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Measuring National Output and National Income

Chapter objectives:

1. Define gross domestic product (GDP) and its components. Detail those transactions that are excluded from GDP calculations. Distinguish between GDP and GNP.
2. Use the expenditure approach to calculate GDP. Distinguish between gross investment and net investment. Discuss the meaning of depreciation and the problems of measuring it. Define the three categories of personal consumption expenditures.
3. Outline the procedure and rationale for determining GDP through the income approach. Distinguish the various national income accounts.
4. Distinguish between real GDP and nominal GDP and explain why real GDP is the preferred measure of production. Discuss the weaknesses of a fixed-weight index to measure real GDP. Discuss how the GDP deflator is constructed.
5. Outline the shortcomings of GDP and per capita GDP as a measure of social well-being.

Most students find this chapter a bit of a chore. Memorize the important definitions: GDP, the components of the expenditure approach, depreciation, saving (nonconsumption), and disposable personal income.

BRAIN TEASER: This chapter explores how economists measure an economy's production, using gross domestic product (GDP), gross national product (GNP), and other aggregates. Usually, the difference between GDP and GNP (net factor payments to the rest of the world) are minimal—for the United States, about one-fifth of 1% of GDP. Consider though, Lesotho, a tiny nation with a poor domestic economy, which is entirely surrounded by wealthy South Africa. Most Lesothans work in South Africa's mines and industries. Which is larger, Lesotho's GDP or its GNP?

**OBJECTIVE 1:**

Define gross domestic product (GDP) and its components. Detail those transactions that are excluded from GDP calculations. Distinguish between GDP and GNP.

There is a family of national income accounts, but the key measure of current domestic economic activity is *gross domestic product*. GDP is the market value of all final goods and services produced within the economy. Second-hand sales, sales of intermediate goods, public and private transfers payments, and the value of financial transactions are all excluded. (page 105 [417])

◆◆◆ **LEARNING TIP:** There's no substitute for learning the rationale behind the concept of GDP. Productive economic activity within the economy results in new final goods and services. Sales of final goods plus (or minus) change in inventories will capture this. Compare this idea of new productive activity with the items that are excluded from GDP.

Consider the logic behind the exclusion of some items from GDP calculations, such as transfer payments (public and private), intermediate goods, second-hand sales, and financial transactions. We're measuring *current* production of goods and services. Why are these categories excluded?

Moonlighting, "do it yourself" activities, barter, and illegal activities don't show up either, although current goods and services are provided through these activities. How much would GDP change if, for example, the sale of drugs were decriminalized?◆

GNP is the market value of all final goods and services produced by an economy's resources (wherever located). The distinguishing feature between GDP and GNP, which is location of production, can be seen in the case of Georgia peaches harvested by Mexican migrant workers. The value of these services adds to U.S. production and, therefore, is counted in U.S. GDP. U.S. GNP focuses on ownership of resources and ignores location. U.S. GNP should exclude the services of the migrant workers because they are not performed by U.S. citizens.

ECONOMICS IN PRACTICE: On page 109 [421], the textbook considered how eBay transactions are figured into the national income accounts. The basic principle is quite simple (although the application might be difficult)—new final goods and services should be counted, others should not. Applications 1 and 10 following give you some practice in this area. Here are some more cases—what *should* count in GDP, what *does* count, and what *doesn't*?

1. You hire a stockbroker to buy \$1,000 of stock in Toyota.
2. You look after the neighbor's child for the afternoon for \$20.
3. You arrange to paint your neighbor's house in exchange for her building you a rock garden.
4. You sell this Study Guide on eBay for \$10.

ANSWER: None of these transactions will be counted as part of GDP. The fee charged by the stockbroker (1) will be included, however, because s/he has provided a service and has charged you for it. Your childcare services (2), and the house painting and gardening (3), *should* be included in GDP—a new final good or service has been provided in each case—but will not be counted, because no transaction has been reported. The sale of the Study Guide (4) will not be included—its value was counted when it was purchased new. The fee charged by eBay will be counted, because eBay has provided a marketing service.

Practice

1. U.S. gross domestic product for 2009 is defined as the total market value of all
- final goods and services sold in 2009.
 - goods and services produced in 2009 by productive resources owned by U.S. citizens.
 - final goods and services produced in 2009 within U.S. boundaries by productive resources owned by U.S. citizens.
 - final goods and services produced in 2009 within U.S. boundaries.

ANSWER: (d) Ownership of resources is irrelevant in GDP calculations; the location of production is—it must be within U.S. boundaries. Refer to p. 105 [417].

2. _____ goods are goods that are not resold to someone else.
- Intermediate
 - Final
 - Transfer
 - Consumer durable

ANSWER: (b) Consumer durables may not be resold (except as second-hand goods)—they are final goods. Goods that are resold are intermediate goods or second-hand goods. Refer to p. 106 [418].

3. Jean, an avid gardener, buys a packet of carrot seeds. The packet of seeds _____ counted in GDP as a final product; the carrots Jean grows and consumes _____ counted in GDP as a final product.
- is; are
 - is; are not
 - is not; are
 - is not; are not

ANSWER: (b) The seeds are sold to the final user. Because Jean grows and eats the carrots, they never reach a market and will not be counted (although they do represent production). This is a limitation of the GDP concept.

4. Many Arbezani workers cross the border to work in Arboc although few Arbocalis work in Arbez. We should expect that Arbezani GDP will be _____ than its GNP and that Arbocali GDP will be _____ than its GNP.
- greater; greater
 - greater; smaller
 - smaller; greater
 - smaller; smaller

ANSWER: (c) GDP measures production by location. More resources are producing in Arboc. GNP measures production by ownership. Refer to p. 107 [419]. ■

**OBJECTIVE 2:**

Use the expenditure approach to calculate GDP. Distinguish between gross investment and net investment. Discuss the meaning of depreciation and the problems of measuring it. Define the three categories of personal consumption expenditures.

Two methods, the *expenditure approach* and the *income approach*, are used to calculate GDP. The two methods should produce the same result, because a dollar spent is also a dollar received as income. The expenditure approach is summed up by:

$$GDP = C + I + G + (EX - IM)$$

where

C = personal consumption expenditures

I = gross private domestic investment

G = government consumption and gross investment

$(EX - IM)$ = net exports

◆◆◆ LEARNING TIP: To organize your thoughts, think of a demand and supply diagram for peaches (the only good the economy produces). The market value of production is the equivalent of price times quantity and can be visualized in two ways. We can measure the market value by focusing on the demand side (expenditure on peaches) or by focusing on the supply side (income of producers of peaches). We'll see later that (aggregate) demand is made up of $C + I + G + (EX - IM)$.◆

Gross private domestic investment (I) includes residential investment, nonresidential investment, and *changes* in the level of business inventories—not financial transactions, or putting money in your savings account. Depreciation is the allowance made by businesses for the deterioration of capital as time passes. This is certainly a cost of production. Net investment is gross investment minus depreciation. (page 110 [422])

◆◆◆ LEARNING TIP: “Change in inventories” is an important part of our upcoming theoretical analysis. What would happen to (total) inventories if (total) demand in the economy exceeded (total) supply? Inventories would fall. Unexpected inventory change is an important part of the economy's signaling mechanism. Falling inventories tell producers to increase production; unpleasantly high inventory levels tell producers to cut back production. Watch for this point in Chapter 8 (23).◆

Personal consumption expenditures (C) are divided among spending on durable goods (e.g., a car), nondurable goods (e.g., gasoline), and services (e.g., an oil change).

Government consumption and gross investment (G) includes expenditures by all levels of government on final goods and services. The salary of your Senator or the purchase of a new school bus would be included.

Net exports (EX - IM) is the difference between exports (domestically-produced goods and services that are sold to foreigners) and imports (foreign-produced goods and services that are sold in the United States).

Practice

5. The expenditure approach equation is
- $C + I + G + (EX + IM)$.
 - $C + I + G - (EX + IM)$.
 - $C + I + G + (EX - IM)$.
 - $C + I + G - (EX - IM)$.

ANSWER: (c) Net exports ($EX - IM$) are added to the total. Refer to p. 108 [420].

6. Peter Rachman builds some apartment buildings. This expenditure is
- residential consumption.
 - residential investment.
 - durable consumption.
 - inventory investment.

ANSWER: (b) All new residential construction is classified as investment. Refer to p. 109 [421].

7. Gross private domestic investment has three components:
- nonresidential investment, residential investment, and inventory investment.
 - business investment in plant and equipment, residential construction, and net exports of machinery.
 - stocks, bonds, and real estate.
 - purchases of new firms, purchases of existing firms, and purchases of residential housing stock.

ANSWER: (a) Refer to p. 109 [421] for a breakdown of gross private domestic investment.

8. GDP is 1,200, consumption (personal consumption expenditures) is 900, gross private domestic investment is 150, exports are 50, and imports are 125. Depreciation is 40. Government spending (government consumption and gross investment) is
- 15.
 - 75.
 - 225.
 - 265.

ANSWER: (c) $GDP = C + I + G + (EX - IM)$. $1,200 = 900 + 150 + G + (50 - 125)$. Depreciation is not relevant in this calculation.

9. The capital stock at the end of the year is equal to the capital stock at the beginning of the year
- plus depreciation.
 - minus depreciation.
 - plus net investment.
 - plus gross investment.

ANSWER: (c) The change in the capital stock is net investment. It can be negative. Refer to p. 110 [422]. ■



OBJECTIVE 3:

Outline the procedure and rationale for determining GDP through the income approach. Distinguish the various national income accounts.

The *income approach* begins by totaling the *national income*—the income earned by the productive resources owned by a country's citizens. This includes compensation of employees (wages and salaries, mostly), proprietors' income, rental income, corporate profits, net interest, indirect taxes minus subsidies, net business transfer payments, and surplus of government enterprises. (page 111 [423])

The difference between national income and *net national product* is any (usually slight) statistical discrepancy caused by measurement problems. In contrast to gross national product, gross national product adds in payments to foreign factors and subtracts payments earned abroad by U.S. citizens. GNP does not count either of these factor payments and, to get to GNP from GDP, we must *subtract* payments

to foreign factors and *add* payments earned abroad by U.S. citizens (i.e., net factor payments to the rest of the world).

Personal income (the total income of households before the payment of personal income taxes) is national income less the earnings that are not distributed to households, such as the retained earnings of corporations. *Disposable personal income* is found by subtracting personal income taxes from personal income.

◆◆◆ **LEARNING TIP:** Think of saving as “nonconsumption.” The income left over after you’ve bought what you want doesn’t have to be put into a bank for an economist to consider as “saved” Bury it in the back yard, keep it in your wallet—if you don’t spend it, it’s saved.

Keep in mind that investment involves purchases of real productive plant and equipment (and changes in inventory), but *not* financial investments. The buying and selling of stocks and bonds does not, in itself, constitute investment. ◀

Practice

10. The best measure of the total income received by households is
- GDP.
 - GNP.
 - national income.
 - personal income.

ANSWER: (d) National income measures the income earned by a nation’s productive resources. Some income though, doesn’t reach households—retained earnings, social insurance payments. Some income received by households is unearned—transfer payments such as welfare. Personal income records the income received by all households after these adjustments have been made.

11. In Arboc, personal income is \$680 billion, personal income taxes are \$170 billion, and personal saving is \$20 billion. The personal saving rate is
- 2.9%.
 - 3.9%.
 - 11.8%.
 - 27.9%.

ANSWER: (b) The personal saving rate is the percentage of disposable personal income that is saved. Disposable personal income is personal income minus personal income taxes (\$680 billion – \$170 billion). The saving rate is \$20 billion/\$510 billion = 0.039, or 3.9%.

12. Arboc is a simple economy in which all income is either compensation of employees or profits. Also, there are no indirect taxes. Using the income approach, GDP is made up of
- compensation of employees + profits + depreciation
 - compensation of employees + profits – depreciation
 - compensation of employees – profits + depreciation
 - compensation of employees – profits – depreciation

ANSWER: (a) Given the assumptions about Arboc, all other differences between national income and GDP disappear.

13. GDP minus _____ the rest of the world and minus _____ equals NNP.
- net factor payments to; depreciation
 - net factor payments to; indirect taxes minus subsidies
 - net factor receipts from; depreciation
 - net factor receipts from; indirect taxes minus subsidies

ANSWER: (a) GDP includes net factor payments to the rest of the world. GNP subtracts these payments. NNP subtracts depreciation from GNP. ■



OBJECTIVE 4:

Distinguish between real GDP and nominal GDP and explain why real GDP is the preferred measure of production. Discuss the weaknesses of a fixed-weight index to measure real GDP. Discuss how the GDP deflator is constructed.

Nominal GDP measures production in current dollars, whereas *real GDP* is a measure of output that controls for price changes. The Bureau of Economic Analysis (BEA) used to use fixed price weights when determining real GDP. That method was flawed—real GDP growth rates depended on the year chosen, prices may not have reflected supply changes, and the chosen base year was likely to become less typical as time went by. The current method of estimating real GDP uses a sequence of pairs of base years.

The GDP deflator, which measures how the overall price level is changing, previously was calculated by the fixed-weights method. That method overestimates the increase in the price level because it ignores substitution away from goods whose prices are rising and toward goods whose prices are increasing less rapidly, or decreasing. The BEA introduced its new approach to calculating the GDP deflator, avoiding the selection of a single base year and fixed weights. (page 114 [426])

◆◆◆ **LEARNING TIP:** In a previous learning tip, nominal GDP was likened to price times quantity. If price changes, so does the value of nominal GDP. To derive the real quantity produced, we can divide $(P \times Q)$ by P —at the macro level, this is the GDP deflator.

A common mistake in macroeconomics is failing to distinguish between real and nominal values, as in the case of GDP. *Real* values correct for the effect of price changes, *nominal* values don't. Example: Your nominal wage is simply the number of dollars in your paycheck; your real wage (spending power) also depends on prices in the grocery store. When your grandmother tells you how wonderfully cheap things were back in the good old days, she's comparing nominal values that shouldn't be compared. Ask her about hourly wage levels back in those same good old days.

◆◆◆ **LEARNING TIP:** Note that the formula

$$\text{GDP deflator} = (\text{Nominal GDP} \div \text{real GDP}) \times 100$$

can be rearranged to get

$$\text{Real GDP} = (\text{Nominal GDP} \div \text{GDP deflator}) \times 100. \blacktriangleleft$$

Practice

14. If real GDP decreases from Year 1 to Year 2, we can conclude that
- production levels are lower in Year 2 than in Year 1.
 - price levels are lower in Year 2 than in Year 1.
 - there is less unemployment in Year 2 than in Year 1.
 - we need more information before commenting.

ANSWER: (a) Real GDP measures the level of real production.

Use the fixed-weights method and following information about prices of goods in Arboc to calculate the economy's production for the next three questions.

Good	Production			Prices		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Goat milk	200	180	160	2.00	2.40	2.50
Bananas	80	90	100	3.00	3.20	3.10

15. Nominal GDP in Year 1 is _____ and nominal GDP in Year 2 is _____ .
- (a) 640; 720
 (b) 640; 736
 (c) 630; 720
 (d) 630; 736

ANSWER: (a) Nominal GDP for Year 1 = $(200 \times 2.00) + (80 \times 3.00) = 640$. Nominal GDP for Year 2 = $(180 \times 2.40) + (90 \times 3.20) = 720$.

16. In Year 1 prices, real GDP in Year 2 is _____ and real GDP in Year 3 is _____ .
- (a) 640; 620
 (b) 640; 630
 (c) 630; 640
 (d) 630; 620

ANSWER: (d) Real GDP for Year 2 = $(180 \times 2.00) + (90 \times 3.00) = 630$. Real GDP for Year 3 = $(160 \times 2.00) + (100 \times 3.00) = 620$.

17. Using Year 1's prices to get real GDP, the GDP fixed-weight deflator for Year 3 is about
- (a) 82.9.
 (b) 87.3.
 (c) 114.5.
 (d) 120.6.

ANSWER: (c) Nominal GDP for Year 3 = $(160 \times 2.50) + (100 \times 3.10) = 710$. Real GDP for Year 3 = $(160 \times 2.00) + (100 \times 3.00) = 620$. GDP deflator = $(\text{nominal GDP}/\text{real GDP}) \times 100 = (710/620) \times 100 = 114.5$.

18. In Arboc, nominal GDP is 4,000 opeks and real GDP is 3,000 opeks. The GDP deflator is
- (a) 25.
 (b) 33.33.
 (c) 75.
 (d) 133.33.

ANSWER: (d) To find the GDP deflator, divide nominal GDP by real GDP and then multiply by 100. In this case, $(4,000/3,000) \times 100 = 133.33$.

Use the new BEA annual weights method and the following information about prices of goods in Arboc to calculate the economy's production for the next two questions.

Good	Production		Prices	
	Year 1	Year 2	Year 1	Year 2
Goat milk	200	180	2.00	2.40
Bananas	80	90	3.00	3.20

19. The real GDP in Year 1 is _____. The real GDP in Year 2 is _____. Use Year 1 as the base year.
- (a) 600; 720
 (b) 600; 630
 (c) 640; 720
 (d) 640; 630

ANSWER: (d) Real GDP for Year 1 = $(200 \times 2.00) + (80 \times 3.00) = 640$. Real GDP for Year 2 = $(180 \times 2.00) + (90 \times 3.00) = 630$.

20. The real GDP in Year 1 is _____. The real GDP in Year 2 is _____. Use Year 2 as the base year.
- (a) 736; 780
 - (b) 736; 720
 - (c) 640; 780
 - (d) 640; 720

ANSWER: (b) Real GDP for Year 1 = $(200 \times 2.40) + (80 \times 3.20) = 736$. Real GDP for Year 2 = $(180 \times 2.40) + (90 \times 3.20) = 720$. ■



OBJECTIVE 5:

Outline the shortcomings of GDP and per capita GDP as a measure of social well-being.

It's tempting to equate a rising GDP, or even a rising per capita GDP, with greater well-being, but the limitations of the national income measure disallow this. GDP measures the "market value" of production; but not all goods and services affecting our well-being reach a market—the "underground economy" is a significant area of economic activity that is not counted. Nor does GDP count "bads" such as pollution, and changes in GDP simply might be due to activities, such as childcare or housework, being recorded in the market when they previously weren't. GDP ignores the quality of our leisure time, the distribution of spending power, and what kinds of goods are being produced—all of these factors can affect the well-being of individuals in society. (page 117 [429])

The World Bank now uses *gross national income (GNI)* to make international comparisons. A nation's GDP (valued in the domestic currency) is converted into a dollar amount using an average of currency exchange rates.

ECONOMICS IN PRACTICE: On page 113 [425], the textbook pays homage to the development of national income accounting. However, GDP is an imperfect measure of social well-being, or even of production. Can you think of examples of production that our national income accounts might fail to capture?

ANSWER: Activities in the underground economy (also known as the informal sector) are missed by GDP. In particular, in countries with high tax rates, there is a strong incentive to do work "off the books." In the U.S. economy, this may represent 10% of reported GDP. Ticket scalping is a service that is unlikely to be included, nor is criminal activity, such as drug dealing or prostitution. Household production is another potentially large area that is not counted—home preparation of meals, for instance.

Practice

21. GDP includes
- (a) the market value of goods and services produced in the underground economy.
 - (b) the value of satisfaction derived from amusement parks.
 - (c) the expenditures involved in changing aerosol production away from the use of CFCs (chlorofluorocarbons).
 - (d) purchases of illegal substances that are produced in the United States.

ANSWER: (c) The expenditures needed to change production of aerosols would be represented in investment expenditures. ■

THE FAMILY OF ACCOUNTS

Collected below is the entire family of national income and production accounts, showing how to move from one account to another. Applications 4 and 6 give you practice in calculating the different values.

Gross Domestic Product	$C + I + G + (EX - IM)$ OR National income + depreciation – statistical discrepancy + net factor payments to the rest of the world
Gross National Product	GDP – net factor payments to the rest of the world
Net National Product	GNP – depreciation
National Income	NNP – statistical discrepancy
Personal Income	National income – amount of national income not going to households
Disposable Personal Income	Personal income – personal income taxes

BRAIN TEASER SOLUTION: Lesotho's workers earn income in South Africa that is not included in Lesotho's GDP. Lesotho's GDP is the total market value of all final goods and services produced within Lesotho, whereas its GNP is the total market value of all final goods and services produced by its resources anywhere. In fact, in 2008, GNP was about 30% higher than GDP.

PRACTICE TEST

I. MULTIPLE-CHOICE QUESTIONS

Select the option that provides the single best answer.

- _____ 1. The value of GDP can be found by adding together
- government consumption and gross investment, private consumption, net exports, and gross private domestic investment.
 - wages, private consumption, gross private domestic investment, and imports.
 - private consumption, government consumption and gross investment, transfer payments, and net exports.
 - wages, investment, government consumption and gross investment, and depreciation.
- _____ 2. For national accounting purposes, which of the following is not investment?
- Accumulation of inventories on a grocery shelf
 - Construction of a residential housing scheme
 - Purchase of 100 shares of Microsoft stock by Prof. Oster from Prof. Case
 - Purchase of a new machine by the Case and Fair Manufacturing Corp.

- _____ 3. Which of the following would be included in this year's GDP?
- (a) The purchase this year of a car produced last year
 - (b) The purchase this year of a share of GM common stock
 - (c) The purchase next year of a car produced this year
 - (d) The construction last year of a car factory that will begin production this year
- _____ 4. Nominal GDP is higher this year than last. We can conclude that
- (a) production levels are higher this year.
 - (b) price levels are higher this year.
 - (c) there is less unemployment this year.
 - (d) we need more information before commenting.
- _____ 5. GDP minus _____ and minus _____ equals national income.
- (a) investment; depreciation
 - (b) net factor payments to the rest of the world; depreciation
 - (c) net factor payments from the rest of the world; net investment
 - (d) depreciation; net investment
- _____ 6. Which one of the following most accurately reflects the amount of income actually received by households after taxes?
- (a) Gross domestic product
 - (b) Net national product
 - (c) Disposable personal income
 - (d) Personal income

- _____ 7. Real gross domestic product
- (a) refers only to manufacturing production.
 - (b) includes government transfers.
 - (c) excludes services.
 - (d) eliminates the effect of price changes on GDP.
- _____ 8. Which of the following items would be included in gross domestic product?
- (a) The value of a German camera brought back to the United States by a G.I.
 - (b) The output of a U.S.-owned family farm in Kansas
 - (c) The value of clean air
 - (d) The value of imports into the United States
- _____ 9. One problem of incorporating the government sector into GDP is that
- (a) we must include transfer payments, so double counting occurs.
 - (b) some government production, such as national defense, is not sold.
 - (c) taxes reduce consumption and investment expenditures.
 - (d) the government adds nothing to the value of production.
- _____ 10. The value of imports is subtracted in the expenditure approach, because
- (a) imports are included when the value of consumption and the other components of expenditure are calculated.
 - (b) imports take away from domestic production.
 - (c) imports are bought by foreigners.
 - (d) imports must be bought with foreign currency.
- _____ 11. The most likely immediate response to an unforeseen surge in demand for a firm's product would be to
- (a) cut the price of the final product.
 - (b) reduce inventory levels.
 - (c) build up inventory levels.
 - (d) reduce depreciation.
- _____ 12. Cambium and Xylem Timber Company of Ontario, Canada, produce and sell wooden furniture in the United States. The profits of this foreign-owned company are included in
- (a) U.S. GDP and U.S. GNP.
 - (b) U.S. GDP but not U.S. GNP.
 - (c) U.S. GNP but not in U.S. GDP.
 - (d) neither U.S. GDP nor U.S. GNP.
- _____ 13. Net investment is
- (a) depreciation plus inventory levels.
 - (b) depreciation minus inventory levels.
 - (c) gross investment plus depreciation.
 - (d) gross investment minus depreciation.

- _____ 14. The personal saving rate is the percentage of _____ that is saved.
- (a) GDP
 - (b) personal income
 - (c) national income
 - (d) disposable personal income
- _____ 15. Assuming no measurement problems, GDP (gross domestic product) equals
- (a) National income + Depreciation + Net factor payments to the rest of the world.
 - (b) National income + Depreciation – Net factor payments to the rest of the world.
 - (c) National income – Depreciation – Net factor payments to the rest of the world.
 - (d) National income – Depreciation + Net factor payments to the rest of the world.
- _____ 16. In Arboc, nominal GDP is 12,000 million opeks and the GDP deflator is 80. Real GDP is
- (a) 150 million opeks.
 - (b) 1,500 million opeks.
 - (c) 9,600 million opeks.
 - (d) 15,000 million opeks.
- _____ 17. Which of the following would not be counted in GDP?
- (a) \$10 million worth of newly produced IBM PCs that IBM can't sell
 - (b) A \$1,000 fee charged by a lawyer to plead a court case that she does not win
 - (c) The salary of a foreign basketball player playing in the NBA
 - (d) The purchase of IBM stock just before its price increases
- _____ 18. Which of the following would be included in U.S. GNP but not in U.S. GDP?
- (a) Profit earned in the United States by Honda Corporation, a Japanese-owned company
 - (b) Wages paid to Mexican migrant workers harvesting peaches for a U.S.-owned company
 - (c) Rent paid to Sean Thornton, the American owner of a piece of property in Ireland
 - (d) Dividends paid to Japanese owners of stock in Honda Corporation, a Japanese-owned company that sells cars in the United States
- _____ 19. Which of the following statements about net investment is true?
- (a) Net investment equals gross investment plus depreciation.
 - (b) When net investment is negative, the stock of capital has decreased.
 - (c) When net investment is negative, inventory levels are decreasing.
 - (d) When net investment is negative, inventory levels are increasing.
- _____ 20. In Arbez, nominal GDP is one billion opeks in both 2005 and 2010. The GDP deflator is 50 in 2005 and 120 in 2010. We can conclude that,
- (a) prices and real GDP have both risen from 2005 to 2010.
 - (b) prices have risen and real GDP has fallen from 2005 to 2010.
 - (c) prices have fallen and real GDP has risen from 2005 to 2010.
 - (d) prices and real GDP have both fallen from 2005 to 2010.

II. APPLICATION QUESTIONS

1. Examine the following list of goods and services. Which goods and services should be included in Freedomian GDP in 2009, which should be excluded, and why?

2,500 quarter-pounder hamburgers produced in 2009
 100 tons of coal from the mines in the Freedomian mountains
 2 Freedomian Drof automobiles, sold in 2009, produced in 2008
 3 Freedomian Drof automobiles, sold in 2010, produced in 2009
 3 American-built Fords produced in 2009 and sold in 2009
 Welfare benefits for Freedomian citizens
 625 pounds of beef used in hamburgers
 Wages of hamburger employees

2. Following are some nominal GDP figures for the nation of Regit.

Year	Nominal GDP	Percentage Change	GDP Deflator	Real GDP	Percentage Change
2005	4,268.6	—	0.9700	_____	—
2006	4,539.9	_____	1.0000	_____	_____
2007	4,900.4	_____	1.0390	_____	_____
2008	5,244.0	_____	1.0840	_____	_____
2009	5,513.8	_____	1.1310	_____	_____
2010	5,672.6	_____	1.1760	_____	_____

- (a) Calculate the percentage change in nominal GDP from one year to the next, i.e., divide the difference in GDP by the GDP in the first year.
- (b) Use the GDP deflator to calculate real GDP for each year.
- (c) Use the real GDP figures to calculate the percentage change in real GDP from one year to the next.
- (d) Write a brief report on the similarities and differences between the “percentage change” columns.
3. In Macrovia, the only two goods produced are bread and wine. In 1999 bread cost 90¢ a loaf and wine cost \$4.00 a bottle; 800 loaves of bread and 180 bottles of wine were produced. In 2004, bread cost \$1.00 a loaf and wine cost \$5.00 a bottle. 1,000 loaves and 200 bottles of wine were produced. In 2009, bread cost \$1.20 a loaf and wine cost \$5.50 a bottle. 1,200 loaves and 220 bottles of wine were produced.
- (a) Calculate the nominal GDP for each of the three years.
- (b) Calculate the real GDP for each of the three years. Use the fixed-weight method and 2004’s prices.
- (c) Calculate the GDP fixed-weight deflator for each of the three years. Use the fixed-weight method and 2004’s prices.
- (d) Calculate the real GDP for 1999 and 2004. Use the fixed-weight method and 1999’s prices.
- (e) Determine the percentage change in the real GDP from 1999 to 2004, using 1999’s prices.
- (f) Calculate the real GDP for 1999 and 2004 using 2004’s prices.
- (g) Determine the percentage change in the quantity index from 1999 to 2004.
- (h) How much has real GDP changed from 1999 to 2004?

4. You are given the following information by a colleague who is doing research on the Freedonian economy. Because she has never taken an economics course, she has turned to you for help using the information she has found. (Assume any unreported values are zero.)

Compensation of employees	1175.2
Corporate profits minus dividends	90.8
Freedonian exports of goods and services	94.4
Depreciation	283.2
Personal income taxes	150.5
Personal consumption expenditures	878.2
Government consumption and gross investment	400.4
Indirect taxes minus subsidies	122.4
Gross private domestic investment	322.7
Freedonian imports of goods and services	70.5

Use the information above to calculate

- (a) GDP _____
- (b) National income _____
- (c) Personal income _____
- (d) Disposable personal income _____
- (e) Net exports _____
- (f) Personal saving rate _____
5. (a) A Macrovia farmer produces 2,005 bushels of wheat, which he sells to a miller for 20¢ a bushel. The farmer receives a payment of \$_____ from the miller. The value added by the farmer is \$_____.
- (b) The miller grinds the wheat into flour. She makes 1,200 pounds of flour that she sells to a baker for 40¢ per pound. The miller receives a payment of \$_____ from the baker. The value added by the miller is \$_____.
- (c) The baker bakes the flour into 1,000 loaves, which he sells for 50¢ apiece to a food distributor. The baker receives a payment of \$_____ from the distributor. The value added by the baker is \$_____.
- (d) The distributor sells 200 loaves to a local restaurant (Loafers) for \$1.00 each. The remainder is sold to grocery stores at 80¢ each. The distributor receives payments totaling \$_____. The value added by the distributor is \$_____.
- (e) At the retail level, Loafers sells 180 loaves at \$1.50 each. 20 loaves are unsold and must be discarded. The grocery stores sell all of their consignment for \$1.00 each. Retailers receive payments totaling \$_____. The value added by the retailers is \$_____.
- (f) The total value added by all participants in the production process is \$_____.

6. Given the following national income and product accounts data, compute:

- (a) Gross private domestic investment _____
- (b) Net exports _____
- (c) National income _____
- (d) Personal income _____
- (e) Disposable personal income _____
- (f) Net national product _____
- (g) Gross national product _____
- (h) Gross domestic product _____

Depreciation	105
Amount of national income not going to households	51
Compensation of employees	1,407
Corporate profits	161
Dividends	49
Exports	133
Government consumption and gross investment	433
Imports	147
Indirect taxes minus subsidies	371
Net business transfer payments	12
Net interest	42
Net private domestic investment	490
Personal consumption expenditures	1,377
Receipts of factor income from the rest of the world	22
Personal income taxes	392
Proprietors' income	168
Payments of factor income to the rest of the world	43
Rental income	21
Statistical discrepancy	15
Surplus of government enterprises	98

7. Arboc and Arbez are two neighboring nations. Each produces only corn. In each case, net factor income from the rest of the world is zero. Last year, sales of corn in each country was 500 units. Inventory rose by 50 in Arboc and fell by 25 in Arbez. Assume no statistical discrepancy. Calculate GDP for:

- (a) Arboc _____
- (b) Arbez _____

Suppose depreciation runs at 10% of GDP in each country. Calculate NNP for:

- (c) Arboc _____
- (d) Arbez _____

Undistributed earnings are a greater percentage of GDP in Arboc (12%) than in Arbez (5%). Calculate personal income for:

- (e) Arboc _____
- (f) Arbez _____

8. Use the following table to answer the following questions.

Year	Nominal GDP	Nominal GDP (% change)	GDP Deflator	Real GDP	Real GDP (% change)
1995	1,212.8	—	46.5	—	—
2000	1,990.5	_____	67.3	_____	_____
2005	3,166.0	_____	100.0	_____	_____
2010	4,486.2	_____	117.3	_____	_____

- (a) Calculate the percentage increase in nominal GDP from one year to the next.
 (b) Use the GDP deflator to derive real GDP.
 (c) Calculate the percentage increase in real GDP from one year to the next.

9. The nation of Arboc produces pencils and notepads. Using the following information, calculate:

	Pencils	Notepads
Year 1	2,000 at 10¢ each	75 at \$1.00 each
Year 2	2,400 at 15¢ each	60 at \$1.10 each

- (a) Nominal GDP for Year 1 _____
 (b) Nominal GDP for Year 2 _____
 (c) Real GDP for Year 1 (Year 1 as base) _____
 (d) Real GDP for Year 2 (Year 1 as base) _____
10. Should each of the following enter into a measure of “the market value of all currently produced final goods and services”? Write “Yes” or “No.”

1. _____ the purchase of a new camera by Joe Blow
2. _____ the gift of the same camera from Joe to Flo Blow
3. _____ the purchase of the same camera by F. Stop Fitzgerald at a yard sale
4. _____ the purchase of a new camera by the CIA
5. _____ the services of a photographer hired by the CIA
6. _____ the services of a photographer hired by Joe and Flo Blow on the occasion of their wedding
7. _____ the services of Cousin Bo Blow (amateur photographer extraordinaire) to photograph the wedding
8. _____ the production of a camera that remains unsold at the factory
9. _____ the purchase of a Japanese camera by Joe Blow
10. _____ the use of welfare money by Moe Blow to buy a new camera
11. _____ the provision of welfare money to Moe Blow
12. _____ the use of welfare money to buy a second-hand camera
13. _____ the use of welfare money to open a bank account
14. _____ the use of welfare money to buy Kodak stock on the stock exchange
15. _____ the purchase of in-store surveillance equipment for “The Camera Cabin”
16. _____ the purchase of a camera for display in “The Camera Cabin”
17. _____ the purchase of film by Joe Blow
18. _____ the purchase of a U.S. camera by Josef von Blau (a German tourist)
19. _____ the purchase, in Germany, of a U.S. camera, by Josef von Blau
20. _____ the payment for the services of a camera repairman hired by Joe Blow, who fails to repair the broken camera
21. _____ the payment for the services of the trashman, who takes the broken camera to the city dump

PRACTICE TEST SOLUTIONS

I. Solutions to Multiple-Choice Questions

1. (a) This is the expenditure approach. Refer to the equation on p. 108 [420].
2. (c) The stock transfer does not represent the production of any additional goods or services.
3. (c) We are interested in measuring how much has been produced this year (whether or not it is sold this year). The stock purchase adds no production, so it is not counted.
4. (d) Nominal GDP measures the current value of production. This value might have increased because more goods and services were produced this year than last (with correspondingly lower unemployment), or because prices are higher this year than last. In short, we must be wary of reading too much into the change in this single figure. Refer to p. 114 [426].
5. (b) Refer to Table 6.4 (21.4) for the relationships between the measures.
6. (c) This is the after-tax income of all households. Refer to p. 114 [426].
7. (d) Real GDP certainly includes manufacturing production, but it includes other forms of production too, including services. “Real” variables are variables that have had the effects of price changes removed. Refer to p. 114 [426].

8. (b) The German camera is not U.S. production. The value of clean air is intangible. Imports are included in the value of consumption purchases, etc., and then subtracted from GDP.
9. (b) GDP measures the market value of production—this is difficult when there is not an explicit market. Note that transfer payments are not included in GDP.
10. (a) Refer to p. 111 [423] for more on net exports.
11. (b) If the demand for orange juice surges at the Food Tiger grocery store, the shelves begin to empty even before the management decides to raise the price.
12. (b) The profits of a foreign-owned company are included in U.S. GDP (which is concerned with the location of production) but not in U.S. GNP (which is concerned with ownership of resources).
13. (d) Refer to p. 110 [422] for more on net investment.
14. (d) Refer to p. 114 [426] for the definition of the personal saving rate.
15. (b) The value of production equals the costs of domestic resources plus other production costs (depreciation) and net income earned outside the country. Refer to p. 111 [423].
16. (d) $\text{Real GDP} = (\text{nominal GDP divided by the GDP deflator}) \times 100 = (12,000/80) \times 100 = 15,000$ million opeks.
17. (d) The purchase of stock is a financial transaction that does not reflect productive activity. Note that goods that are produced but not sold are included in inventory.
18. (c) GNP measures production by resources owned by U.S. citizens, regardless of where that output is produced.
19. (b) Net investment will be negative if gross investment is less than depreciation. In that case, the addition to the capital stock is less than the reduction due to wear and tear. Note that net investment is gross investment *minus* depreciation. Refer to the equation on p. 110 [422].
20. (b) Rising prices are indicated by the higher GDP deflator in 2010. $\text{Real GDP} = \text{nominal GDP}/\text{GDP deflator}$, therefore the real GDP is lower in 2010 than in 2005, (833,333,333 opeks instead of 2 billion opeks).

II. *Solutions to Application Questions*

1. There were 2,500 quarter-pounder hamburgers produced in 2009, 100 tons of coal from the mines in the Freedomian mountains, and 3 Freedomian Drof automobiles sold in 2010 but produced in 2009 are final items that would qualify for inclusion in 2009's GDP.

The 2 Freedomian Drof automobiles produced in 2008 were not produced in 2009. The 3 American-built Fords were not produced in Freedomia. Welfare benefits for Freedomian citizens are transfer payments. The beef used in hamburgers and the wages of hamburger employees are costs of intermediate goods and services that are captured in the price of the hamburgers.

2. (a) Refer to the following table. Percentage change in nominal GDP = $(\text{GDP in Year 2} - \text{GDP in Year 1}) \div \text{GDP in Year 1}$.
Example, using 2006 and 2007: $(4,900.4 - 4,539.9) \div 4,539.9 = 7.94$. Note: other formulas could also be used giving somewhat different results, for example

$$(\text{GDP in Year 2} - \text{GDP in Year 1}) \div (\text{GDP in Year 2} + \text{GDP in Year 1})/2.$$

Year	Nominal GDP	Percentage Change	GDP Deflator	Real GDP	Percentage Change
2005	4,268.6	—	0.9700	4,400.6	—
2006	4,539.9	6.36	1.0000	4,539.9	3.17
2007	4,900.4	7.94	1.0390	4,716.5	3.89
2008	5,244.0	7.02	1.0840	4,837.6	2.57
2009	5,513.8	5.14	1.1310	4,875.2	0.77
2010	5,672.6	2.88	1.1760	4,823.6	-1.06

- (b), (c) Refer to the preceding table. Real GDP = nominal GDP \times 100/GDP deflator. Example: 2007's real GDP = $4,900.4 \times 100/103.9 = 4,716.5$.
- (d) The "percentage change" figures display similarities, e.g., 2007 is the best year and 2010 the worst in each case. Notably, the real values are consistently lower than the nominal values because of rising prices. The nominal result for 2010 is the most misleading—recording 2.88% growth while the economy in fact shrank in size.
3. (a) Refer to the following table.

	1999	2004	2009
Bread	$800 \times 0.9 = \$720$	$1,000 \times \$1.00 = \$1,000$	$1,200 \times \$1.20 = \$1,440$
Wine	$180 \times \$4.00 = \720	$200 \times \$5.00 = \$1,000$	$220 \times \$5.50 = \$1,210$
Nominal GDP	\$1,440	\$2,000	\$2,650
Bread	$800 \times \$1.00 = \800	$1,000 \times \$1.00 = \$1,000$	$1,200 \times \$1.00 = \$1,200$
Wine	$180 \times \$5.00 = \900	$200 \times \$5.00 = \$1,000$	$220 \times \$5.00 = \$1,100$
Real GDP	\$1,700	\$2,000	\$2,300
GDP deflator	0.8471	1.0000	1.1522

- (b), (c) Refer to the preceding table.
(d) Refer to the following table.

	1999	2004
Bread	$800 \times 0.90 = \$720$	$1000 \times 0.90 = \$900$
Wine	$180 \times \$4.00 = \720	$200 \times \$4.00 = \800
Real GDP (1999 prices)	\$1,440	\$1,700

- (e) Percentage change from 1999 to 2004 = $[(1,700 - 1,440)/1,440] \times 100 = 18.0556$.
 (f) Refer to the following table.

	1999	2004
Bread	$800 \times \$1.00 = \800	$1,000 \times \$1.00 = \$1,000$
Wine	$180 \times \$5.00 = \900	$200 \times \$5.00 = \$1,000$
Real GDP (2004 prices)	\$1,700	\$2,000

- (g) Percentage change from 1999 to 2004 = $[(2,000 - 1,700)/1,700] \times 100 = 17.6471$.
 (h) Real GDP has grown by 17.85% from 1999 to 2004, because $117.85 = (118.0556 \times 117.6471)$.
4. (a) $GDP = C + I + G + (EX - IM) = 878.2 + 322.7 + 400.4 + (94.4 - 70.5) = 1,625.2$.
 (b) National income = GDP – depreciation = 1342.0.
 (c) Personal income = national income – retained earnings = 1,251.2.
 (d) Disposable personal income = personal income – personal income taxes = 1,100.7
 (e) Net exports = exports – imports = $94.4 - 70.5 = 23.9$
 (f) Personal saving rate = (national income – personal consumption expenditures)/ national income = $(1,100.7 - 878.2)/ 1,100.7 = 222.5/ 1,100.7 = 20.2\%$.
5. (a) \$400; \$400 (b) \$480; \$80 (c) \$500; \$20 (d) \$840; \$340
 (e) \$1,070; \$230 (f) \$1,070
6. (a) Gross private domestic investment = net private domestic investment + depreciation = $490 + 105 = 595$
 (b) Net exports = exports – imports = $133 - 147 = -14$
 (c) National income = compensation of employees + proprietors' income + rental income + corporate profits + net interest + indirect taxes minus subsidies + net business transfer payments + surplus of government enterprises = $1,407 + 168 + 21 + 161 + 42 + 371 + 12 + 98 = 2,280$
 (d) Personal income = NI – amount of national income not going to households = $2,280 - 51 = 2,229$
 (e) Disposable personal income = PI – personal income taxes = $2,229 - 392 = 1,837$
 (f) Net national product = NI – statistical discrepancy = $2,280 - 15 = 2,265$
 (g) Gross national product = NNP + depreciation = $2,265 + 105 = 2,370$
- (h) Gross domestic product = GNP – receipts of factor income from the rest of the world + payments of factor income to the rest of the world = $2,370 - 22 + 43 = 2,391$
 Check using expenditure approach. GDP = personal consumption expenditures + gross private domestic investment + government consumption and gross investment + net exports = $1,377 + (490 + 105) + 433 + (133 - 147) = 2,391$

7. (a) $\text{GDP} = \text{GNP}$ (because net factor payments are zero) = sales + inventory change = $500 + 50 = 550$ units
 (b) $\text{GDP} = \text{GNP}$ (because net factor payments are zero) = sales + inventory change = $500 - 25 = 475$ units
 (c) Depreciation = 10% of GDP = 55;
 $\text{NNP} = \text{GNP} - \text{depreciation} = 550 - 55 = 495$ units
 (d) Depreciation = 10% of GDP = 47.5;
 $\text{NNP} = \text{GNP} - \text{depreciation} = 475 - 47.5 = 427.5$ units
 (e) Personal income = GDP – depreciation – (undistributed earnings) – net factor payments = $550 - 55 - 550(0.12) - 0 = 429$ units
 (f) Personal income = GDP – depreciation – (undistributed earnings) – net factor payments = $475 - 47.5 - 475(0.05) - 0 = 403.75$ units
8. Refer to the following table.

Year	Nominal GDP	Nominal GDP (% change)	GDP Deflator	Real GDP	Real GDP (% change)
1995	1,212.8	—	46.5	2,608.2	—
2000	1,990.5	+64.1	67.3	2,957.7	+13.4
2005	3,166.0	+59.1	100.0	3,166.0	+7.0
2010	4,486.2	+41.7	117.3	3,824.6	+20.8

Note: Rearrange the formula $\text{GDP deflator} = (\text{Nominal GDP} \div \text{real GDP}) \times 100$ to get: $\text{Real GDP} = (\text{Nominal GDP} \div \text{GDP deflator}) \times 100$

9. (a) Nominal GDP for Year 1 \$275
 (b) Nominal GDP for Year 2 \$426
 (c) Real GDP for Year 1 (Year 1 as base) \$275
 (d) Real GDP for Year 2 (Year 1 as base) \$300
10. 1. Yes 2. No 3. No 4. Yes 5. Yes 6. Yes
 7. No 8. Yes 9. No 10. Yes 11. No 12. No
 13. No 14. No 15. Yes 16. Yes 17. Yes 18. Yes