

Module 1: National Income Accounting

Module 1: National Income Accounting practice problems

(The attached PDF file has better formatting.)

Know how to compute GDP, GNP, NDP, and NNP. Examples of items that are asked on the final exam are

- Sales of final products vs intermediate products. Final sales to consumers are included in the expenditure perspective for computing GDP; intermediate sales to other producers are not included.
- Re-sale of used products are not included in the expenditure perspective for computing GDP.
- Change in business inventories are part of business investment and are in the expenditure perspective for computing GDP
- Imputed rental income is the income part of homes and offices and the cost of homes and offices; the imputed income is included in both the expenditure and the income perspectives for computing GDP.
- Wages from labor by U.S. citizens in other countries and profits from foreign operations owned by U.S. citizens are added to GDP to get GNP; wages to foreigners working in the U.S. and profits of businesses in the U.S. owned by foreigners are subtracted from GDP to get GNP.
- Exports minus imports, or net exports, are included in the expenditure perspective to compute GDP.
- Costs of government services that are provided free (e.g., national defense, public schools) are included in the expenditure perspective for computing GDP.
- Government transfer payments (e.g., social security, welfare) are not in GDP.
- Depreciation of domestic or national investment is subtracted from GDP to get NDP.

These are examples; other items in the textbook are also asked. All final exam problems are multiple choice.

**** Question 1.1: GDP and GNP**

U.S. GDP in 20X5 is 400,000.

- Jacob, a U.S. citizen, works in Paris and earns 30,000.
- Jacques, a French citizen, works in Boston and earns 40,000.
- Rachel, a U.S. citizen, owns a condominium in Berlin which she rents to a German family for 20,000.
- Angela, a German citizen, owns a warehouse in California which she rents to a U.S. firm for 70,000.

- A. What are income receipts from the rest of the world?
B. What are income payments to the rest of the world?
C. What is U.S. GNP in 20X5?

Solution 1.1: The four entries in the bulleted list above are re-labeled in the table below.

Income on Capital Owned by U.S. Residents but Located Abroad	20,000
Labor Income of U.S. Residents Working Abroad	30,000
Payments to Capital in the U.S. Owned by Foreigners	70,000
Payment to Foreigners Working in the U.S.	40,000

Part A: Income receipts from rest of world = income on capital owned by U.S. residents but located abroad + labor income of U.S. residents working abroad = 30,000 + 20,000 = 50,000.

Part B: Income payments to rest of world = payments to capital in the U.S. owned by foreigners + payments to foreigners working in the U.S. = 70,000 + 40,000 = 110,000

Part C: Gross National Product (GNP) = Gross Domestic Product (GDP) + income receipts from rest of world – income payments to rest of world = 400,000 + 50,000 – 110,000 = 340,000.

GDP (Gross Domestic Product) is the wealth produced in the country, regardless who owns the wealth. GNP is the wealth produced by citizens of the country, regardless where the wealth is produced.

Question: Which is the better measure, GDP or GNP?

Answer: Each measure has advantages.

GDP is the better measure of the wealth produced in the country. We don't care about the citizenship of the people producing the wealth. If Jacob and Jacques work as actuaries and each produces 50,000 of wealth, GDP increases the same amount from each worker, even if Jacob is a citizen and Jacques is a foreigner.

GDP is the better measure of the wealth produced by the citizens. We don't care where the people work. If Jacob and Rachel are oil engineers earning 50,000 apiece, GNP increases the same amount from each worker, even if Jacob works in Texas and Rachel works in Libya.

See Barro *Macroeconomics* Chapter 2 National Income Accounting, page 20

**** Exercise 1.2: National income accounts**

For each of the following pairs, which is larger?

- A. GDP *or* GNP
- B. NNP *or* GNP
- C. Personal income *or* national income
- D. National income *or* net national product
- E. Personal income *or* disposable personal income

Part A: GDP may be more or less than GNP. For the entire world, combining the national income accounts for all countries, $GDP = GNP$.

Part B: $NNP = GNP - \text{depreciation}$, so $NNP < GNP$.

Part C: National income is more than personal income in the United States, though the relation depends on the size of personal transfer payments and corporate taxes.

Part D: National income = net national product (NNP), except for statistical discrepancies.

Part E: Personal income – personal taxes = disposable personal income, so personal income is greater

See Barro *Macroeconomics* Chapter 2 National Income Accounting, page 21

**** Exercise 1.3: National income accounts**

The national accounts show

- Net factor income from abroad = 10
- Income from private domestic industries = 780
- Income from governmental industries = 100
- Personal consumption expenditures = 500
- Government purchases = 250
- Exports = 40
- Imports = 60
- Depreciation = 30

- A. What is net national product (NNP)?
- B. What is net domestic product (NDP)?
- C. What is Gross Domestic Product (GDP)?
- D. What is gross private domestic investment?

Part A: Measuring by the production approach gives

$$\text{National income} = \text{net national product (NNP)} = 10 + 780 + 100 = 890.$$

Part B: Subtract factor income from abroad to get

$$\text{Net Domestic Product (NDP)} = 890 - 10 = 880.$$

Part C: Add depreciation to get

$$\text{Gross Domestic Product (GDP)} = 880 + 30 = 910.$$

Part D: Use the expenditure approach:

$$\text{GDP} = \text{Personal consumption expenditures} + \text{government purchases} + \text{net exports} + \text{investment}$$

$$\text{GDP} = 500 + 250 + (40 - 60) + \text{investment}$$

$$\Rightarrow \text{investment} = 910 - (500 + 250 + 40 - 60) = 180$$

See Barro *Macroeconomics* Chapter 2 National Income Accounting, page 22

** Exercise 1.4: GDP and social welfare

Some economists propose GDP yardsticks to better measure social welfare.

- A. Why might real GDP not be a good measure of social welfare?
- B. Why are the criticisms of real GDP too subjective for scientific use?
- C. Why might traditional real GDP be a good measure of social welfare?

Part A: The problems of real GDP as a measure of social welfare are shown by the Soviet satellites before the collapse of the Soviet Union, such as East Germany. Industrial production was forced on communities with no concern for environmental hazards. The social welfare costs of pollution often exceeded the welfare benefits of higher real GDP.

Part B: Social welfare costs like global warming and degradation of the environment depend on the observer. Carbon dioxide emissions might expose the world to a less healthy environment in the future, but these costs are unknown.

Part C: Economic progress is often the best way to solve other problems. Wealthier countries can afford better education and health care for their citizens; programs to reduce air and water pollution; and welfare payments to reduce income inequality. During the transition phase, developing countries may neglect non-economic goals, and they may have high growth rates of real GDP but poor results on other objectives. In the steady state phase, the wealthier countries have the best grades on other indices of social welfare.

The textbook lists items that are not in GDP but affect social welfare.

See Barro *Macroeconomics* Chapter 2 National Income Accounting, page 15, column 2.

** Exercise 1.5: Wheat, Flour, Bread, and GDP

A country grows wheat to make flour and bread. Its costs and revenue are shown below.

<i>Worker</i>	<i>Farmer</i>	<i>Miller</i>	<i>Baker</i>
<i>Product</i>	<i>Wheat</i>	<i>Flour</i>	<i>Bread</i>
<i>Labor Costs</i>	175	200	200
<i>Supplies</i>	0	200	350
<i>Profit</i>	25	50	150
<i>Sales</i>	200	450	700

Wheat is used to make flour, which is used to make bread.

- A. How much wheat is sold to millers to make flour, and how much is sold to consumers?
- B. How much flour is sold to bakers to make bread, and how much is sold to consumers?
- C. From the expenditure perspective, what is the country's GDP?
- D. From the income perspective, what is the country's GDP?

Part A: What sales are 200, and flour supplies are 200. All the wheat is sold to millers to make flour; nothing is sold to final consumers.

Part B: Flour sales are 450, and bread supplies are 350. Wheat sales to bakers to make bread are 350, and sales to final consumers are 100.

Part C: The expenditure perspective uses final sales to consumers, not intermediate sales to producers. Final sales are 0 for wheat (all is sold to millers), 100 for flour (the other 350 is sold to bakers), and 700 for bread. GDP is $0 + 100 + 700 = 800$.

Part D: The income perspective uses labor costs and profit, which are $175 + 25 = 200$ for wheat, $200 + 50 = 250$ for flour, and $200 + 150 = 350$ for bread. GDP is $200 + 250 + 350 = 800$.

**** Exercise 1.6: GDP**

- 20X6: Ford Motor Co. buys auto parts for \$10,000. The parts were made in 20X5.
- 20X7: Ford spends \$12,000 in labor costs to build a car.
- 20X8: Ford sells the car for \$35,000 to a visiting Japanese businessman.
- 20X9: The Japanese businessman re-sells the car to a U.S. resident for \$24,000.

- A. What are the contributions to GDP in 20X6 from the expenditure and income perspectives?
- B. What are the contributions to GDP in 20X7 from the expenditure and income perspectives?
- C. What are the contributions to GDP in 20X8 from the expenditure and income perspectives?
- D. What are the contributions to GDP in 20X9 from the expenditure and income perspectives?

Part A: From the expenditure perspective, the auto parts are sold to a producer (Ford), not to final consumers, so they are not included in GDP. From the income perspective, the parts were made in 20X5, so the income goes to 20X5 GDP.

Part B: From the expenditure perspectives, sales are zero. Inventories increase from \$10,000 of auto parts to $\$10,000 + \$12,000 = \$22,000$ of unsold cars. The change in business inventories is included in GDP, which is \$12,000 for 20X7. From the income perspective, 20X7 GDP is labor costs of \$12,000.

Part C: From the expenditure perspective, sales are \$35,000 to a final consumer. Business inventories change from \$22,000 to zero, so the change is $-\$22,000$. The contribution to GDP is $\$35,000 - \$22,000 = \$13,000$. From the income perspective, labor costs in 20X8 are zero and profit is \$13,000, so GDP is \$13,000.

Question: Total GDP for 20X6, 20X7, and 20X8 is $\$12,000 + \$13,000 = \$25,000$, but the car sells for \$35,000.

Answer: Correct; \$10,000 of GDP (making the auto parts) occurs in 20X5.

Question: How would the answer change if Ford sold the car to a person in Japan?

Answer: Sales in the U.S. would be zero, but net exports would be \$35,000. GDP would not change.

Part D: From the expenditure perspective, re-sales of used goods are not included in GDP. From the income perspective, no labor costs occur in 20X9, so 20X9 GDP is zero.

Question: How would the answers change if the auto maker were Toyota (a Japanese firm), instead of Ford?

Answer: All the work is done in the U.S. by American workers, so the answers would not change.

Question: What if the exercise asked about GNP, not GDP, and the auto maker were Toyota, not Ford?

Answer: We derive GNP from GDP by subtracting labor costs and profits of foreigners working in the U.S. and add labor costs and profits of U.S. citizens from overseas. The \$13,000 profit of Toyota is part of Japan's GNP instead of U.S. GNP for 20X8.

**** Exercise 1.7: Gross Domestic Product and income**

The national income accounts for 20X7 are

Income on Capital Owned by U.S. Residents but Located Abroad	3.25
Labor Income of U.S. Residents Working Abroad	1.75
Payments to Capital in the U.S. Owned by Foreigners	0.75
Payment to Foreigners Working in the U.S.	4.50
Depreciation of capital stock	12.50
Corporate profits, taxes on production, business transfers, and net interest	22.25
Personal transfer payments and personal income receipts on assets	18.50
Personal taxes	8.75

Gross Domestic Product is 100. The national accounts have no statistical discrepancies.

- A. What are income receipts from rest of world?
- B. What are income payments to rest of world?
- C. What is Gross National Product?
- D. What is net national product?
- E. What is personal income?
- F. What is disposable personal income?

Part A: Income receipts from rest of world = income on capital owned by U.S. residents but located abroad + labor income of U.S. residents working abroad = $3.25 + 1.75 = 5.00$

Part B: Income payments to rest of world = payments to capital in the U.S. owned by foreigners + payments to foreigners working in the U.S. = $0.75 + 4.50 = 5.25$

Part C: Gross National Product (GNP) = Gross Domestic Product (GDP) + income receipts from rest of world – income payments to rest of world = $100 + 5.00 - 5.25 = 99.75$

Part D: Net national product (NNP), or national income (statistical discrepancies = 0) = Gross National Product – depreciation of the capital stock = $99.75 - 12.50 = 87.25$

Part E: Personal income = Net national product (NNP) – Corporate profits, taxes on production, business transfers, and net interest + Personal transfer payments and personal income receipts on assets = $87.25 - 22.25 + 18.50 = 83.50$

Part F: Disposable personal income = Personal income – Personal taxes = $83.50 - 8.75 = 74.75$

Know the entries in the table below, patterned after Table 2.5 on page 21 of Barro's *Macroeconomics*.

Gross Domestic Product (GDP)	100.00
<i>Income on Capital Owned by U.S. Residents but Located Abroad</i>	3.25
<i>Labor Income of U.S. Residents Working Abroad</i>	1.75
+ Income receipts from rest of world	5.00
<i>Payments to Capital in the U.S. Owned by Foreigners</i>	0.75
<i>Payments to Foreigners Working in the U.S.</i>	4.50
– Income payments to rest of world	5.25
Gross National Product (GNP)	99.75
– Depreciation of capital stock	12.50
Net national product (NNP) \approx National income	87.25
– Corporate profits, taxes on production, business transfers, and net interest	22.25
+ Personal transfer payments and personal income receipts on assets	18.50
Personal income	83.50
– Personal taxes	8.75
Disposable personal income	74.75

**** Exercise 1.8: Gross Private Domestic Investment**

Which of the following are included in the national income account *gross private domestic investment*?

- A. Purchases of factories and equipment
- B. Purchases of homes
- C. Purchases of cars and other durable goods
- D. The change in business inventories
- E. The change in personal inventories
- F. Purchases of stocks and bonds

Part A: Consumption goods are used up soon after they are bought; investment goods are used over many years. Factories and equipment are used for many years. The consumption in any year is the imputed rent.

Question: How does consumption differ from investment for macroeconomics?

Answer: Investment creates capital; consumption does not create capital. The opposite of investment is depreciation, which reduces capital. For example, a factory may be bought for \$40 million (investment) and depreciated over 20 years at \$2 million a year. The gross investment is \$40 million. The net investment is the gross investment minus the depreciation of all factories, both the factory bought this year and the factories bought in previous years.

Question: What if a firm builds its own factory instead of buying it? Is that also private domestic investment?

Answer: Yes, building a factory is an investment just like buying a factory.

Part B: A home is used by the owner for many years. It may be bought for \$200,000 in 20X0 and depreciated for 40 years at \$5,000 a year.

Part C: Cars and other durable goods (furniture, lawn mowers, household equipment) are consumption goods, not investment. Computing depreciation of these goods is complex; treating them as consumption is simpler.

Part D: Firms normally sell their goods soon after they make them, so the income perspective for GDP equals the expenditure perspective. For example, a restaurant pays cooks, cashiers, and waiters (labor costs) and charges patrons (sales). Labor plus supplies plus profits equals sales. Some firms sell their goods long after they make them. An aircraft maker may spend five years building a plane. It pays labor costs each year, so the income perspective shows GDP each year, but it sells the plane at the end of the five years. To ensure that the expenditure perspective is the same as the income perspective, the change in inventories (unsold planes and parts) is considered investment and is part of GDP.

Part E: Personal inventories (a consumer's durable goods, clothes, and appliances) are already included in GDP when they are bought. The change in personal inventories is not part of GDP.

Part F: Stocks and bonds are not goods; they are documents which give the holder the rights to cash flows. We refer to them as investment in common speech. Economists use the term *investment* to mean the creation of capital, such as factories, not the purchase of stocks and bonds.

**** Exercise 1.9: Imputed Rental Income**

A woman buys a house on Dec 31, 20X5, for \$300,000, and she lives in the house in 20X6.

- The interest rate in 20X6 is 8%.
- Depreciation on the house in 20X6 is \$15,000.
- She could rent the house in 20X6 for \$25,000.

She sells the house on December 31, 20X6, for \$340,000.

- A. What does the house contribute to GDP in 20X5?
- B. What does the house contribute to GDP in 20X6?

Part A: Purchase of the house contributes \$300,000 to GDP by the expenditure perspective.

Question: The income perspective shows no income if the house was built in previous years. Suppose the house was built in 20X3 and 20X4, but it was not sold until 12/31/20X5.

Answer: Suppose the house was built in 20X4 for \$250,000 in labor costs and supplies. GDP in 20X4 is \$250,000 from the income perspective. The builder's inventory of unsold houses increases \$250,000, so GDP from the expenditure perspective is also \$250,000.

On December 31, 20X5, the house is sold for \$300,000. From the income perspective, the builder's profit is \$50,000, so GDP is \$50,000. From the expenditures perspective, the sale of the house contributes \$300,000 and the change in business inventories (from \$250,000 to zero) subtracts \$250,000, so GDP is \$50,000.

Part B: GDP in 20X6 is the value of living in the house, or the imputed rental income of \$25,000.

Depreciation reduces NDP (Net Domestic Product) by \$15,000; it is not the value of the house. The interest rate is not relevant. Re-sale of the house does not affect GDP.

Question: Is imputed rental income the expenditures perspective or the income perspective?

Answer: Both the expenditures perspective and the income perspective include imputed rental income. For expenditures perspective, it is rent paid by tenants; for the income perspective, it is rent received by landlords.

Question: Why do we impute rental income when no rent is actually paid?

Answer: Consider the following scenario.

- In 20X4, David lives in his home in New York and Jonathan lives in his home in California.
- In 20X5, David takes a job in California and Jonathan takes a job in New York. David rents Jonathan's home in California for \$2,000 a month and Jonathan rents David's home in New York for \$2,000 a month.
- In 20X6, David and Jonathan exchange homes and stop paying rent to each other.

If we did not impute rent, GDP would rise from 20X4 to 20X5 by $12 \times 2 \times \$2,000 = \$48,000$ a year and decline from 20X5 to 20X6 by \$48,000 a year. But there is no change in actual production. Imputed rental income makes GDP the same in each year.