

PROBLEM SET 1 – SOLUTIONS

14.02 Macroeconomics

February 22, 2006

I. Answer each as True, False, or Uncertain, providing a few sentences of explanation for your choice.

1. The annual growth rate of GDP was 0.8% in 2001, so the positive growth rate indicates there was in fact no “recession of 2001.”

False. Although the growth rate remained positive for the year as a whole, it was negative for the first three quarters in 2001, so economists refer to this period as the recession of 2001. Recession usually refers to at least two consecutive quarters of negative GDP growth.

2. Last year, government spending on goods and services (G) grew significantly. This was due partly to an increase in Social Security, welfare and Medicare payments as well as an increase in unemployment compensation.

False. Total government expenditures consist of two main components. First, government spending on goods and services (G) which is counted under GDP. The second component are government transfers (e.g. welfare, social security, medicare, etc.) and interest payment on government debt. We do not count government transfers under GDP because they are not purchases of goods and services, but rather represent transfers of income from some taxpayers to others or foreigners. An increase in government transfers does not increase GDP directly, but an increase in G does.

3. The unemployment rate must go up when the economy slows down.

Uncertain. The change in the unemployment rate is ambiguous because an increase in unemployment is typically associated with an increase in the number of people who drop out of the labor force.

4. Deflation is desirable for an economy since a decline in the price level improves real incomes in the economy.

False. Recall the “Japanese Slump” discussed in Chapter 1. Deflation can be harmful.

5. Although both the GDP deflator and the CPI are measures of the price level, the two do not necessarily move together all the time. In 2005, the annual GDP deflator inflation was 2.7% while the CPI inflation was 3.4%.

True. The rise in oil price increased the price of goods consumed relative to the price of goods produced in the US.

6. The rich spend more than the poor since they have more income to spend, therefore a tax cut designed to revive the economy from a recession should be targeted towards the rich.

False. Even though the rich spend more in absolute terms, they may have a lower marginal propensity to consume, i.e., they may consume a lower fraction of the extra dollar made available to them through the tax increase. If this were the case, then the tax cut should be targeted at the poor, since the multiplier for the poor would be larger.

II. Short questions

1. Consider an economy with three companies A, B, C. Company A grows oranges. Half of the oranges are used by Company B to produce orange juice. Company B exports part of its products and sells the rest to Company C. Company C is a retail store that distributes the juice manufactured by B in the domestic market and the rest of the oranges harvested by A. Below are balance sheets for all three companies for year 2005 and 2006.

Company A	2005	2006
Revenues from sales	\$100	\$200
Expenses	\$50	\$50
Wages	\$50	\$50
Profits	\$50	\$150

Company B	2005	2006
Revenues from sales	\$200	\$200
Expenses	\$100	\$150
Wages	\$50	\$50
Orange purchases	\$50	\$100
Profits	\$100	\$50

Company C	2005	2006
Revenues from sales	\$500	\$600
Expenses	\$150	\$200
Juice purchases	\$100	\$100
Orange purchases	\$50	\$100
Profits	\$350	\$400

- (a) Show three different ways to compute this economy's GDP in both 2005 and 2006.

$$\text{GDP} = \text{Value of final goods produced} = (200-100) + 500 = 600$$

$$\text{GDP} = \text{Value added} = 100 + (200-50) + (500-100-50) = 600$$

$$\begin{aligned} \text{GDP} &= \text{Sum of incomes} = \text{Incomes from labor} + \text{Incomes from profits} \\ &= (50+50) + (50+100) + 350 = 600 \end{aligned}$$

Similarly, it can be shown that the GDP in 2006 equals to 700.

- (b) Suppose the number of the oranges and the amount of the orange juice produced are exactly the same for both years. Compute the rate of inflation from 2005 to 2006 based on the GDP deflator.

$$\begin{aligned} \text{GDP deflator for 2005} &= (\text{Nominal GDP in 2005})/(\text{Real GDP in 2005}) \\ &= 600/(\text{Real GDP in 2005}) \end{aligned}$$

$$\begin{aligned} \text{GDP deflator for 2006} &= (\text{Nominal GDP in 2006})/(\text{Real GDP in 2006}) \\ &= 700/(\text{Real GDP in 2006}) \end{aligned}$$

Since the real outputs are exactly the same for year 2005 and 2006,

Real GDP in 2005 = Real GDP in 2006, regardless of the choice of base-year price set.

$$\text{Therefore, inflation from 2005 to 2006} = (700-600)/600 = 16.7\%$$

- (c) In addition to (b), suppose all individuals in this economy consume only oranges and juices bought from Company C, and Company C sells to consumers only. Compute the rate of inflation from 2005 to 2006 based on the Consumer Price Index.

Since the aggregate bundle of consumption goods remains the same from 2005 to 2006, the change in aggregate expenditures on consumption should reflect the change in CPI. The revenues of Company C equals to the total expenditures on consumption, therefore, inflation from 2005 to 2006 = $(600-500)/500 = 20\%$

2. Consider an economy whose GDP of \$100 can be decomposed as follows: Private consumption = \$40, Government consumption = \$30, Private investment = \$30.
- (a) Suppose $G=T$. Show that in this economy, saving = investment.
- (b) Suppose $G \neq T$. Is saving = investment?
- Saving = private saving + public saving = $(Y-T-C) + (T-G) = Y-C-G = I$.
Therefore, saving = investment always holds in a closed economy.

III. Long question

Suppose a closed economy is described as follows:

The consumption function is $C=c_0+c_1Y_D$

The investment (I) and the government spending (G) are exogenously determined. The government is running a balanced budget.

1. Write down the equilibrium condition for the goods market. What is equilibrium output?

The equilibrium condition is $Y=c_0+c_1(Y-G)+I+G$

Upon solving for Y, we get equilibrium output $Y = [c_0+I+(1-c_1)G]/(1-c_1)$

2. Derive an expression for the goods market multiplier and autonomous spending. The multiplier is $(1-c_1)^{-1}$, and the autonomous spending is $[c_0+I+(1-c_1)G]$.

3. Compute the impact of increasing G on equilibrium output, i.e., derive an expression for $\Delta Y/\Delta G$ where Y is the equilibrium output. What is the multiplier? Explain why the multiplier is what it is.

$\Delta Y/\Delta G = 1$. So, under a balanced budget, equilibrium output rises by the same amount as government spending (instead of a multiple), and the multiplier is 1. The multiplicative potential of government spending is exactly neutralized by the leakage due to the necessity to increase taxes to keep the budget balanced.

4. Suppose the latest consumer survey reports a decrease in the propensity to save. Compute its impact on equilibrium output, i.e., derive an expression for $\Delta Y/\Delta s_1$ where Y is the equilibrium output and s_1 is the propensity to save. (Note: $s_1 + c_1 = 1$) What is the effect on equilibrium saving?

$\Delta Y/\Delta s_1 = -(1 - c_1)^{-2}(c_0 + I)$. The equilibrium saving will not change. Read the "Paradox of Saving" for a detailed discussion.

5. Suppose, instead of a lump-sum tax, the government collects a proportional tax, $T = tY$, and G remains constant. Redo (1) to (4). Compare and explain the difference.

The equilibrium condition is $Y = c_0 + c_1(Y - tY) + I + G$

Upon solving for Y , we get equilibrium output $Y = [c_0 + I + G] / [1 - c_1(1 - t)]$.

The multiplier is $[1 - c_1(1 - t)]^{-1}$, a smaller multiplier due to the automatic stabilizing effect of a proportional tax. The autonomous spending is $[c_0 + I + G]$.

$\Delta Y/\Delta G = [1 - c_1(1 - t)]^{-1}$, a larger effect because the tax needs not to adjust quickly with the government expenditure to keep a balanced budget.

$\Delta Y/\Delta s_1 = -[1 - c_1(1 - t)]^{-2}(1 - t)[c_0 + I + G]$. The equilibrium total saving will not change. However, the private saving will decrease and the public saving will increase.