



Measuring a Nation's Income

Goals

In this chapter you will

Consider why an economy's total income equals its total expenditure

Learn how gross domestic product (GDP) is defined and calculated

See the breakdown of GDP into its four major components

Learn the distinction between real GDP and nominal GDP

Consider whether GDP is a good measure of economic well-being

Outcomes

After accomplishing these goals, you should be able to

Demonstrate why income equals expenditure equals output

Explain the key words and phrases in the definition of GDP

Define consumption, investment, government purchases, and net exports

Calculate real and nominal GDP using base-year and current-year prices

List a number of welfare-enhancing activities that are not captured by GDP

Chapter Overview

Context and Purpose

Chapter 23 is the first chapter in the macroeconomic section of the text. It is the first of a two-chapter sequence that introduces you to two vital statistics that economists use to monitor the macroeconomy—GDP and the consumer price index. Chapter 23 develops how economists measure production and income in the macroeconomy. Chapter 24 develops how economists measure the level of prices in the macroeconomy. Taken together, Chapter 23 concentrates on the *quantity* of output in the macroeconomy while Chapter 24 concentrates on the *price* of output in the macroeconomy.

The purpose of this chapter is to provide you with an understanding of the measurement and the use of gross domestic product (GDP). GDP is the single most important measure of the health of the macroeconomy. Indeed, it is the most widely reported statistic in every developed economy.

Chapter Review

Introduction Microeconomics is the study of individual markets and the decision making of individual firms and households that meet in those markets. Macroeconomics is the study of the entire economy as a whole. This chapter and the remainder of this text deals with macroeconomics.

The Economy's Income and Expenditure

In a nation's macroeconomy, income must equal expenditure. This is true because, in every transaction, the income of the seller must be equal to the expenditure of the buyer. Gross domestic product (GDP) is a measure of the *total income* or total output in the economy. Since income equals expenditure, GDP can be measured by adding up the income earned in the economy (wages, rent, and profit) or the expenditure on goods and services produced in the economy. That is, income equals expenditure equals GDP.

The Measurement of Gross Domestic Product

GDP is defined as the market value of all final goods and services produced within a country in a given period of time.

- “Market value” means that production is valued at the price paid for the output. Hence, items sold at higher prices are more heavily weighted in GDP.
- “Of all” means that GDP attempts to measure all production in the economy that is legally sold in markets. For example, GDP excludes the production and sale of illegal drugs and household production such as when homeowners clean their own houses. However, in an attempt to be comprehensive, GDP does include the estimated rental value of owner-occupied housing as an expenditure on housing services.
- “Final” means that GDP includes only goods and services that are sold to the end user. Thus, GDP counts the sale of a Ford Taurus when it is sold at retail, but it excludes Ford's purchases of intermediate goods such as glass, steel, and tires used up during the production of the car. *Intermediate goods* are goods that are produced by one firm to be further processed by another firm. Counting only final goods and services avoids double counting *intermediate production*.
- “Goods and services” means that while GDP clearly includes tangible manufactured items such as cars and trucks, it also includes intangible items such as lawyers' and doctors' services.
- “Produced” means that we exclude the sale of used items that were produced (and counted) in a previous period. Again, this avoids double counting.
- “Within a country” means that GDP measures the value of production within the geographic borders of a country.
- “In a given period of time” means that we measure GDP per year or per quarter.

GDP data are statistically “seasonally adjusted” to eliminate the systematic variations in the data that are caused by seasonal events such as Christmas and crop harvest. Our definition of GDP focuses on expenditures. The government also adds up income to measure GDP. The difference between the two calculations is statistical discrepancy.

Other measures of income besides GDP are listed below, from largest to smallest.

- **Gross national product (GNP):** GNP measures the income or production of a nation's permanent residents or “nationals” (both people and their factories) no matter where they are located.
- **Net national product (NNP):** NNP is the total income of a nation's residents (GNP) minus depreciation. *Depreciation* is the value of the wear and tear on the economy's capital stock.
- **National income:** National income is the total income earned by a nation's residents. It is NNP less indirect business taxes plus business subsidies.
- **Personal income:** Personal income is the income of households and noncorporate businesses. It excludes retained earnings (corporate income not paid out as dividends) but includes interest income households receive from government debt and government *transfer payments* (welfare and Social Security).
- **Disposable personal income:** This is income of households and nonincorporated businesses after they pay their obligations to the government (taxes, traffic tickets).

The Components of GDP

GDP can be measured by adding up the value of the expenditures on final goods and services. Economists divide expenditures into four components: consumption (C), investment (I), government purchases (G), and net exports (NX).

- Consumption is spending by households on goods and services, with the exception of new housing.
- Investment is spending on capital equipment, inventories, and structures such as new housing. Investment does not include spending on stocks, bonds, and mutual funds.
- Government purchases is spending on goods and services by all levels of government (federal, state, and local). Government purchases do not include *transfer payments* such as government payments for Social Security, welfare, and *unemployment* benefits because the government does not receive any product or service in return.
- Net exports is the value of foreign purchases of U.S. domestic production (exports) minus U.S. domestic purchases of foreign production (imports). Imports must be subtracted because consumption, investment, and government purchases include expenditures on all goods, foreign and domestic, and the foreign component must be removed so that only spending on domestic production remains.

Denoting GDP as Y , we can say that $Y = C + I + G + NX$. The variables are defined in such a way that this equation is an identity.

Real versus Nominal GDP

Nominal GDP is the value of output measured in the prices that existed during the year in which the output was produced (current prices). Real GDP is the value of output measured in the prices that prevailed in some arbitrary (but fixed) *base year* (constant prices). If we observe that nominal GDP has risen from one year to the next, we are unable to determine whether the quantity of goods and services has risen or whether the prices of goods and services have risen. However, if we observe that real GDP has risen, we are certain that the quantity of goods and services has risen because the output from each year is valued in terms of the same base-year prices. Thus, real GDP is the better measure of production in the economy.

The GDP deflator = $(\text{nominal GDP}/\text{real GDP}) \times 100$. The GDP deflator is a price index that measures the level of prices in the current year relative to the level of prices in the base year. The percentage change in the GDP deflator is a measure of the rate of inflation.

In the United States, real GDP has grown on average at a rate of 3.2 percent per year since 1965. Occasional periods of decline in real GDP are known as *recessions*.

Is GDP a Good Measure of Economic Well-Being?

Real GDP is a strong indicator of the economic well-being of a society because countries with a large real GDP per person tend to have better educational systems, better health care systems, more literate citizens, better housing, a better diet, a longer life expectancy, and so on. A country with a larger GDP even wins more Olympic medals. That is, a larger real GDP per person generally indicates a larger consumption per person. However, GDP is not a perfect measure of material well-being because it excludes leisure, the quality of the environment, and goods and services produced at home and not sold in markets such as child rearing, housework, and volunteer work. In addition, GDP says nothing about the *distribution* of income. GDP also fails to capture the underground or shadow economy—the portion of the economy that does not report its economic activity. For example, GDP does not measure illegal drug sales or income that is unreported to avoid taxation. The underground economy is relatively small in the United States.

Helpful Hints

1. GDP measures production. When we set out to measure GDP, we must first remember that we are measuring production (and the income earned from producing it) over a period of time. If we can remember that, we will generally account for unusual types of production correctly. Examples:

- How should we handle the measurement of the production of a cruise ship that takes three years to build and is sold at the end of the third year? Logically, we should count the portion of the ship that was completed during each year and apply it to that year's GDP. In fact, that is what economists do. If we had accounted for the entire ship in the year in which it was sold, we would have overestimated GDP in the third year and underestimated GDP in the previous two years.
- Similarly, if a new house were built during one year but sold for the first time during the next year, we should account for it during the first year because that is when it was produced. That is, the builder "purchased" the finished home during the first year and added it to his or her inventory of homes.

While in general we only wish to count final goods and services, we do count the production of intermediate goods that were not used during the period but were added to a firm's inventory because this production will not be captured by counting all of the final goods.

2. GDP does not include all expenditures. We have learned that we can measure GDP by adding the expenditures on final goods and services ($Y = C + I + G + NX$). Once we have learned the expenditure approach, however, we must not forget the words "on final goods and services" and mistakenly count all expenditures. When we include expenditures on used items, intermediate goods, stocks and bonds, or government transfer payments, we get a very large dollar value, but it has nothing to do with GDP. The dollar value of total transactions in the economy is enormous and many times that of GDP.
3. Intermediate goods and final goods are distinct. It should be helpful to clarify the distinction between intermediate goods and final goods with an example. Recall:
 - Intermediate goods are goods that are produced by one firm to be further processed by another firm.
 - Final goods are sold to the end user.

GDP only includes the value of the final goods and services because the value of the intermediate goods used in the production of a final good or service is fully captured in the price of the final good or service. If we include the value of intermediate production in GDP, we would double count the intermediate goods.

If we understand this distinction, can we list the items in the economy that are intermediate or final? For example, is a tire an intermediate good or a final good? The answer is: It depends on who bought it. When General Motors buys a tire from Goodyear, the tire is an intermediate good because General Motors will attach it to a car and sell it. When you buy a tire from your Goodyear dealer, it is a final good and should be counted in GDP. Thus, it is difficult to list items in the economy that are intermediate or final without knowledge of the buyer.

4. Comparisons of GDP across countries and time can be biased. We should be cautious when we compare GDP across nations of different levels of market development and when we compare GDP across long periods of time within a single nation. This is because GDP excludes most nonmarket activities. Clearly, a greater proportion of the output of lesser-developed nations is likely to be household production such as when someone does their own farming, cleaning, sewing, and maybe even home construction. Since these activities are not captured by a market transaction, they are not recorded in lesser-developed nations or in earlier periods of industrialized nations when market development was less extensive. The result is an even lower estimate of their GDP.

Terms and Definitions

Choose a definition for each key term.

Key Terms

- ___ Inflation
- ___ Unemployment
- ___ Macroeconomics
- ___ Microeconomics
- ___ Total income
- ___ Total expenditure
- ___ Gross domestic product
- ___ Intermediate production
- ___ Final production
- ___ Gross national product
- ___ Depreciation
- ___ Consumption
- ___ Investment
- ___ Government purchases
- ___ Net exports
- ___ Transfer payment
- ___ Real GDP
- ___ Nominal GDP
- ___ Base year
- ___ GDP deflator
- ___ Recession

Definitions

1. The production of goods and services valued at current prices
2. Spending by households on goods and services, excluding new housing
3. Spending on domestically produced goods by foreigners (exports) minus spending on foreign goods by domestic residents (imports)
4. Period of decline in GDP
5. Market value of all final goods and services produced within a country in a given period of time
6. Wages, rent, and profit
7. The rate at which prices are rising
8. Market value of all final goods and services produced by a nation's residents in a given period of time
9. Spending on capital equipment, inventories, and structures, including household purchases of new housing
10. Spending on goods and services by all levels of government
11. A measure of the price level calculated as the ratio of nominal GDP to real GDP then multiplied by 100
12. Expenditures by government for which they receive no goods or services
13. Percent of the labor force that is out of work
14. The study of how households and firms make decisions and how they interact in markets
15. Goods that are produced by one firm to be further processed by another firm
16. The study of economy-wide phenomena
17. The production of goods and services valued at base-year prices
18. Finished products sold to the end user
19. Consumption, investment, government purchases, and net exports
20. The year from which prices are used to measure real GDP
21. Value of worn-out equipment and structures

Problems and Short-Answer Questions

Practice Problems

1. a. Complete the following table.

	Year 1	Year 2	Year 3
Gross Domestic Product	4,532	4,804	
Consumption		3,320	3,544
Investment	589	629	673
Government Purchases	861		977
Net Exports	-45	-58	-54

- b. What is the largest expenditure component of GDP?

- c. Does investment include the purchase of stocks and bonds? Why?

- d. Do government purchases include government spending on unemployment checks? Why?

- e. What does it mean to say that net exports are negative?

2. Suppose the base year in the following table is 2006.

Year	Production of X	Price per Unit of X
2006	20 units	\$ 5
2007	20 units	10
2008	20 units	20

- a. What is nominal GDP for 2006, 2007, and 2008?

- b. What is real GDP for 2006, 2007, and 2008?

3. Suppose the following table records the total output and prices for an entire economy. Furthermore, suppose the base year in the following table is 2006.

Year	Price of Soda	Quantity of Soda	Price of Jeans	Quantity of Jeans
2006	\$1.00	200	\$10.00	50
2007	1.00	220	11.00	50

- a. What is the value of nominal GDP in 2006?

- b. What is the value of real GDP in 2006?

- c. What is the value of nominal GDP in 2007?

- d. What is the value of real GDP in 2007?

- e. What is the value of the GDP deflator in 2006?

- f. What is the value of the GDP deflator in 2007?

- g. From 2006 to 2007, prices rose approximately what percentage?

- h. Was the increase in nominal GDP from 2006 to 2007 mostly due to an increase in real output or due to an increase in prices?

4. Complete the following table.

Year	Nominal GDP	Real GDP	GDP Deflator
1	_____	\$100	100
2	\$120	_____	120
3	150	125	_____

- a. What year is the base year? How can you tell?

- b. From year 1 to year 2, did real output rise or did prices rise? Explain.

- c. From year 2 to year 3, did real output rise or did prices rise? Explain.

Short-Answer Questions

1. Why does income = expenditure = GDP?

2. Define GDP and explain the important terms in the definition.

3. What are the components of expenditure? Provide an example of each.

4. Provide an example of a transfer payment. Do we include it in GDP? Why or why not?

5. If nominal GDP in 2008 exceeds nominal GDP in 2007, did real output rise? Did prices rise?

6. If real GDP in 2008 exceeds real GDP in 2007, did real output rise? Did prices rise?

7. If you buy a \$20,000 Toyota that was produced entirely in Japan, does this affect U.S. GDP? Show how this transaction would affect the appropriate expenditure categories that make up GDP.

8. Explain the difference between GDP and GNP. If the residents of the United States generate as much production in the rest of the world as the rest of the world produces in the United States, what should be true about U.S. GDP and GNP?

9. Which contributes more when measuring GDP, a new diamond necklace purchased by a wealthy person or a soda purchased by a thirsty person? Why?

10. If your neighbor hires you to mow her lawn instead of doing it herself, what will happen to GDP? Why? Did output change?

Self-Test

True/False Questions

- 1. For an economy as a whole, income equals expenditure because the income of the seller must be equal to the expenditure of the buyer.
- 2. The production of an apple contributes more to GDP than the production of a gold ring because food is necessary for life itself.
- 3. If the lumberyard sells \$1,000 of lumber to a carpenter and the carpenter uses the lumber to build a garage that he sells for \$5,000, the contribution to GDP is \$6,000.
- 4. A country with a larger GDP per person generally has a greater standard of living or quality of life than a country with a smaller GDP per person.
- 5. If nominal GDP in 2006 exceeds nominal GDP in 2005, real output must have risen.
- 6. If U.S. GDP exceeds U.S. GNP, then foreigners produce more in the United States than U.S. citizens produce in the rest of the world.
- 7. Wages are an example of a transfer payment because there is a transfer of payment from the firm to the worker.
- 8. In the United States, investment is the largest component of GDP.
- 9. Nominal GDP employs current prices to value output while real GDP employs constant base-year prices to value output.
- 10. A new car produced in 2007, but first sold in 2008, should be counted in 2008 GDP because that is when it was first sold as a final good.

- _____ 11. When the city of Chicago purchases a new school building, the investment component of GDP increases.
- _____ 12. A recession occurs when real GDP declines.
- _____ 13. Depreciation is the value of the wear and tear on the economy's equipment and structures.
- _____ 14. Cigarettes should be valued in GDP at \$4.50 per pack even though \$1.00 of that price is tax because the buyers paid \$4.50 per pack.
- _____ 15. Net national product always exceeds a nation's total income because of depreciation and taxes.

Multiple-Choice Questions

1. An example of a transfer payment is
 - a. wages.
 - b. profit.
 - c. rent.
 - d. government purchases.
 - e. unemployment benefits.
2. The value of plant and equipment worn out in the process of manufacturing goods and services is measured by
 - a. consumption.
 - b. depreciation.
 - c. Net national product.
 - d. investment.
 - e. intermediate production.
3. Which of the following would be excluded from 1999 GDP? The sale of
 - a. a 1999 Honda made in Tennessee.
 - b. a haircut.
 - c. a realtor's services.
 - d. a home built in 1998 and first sold in 1999.
 - e. All of the above should be counted in 1999 GDP.
4. Gross domestic product can be measured as the sum of
 - a. consumption, investment, government purchases, and net exports.
 - b. consumption, transfer payments, wages, and profits.
 - c. investment, wages, profits, and intermediate production.
 - d. final goods and services, intermediate goods, transfer payments, and rent.
 - e. net national product, gross national product, and disposable personal income.
5. U.S. gross domestic product (in contrast to gross national product) measures the production and income of
 - a. Americans and their factories no matter where they are located in the world.
 - b. people and factories located within the borders of the United States.
 - c. the domestic service sector only.
 - d. the domestic manufacturing sector only.
 - e. none of the above.
6. Gross domestic product is the sum of the market value of the
 - a. intermediate goods.
 - b. manufactured goods.
 - c. normal goods and services.
 - d. inferior goods and services.
 - e. final goods and services.

7. If nominal GDP in 2008 exceeds nominal GDP in 2007, then the production of output must have
 - a. risen.
 - b. fallen.
 - c. stayed the same.
 - d. risen or fallen because there is not enough information to determine what happened to real output.
8. If a cobbler buys leather for \$100 and thread for \$50 and uses them to produce and sell \$500 worth of shoes to consumers, the contribution to GDP is
 - a. \$50.
 - b. \$100.
 - c. \$500.
 - d. \$600.
 - e. \$650.
9. GDP would include which of the following?
 - a. housework
 - b. illegal drug sales
 - c. intermediate sales
 - d. consulting services
 - e. the value of taking a day off from work
10. Real GDP is measured in _____ prices while nominal GDP is measured in _____ prices.
 - a. current year; base year
 - b. base year; current year
 - c. intermediate; final
 - d. domestic; foreign
 - e. foreign; domestic

The following table contains information about an economy that produces only pens and books. The base year is 2005. Use this information to answer questions 11 through 16.

Year	Price of Pens	Quantity of Pens	Price of Books	Quantity of Books
2005	\$3	100	\$10	50
2006	3	120	12	70
2007	4	120	14	70

11. What is the value of nominal GDP for 2006?
 - a. \$800
 - b. \$1,060
 - c. \$1,200
 - d. \$1,460
 - e. none of the above
12. What is the value of real GDP for 2006?
 - a. \$800
 - b. \$1,060
 - c. \$1,200
 - d. \$1,460
 - e. none of the above

13. What is the value of the GDP deflator in 2006?
 - a. 100
 - b. 113
 - c. 116
 - d. 119
 - e. 138
14. What is the percentage increase in prices from 2005 to 2006?
 - a. 0 percent
 - b. 13 percent
 - c. 16 percent
 - d. 22 percent
 - e. 38 percent
15. What is the approximate percentage increase in prices from 2006 to 2007?
 - a. 0 percent
 - b. 13 percent
 - c. 16 percent
 - d. 22 percent
 - e. 38 percent
16. What is the percentage increase in real GDP from 2006 to 2007?
 - a. 0 percent
 - b. 7 percent
 - c. 22 percent
 - d. 27 percent
 - e. 32 percent
17. If U.S. GDP exceeds U.S. GNP, then
 - a. foreigners are producing more in the United States than Americans are producing in foreign countries.
 - b. Americans are producing more in foreign countries than foreigners are producing in the United States.
 - c. real GDP exceeds nominal GDP.
 - d. real GNP exceeds nominal GNP.
 - e. intermediate production exceeds final production.
18. U.S. GDP would exclude which of the following?
 - a. lawyer services purchased by a home buyer
 - b. lawn care services purchased by a homeowner
 - c. a new bridge purchased by the state of Texas
 - d. cotton purchased by Lee Jeans
 - e. the purchase of a new Mazda produced in Illinois
19. How is your purchase of a \$40,000 BMW automobile that was produced entirely in Germany recorded in the U.S. GDP accounts?
 - a. Investment increases by \$40,000 and net exports increase by \$40,000.
 - b. Consumption increases by \$40,000 and net exports decrease by \$40,000.
 - c. Net exports decrease by \$40,000.
 - d. Net exports increase by \$40,000.
 - e. There is no impact because this transaction does not involve domestic production.
20. If your grandparents buy a new retirement home, this transaction would affect
 - a. consumption.
 - b. investment.
 - c. government purchases.
 - d. net exports.
 - e. none of the above.

Advanced Critical Thinking

You are watching a news report with your father. The news anchor points out that a certain troubled Caribbean nation generates a GDP per capita of only \$450 per year. Since your father knows that U.S. GDP per capita is approximately \$45,000, he suggests that we are materially 100 times better off in the United States than in the Caribbean nation.

1. Is your father's statement accurate?

2. What general category of production is not captured by GDP in both the United States and the Caribbean nation?

3. Provide some examples of this type of activity.

4. Why would the exclusion of this type of production affect the measurement of Caribbean output more than U.S. output?

5. Does this mean that residents of the Caribbean nation are actually as well off materially as residents in the United States?

Solutions

Terms and Definitions

- 7 Inflation
 13 Unemployment
 16 Macroeconomics
 14 Microeconomics
 6 Total income
 19 Total expenditure
 5 Gross domestic product
 15 Intermediate production
 18 Final production
 8 Gross national product
 21 Depreciation
 2 Consumption
 9 Investment
 10 Government purchases
 3 Net exports
 12 Transfer payment
 17 Real GDP
 1 Nominal GDP
 20 Base year
 11 GDP deflator
 4 Recession

Practice Problems

1. a.

	Year 1	Year 2	Year 3
Gross Domestic Product	4,532	4,804	5,140
Consumption	3,127	3,320	3,544
Investment	589	629	673
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Net Exports	-45	-58	-54

- b. consumption
 c. No, because that transaction is a purchase of an asset, not a purchase of currently produced capital goods.
 d. No, because unemployment benefits are expenditures for which the government receives no production in return.
 e. It means that imports exceed exports.
2. a. \$100, \$200, \$400
 b. \$100, \$100, \$100
3. a. \$700
 b. \$700
 c. \$770
 d. \$720

- e. 100
 f. 107
 g. $(107 - 100)/100 = 0.07 = 7\%$
 h. Percent increase in nominal = $(\$770 - \$700)/700 = 0.10 = 10\%$. Percent increase in prices = 7%; therefore, most of the increase was due to prices.

4.

Year	Nominal GDP	Real GDP	GDP Deflator
1	\$100	\$100	100
2	120	100	120
3	150	125	120

- a. Year 1, because the deflator = 100.
 b. Prices rose 20 percent and real output stayed the same.
 c. Prices stayed the same and real output rose 25 percent.

Short-Answer Questions

- Because the income of the seller equals the expenditure of the buyer and GDP can be measured with either one.
- Market value of all final goods and services produced within a country in a given period of time. "Market value" = price paid, "of all" = all legal production, "final" = to end users, "goods and services" = includes services, "produced" = no used items, "within a country" = inside borders, "in a given period" = per quarter or year.
- Consumption (food), investment (factory), government purchases (military equipment), net exports (sale of a Ford to France minus purchase of a Toyota produced in Japan).
- Social Security payments. No, because the government received no good or service in return.
- We can't be certain which rose, prices or real output, because an increase in either prices or real output will cause nominal output to rise.
- Real output rose because the value of output in each year is measured in constant base-year prices. We have no information on prices.
- No. Consumption would increase by \$20,000 and net exports would decrease by \$20,000. As a result, U.S. GDP is unaffected.
- GDP is the production within the borders of the United States. GNP is the production of Americans no matter where the production takes place. They should be equal.
- A diamond necklace because GDP measures market value.

10. GDP will rise because the mowing of the lawn was a market transaction. However, output didn't really rise.

True/False Questions

1. T
2. F; contribution is based on market value.
3. F; the garage is the final good, valued at \$5,000.
4. T
5. F; prices or real output could have risen.
6. T
7. F; transfer payments are expenditures for which no good or service is received in return.
8. F; consumption is the largest component of GDP.
9. T
10. F; goods are counted in the year produced.
11. F; the purchase is included in government purchases.
12. T
13. T
14. T
15. F; total income – depreciation = NNP.

Multiple-Choice Questions

1. e
2. b
3. d
4. a
5. b
6. e
7. d
8. c
9. d
10. b
11. c
12. b
13. b
14. b
15. d
16. a
17. a
18. d
19. b
20. b

Advanced Critical Thinking

1. No.
2. Nonmarket activities such as household production.
3. Household production done by an individual without pay such as gardening, cleaning, sew-

ing, home improvement or construction, child supervision, etc.

4. A greater proportion of the output produced by less-developed nations is nonmarket output. That is, it is not sold and recorded as a market transaction.
5. No. It just means that quantitative comparisons between nations of greatly different levels of development are very difficult to do and are often inaccurate.