

Economics 132.03
Principles of Macroeconomics
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Professor Peter Ireland

<http://www2.bc.edu/~irelandp/ec132.html>

Solutions to First Midterm Exam

1. What happens to US gross domestic product (GDP) and its four main components when ...
- a. Hallmark a (US firm) buys \$1 million worth of paper from International Paper (another US firm) to make greeting cards?

In this case paper is an intermediate good, so GDP and all of its components remain unchanged.

- b. You (a US resident) buy a used car?

GDP only includes newly-produced items, so again, GDP and all of its components remain unchanged.

- c. The State of Massachusetts hires a new employee?

Salaries of all government employees at the federal, state, and local level are included in the government purchases component of GDP, so G goes up and so does GDP.

- d. General Motors (a US firm) buys new computer equipment made in Japan?

GDP only includes domestically-produced goods. I goes up, but NX goes down by the same amount. GDP remains unchanged.

- e. You (a US resident) spend \$25 on a haircut?

Consumption includes durable goods, nondurable goods, and services, so C goes up and so goes GDP.

2. Consider a simple economy in which only two goods are produced and sold: pizza and beer. The prices and quantities produced of these two goods over a three-year period are shown in the table below.

Year	Price of Pizza	Quantity of Pizza	Price of Beer	Quantity of Beer
2005	\$2	1	\$2	1
2006	\$2	3	\$2	2
2007	\$4	3	\$8	2

- a. Calculate nominal GDP in 2005, 2006, and 2007.

$$2005: \$2 \times 1 + \$2 \times 1 = \$4$$

$$2006: \$2 \times 3 + \$2 \times 2 = \$10$$

$$2007: \$4 \times 3 + \$8 \times 2 = \$28$$

- b. Next, using 2005 as your base year, calculate real GDP in 2005, 2006, and 2007.

$$2005: \$2 \times 1 + \$2 \times 1 = \$4$$

$$2006: \$2 \times 3 + \$2 \times 2 = \$10$$

$$2007: \$2 \times 3 + \$2 \times 2 = \$10$$

- c. Does the GDP deflator rise between 2005 and 2006? Why or why not?

No. Because quantities rise while prices remain unchanged, nominal and real GDP rise by the same amount, leaving the GDP deflator unchanged.

- d. Does the GDP deflator rise between 2006 and 2007? Why or why not?

Yes. Because prices rise while quantities remain unchanged, nominal GDP rises but real GDP stays unchanged, and the GDP deflator rises too.

3. In recent years, many new parents (fathers and mothers alike) have chosen to quit their jobs to stay home and care for their children.

- a. What happens to GDP when both parents work before having children, but one decides to stay at home afterwards to take care of the kids full time?

GDP measures the value of goods and services using market values; hence, activities like housework and childcare from a parent are not accounted for. Because of this convention, GDP falls when one parent who had been working decides to stay home and care for the children.

- b. How does this change in GDP compare to the change in the parents' well-being?

Presumably, the parent gets a benefit from being with his or her children that is not accounted for in GDP. Hence, we can say that the decline in GDP is not necessarily matched by a decline in the parents' true well-being.

4. Go back to the same example from question 2, above. Consumers in the economy like two goods: pizza and beer. Prices and quantities consumed are the same as before:

Year	Price of Pizza	Quantity of Pizza	Price of Beer	Quantity of Beer
2005	\$2	1	\$2	1
2006	\$2	3	\$2	2
2007	\$4	3	\$8	2

- a. As a first step in computing the consumer price index (CPI), the Bureau of Labor Statistics surveys consumers to determine the “basket of goods” purchased by a typical consumer. Using 2005 as your base year, what is the basket of goods in this economy?

The basket of goods consists of one pizza and one beer.

- b. What is the cost of the basket in each year: 2005, 2006, and 2007?

2005: $\$2 \times 1 + \$2 \times 1 = \$4$

2006: $\$2 \times 1 + \$2 \times 1 = \$4$

2007: $\$4 \times 1 + \$8 \times 1 = \$12$

- c. Still using 2005 as the base year, what is the CPI in each year: 2005, 2006, 2007?

2005: $\$4/\$4 \times 100 = 100$

2006: $\$4/\$4 \times 100 = 100$

2007: $\$12/\$4 \times 100 = 300$

- d. Is percentage change in the CPI between 2005 and 2007 in this question larger than, smaller than, or the same as the percentage change in the GDP deflator between 2005 and 2007 in question 2? What explains the difference, if any?

In this example, the inflation rate as measured by the CPI is larger than the inflation rate as measured by the GDP deflator. This is because of what macroeconomists call “substitution bias.” The CPI holds the basket of goods fixed, even though consumers will tend to substitute away from goods, such as beer in this case, with prices that rise at relatively faster rates.

5. Explain what happens to the GDP deflator and the CPI in the United States when ...

- a. The price of fighter planes, newly-produced by Lockheed Martin (a US firm) and sold to the US Air Force, rises.

The sale contributes to government purchases and hence to GDP, but fighter planes are not included in the basket of goods used to compute the CPI. Hence, the GDP deflator rises but the CPI remains unchanged.

- b. The price of a BMW (a car, newly-produced in Germany) sold to a US consumer rises.

The imported car is not included in GDP, but will be in the basket of goods used to compute the CPI. Hence, the GDP deflator remains unchanged but the CPI rises.

- c. The price of a Ford Taurus (a car, newly-produced in the US) sold to a US consumer rises.

The GDP deflator rises and so does the CPI.

- d. The price of a Boeing 747 (a commercial aircraft, newly-produced in the US) sold to US Airways (a US firm) rises.

The sale of commercial aircraft to a US firm contributes to investment but not to consumption. Hence the GDP deflator rises but the CPI remains unchanged.

- e. The price of a Boeing 747 (a commercial aircraft, newly-produced in the US) sold to British Airways (a foreign firm) rises.

The export contributes to the net export component of GDP but commercial aircraft are not included in the basket of goods used to compute the CPI. Hence the GDP deflator rises but the CPI remains unchanged.

6. In 1980, major US banks offered interest rates as high as 15% per year on savings accounts offered to consumers. By 2000, that rate had dropped to 5% per year. On the other hand, in 1980 the US inflation rate was about 14% per year, whereas in 2000, the US inflation rate was only 3% per year.
- a. What was the real interest rate in 1980? What was the real interest rate in 2000?

The real interest rate equals the nominal interest rate minus the rate of inflation.

1980: 15% - 14% = 1%

2000: 5% - 3% = 2%

- b. What was the nominal interest rate in 1980? What was the nominal interest rate in 2000?

The nominal interest rate is the rate that is actually quoted by the bank: 15% in 1980 and 5% in 2000.

- c. For a consumer, which year – 1980 or 2000 – was a better time to put money in the bank?

Nominal interest rates can be misleading measures of the return on saving when the inflation rate changes a lot; real interest rates are more relevant, since consumers care not so much about the number of dollars received but about the amount of goods and services those dollars can buy. In this case, higher real interest rates make 2000 the better time to put money in the bank, even though the nominal interest rate was lower than in 1980.

7. Explain *briefly* (in one, two, or three sentences):
- What do macroeconomist mean by the term “human capital?”

Human capital refers to the knowledge and skills that workers require through education, training, and experience.

- How does the process of “investing” in human capital resemble the process of investing in physical capital?

Both activities involve a trade-off over time: a cost is incurred today and a benefit is enjoyed in the future. In the case of physical capital, the cost is the cost of the capital investment today and the benefit is the earnings that capital provides in the future. In the case of human capital, the cost is the cost of tuition and of foregone earnings while receiving training, but the benefit is the higher wage earned by the more highly-skilled labor.

8. Macroeconomists sometimes think about the determinants of a nation’s standard of living with the help of an “aggregate production function” such as

$$Y = AF(L, K, H, N)$$

Where Y denotes real GDP, L the number of workers, K the stock of physical capital, H the stock of human capital, N the stock of natural resources, and A the stock of technological knowledge.

- What does it mean to say that holding the stock of knowledge fixed, the aggregate production function has the property of constant returns to scale?

Constant returns to scale means that holding A fixed, doubling L , K , H , and N leads to a doubling of output. Mathematically:

$$2Y = AF(2L, 2K, 2H, 2N)$$

or, more generally, for any multiple or fraction x ,

$$xY = AF(xL, xK, xH, xN),$$

- Assuming that this aggregate production function has this property of constant returns to scale, rewrite the equation from above as one that shows how productivity depends on four determinants: physical capital per worker, human capital per worker, natural resources per worker, and the stock of technological knowledge.

Choosing $x = 1/L$ in the last expression from above:

$$Y/L = AF(1, K/L, H/L, N/L).$$

9. Explain *briefly* (in no more than a sentence or two for each part) how the following public policies might help raise the US standard of living?

- a. The government decides to spend money to improve the quality of primary and secondary school education.

This policy will increase the standard of living by raising productivity and, more specifically, by contributing to the accumulation of human capital per worker.

- b. The government increases the budget for the National Science Foundation.

This policy will increase the standard of living by raising productivity and, more specifically, by adding to the stock of technological knowledge.

- c. The government adopts policies that encourage US households to consume less and save more.

This policy will increase the standard of living by raising productivity and, more specifically, by contributing to the accumulation of physical capital per worker.

- d. The government allows foreigners to build, own, and operate new factories in the US.

This policy will increase the standard of living by raising productivity and, more specifically, by contributing to the accumulation of physical capital per worker.

- e. The government secures property rights so that all citizens can benefit in the future from their investments today.

This policy will increase the standard of living by raising productivity and, more specifically, by contributing to the accumulation of physical capital per worker, and possibly human capital per worker as well.