depreciation rate is 10% is 10, so new investment just replaces the capital that depreciates each period. Here 100 is what we would call the "steady state" quantity of capital. Steady states are useful when we study economic growth in Chapters 6 and 7.

12. $S^p - I = CA + D$

a) By definition:

$$S^p = Y^d - C = Y + NFP + TR + INT - T - C$$

Next, recall that $Y = C + I + G + NX$. Substitute into the equation above and subtract I to obtain:

$$\begin{aligned} S^p - I &= C + I + G + NX + NFP + INT - T - C - I \\ &= (NX + NFP) + (G + INT + TR - T) \\ &= CA + D \end{aligned}$$

b) Private saving, which is not used to finance domestic investment, is either lent to the domestic government to finance its deficit (D) or is lent to foreigners (CA).

13. Assume the following:

$D = 10$
$INT = 5$
$T = 40$
$G = 30$
$C = 80$
$NFP = 10$
$CA = -5$
$S = 20$

a) $Y^d = S^p + C$
$= S + D + C$
$= 20 + 10 + 80 = 110$

b) $D = G + TR + INT - T$
$TR = D - G - INT + T = 10 - 30 - 5 + 40 = 15$

c) $S = GNP - C - G$
$GNP = S + C + G = 20 + 80 + 30 = 130$

d) $GDP = GNP - NFP = 130 - 10 = 120$

e) Government Surplus $= S^g = -D = -10$

f) $CA = NX + NFP$
$NX = CA - NFP = -5 - 10 = -15$

g) $GDP = C + I + G + NX$
$I = GDP - C - G - NX = 120 - 80 - 30 + 15 = 25$

14. If the unemployment rate is 5% and the number of unemployed is 2.5 million, therefore the labour force must be 2 500 000/.05 = 50 million. The participation rate is then (50/100) × 100% = 50%. The number of employed = 0.95 × 50 = 47.5 million, and the employment/population ratio = (47.5/100) × 100% = 47.5%.