

Problem Set 1

Problem 1:

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1) **False.** The real GDP growth rate is $\frac{Y_t}{Y_{t-1}} - 1$. Y_t and Y_{t-1} both depend on the choice of base year, in that the quantities of goods produced are weighted by their prices in the base year, so changing the base year could cause Y_t to be greater relative to Y_{t-1} . If so, however, the inflation rate would decrease. Since the GDP deflator for year t is $\frac{\$Y_t}{Y_t}$, and the nominal GDP $\$Y_t$ is unaffected by the base year, if the base year choice causes Y_t to be higher, then it will cause the GDP deflator to be lower.

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2) **True.** The GDP deflator is the ratio of nominal to real GDP, so its change reflects the change in prices of goods weighted by the total amount produced in the economy, including goods not typically purchased by consumers. The CPI reflects the change in the cost of a basket of goods typically purchased by a consumer. Assuming that this basket actually is representative of consumer consumption patterns, then it will be a better indicator for the cost of living. (This might not be true if consumption patterns change over time, for example.)

3) **False.** Private savings is discretionary income minus consumption,

$$S = Y^d - C = Y - T - C$$

and so, using the equilibrium condition and definition of total demand,

$$S = C + I + G - T - C = I + G - T$$

3 reasoning almost there

so investment is only equal to private savings if public savings ($G - T$) is zero.

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4) **False.** When the value of a bank's assets falls, it must write down its capital accordingly. However, this increases its leverage. In order to keep its leverage constant (or reduce it, if procyclical), it must either raise new capital, or sell some assets to reduce debt.

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Problem 2:

1) a) Nominal GDP, 2006 base

$\$Y_{2006} = P_{S,2006}Q_{S,2006} + P_{B,2006}Q_{B,2006}$	$= 2 \cdot 1200 + 25 \cdot 500 = 14900$	✓
$\$Y_{2007} = P_{S,2007}Q_{S,2007} + P_{B,2007}Q_{B,2007}$	$= 2.5 \cdot 1500 + 24 \cdot 400 = 13350$	✓
$\$Y_{2008} = P_{S,2008}Q_{S,2008} + P_{B,2008}Q_{B,2008}$	$= 2.5 \cdot 1650 + 24 \cdot 440 = 14685$	✓

b) Real GDP, 2006 base

$Y_{2006} = P_{S,2006}Q_{S,2006} + P_{B,2006}Q_{B,2006}$	$= 2 \cdot 1200 + 25 \cdot 500 = 14900$	✓
$Y_{2007} = P_{S,2006}Q_{S,2007} + P_{B,2006}Q_{B,2007}$	$= 2 \cdot 1500 + 25 \cdot 400 = 13000$	✓
$Y_{2008} = P_{S,2006}Q_{S,2008} + P_{B,2006}Q_{B,2008}$	$= 2 \cdot 1650 + 25 \cdot 440 = 14300$	✓

c) GDP deflator, 2006 base

$$\begin{aligned} \text{GDP deflator}_{2006} &= \frac{\$Y_{2006}}{Y_{2006}} = \frac{14900}{14900} = 1 \\ \text{GDP deflator}_{2007} &= \frac{\$Y_{2007}}{Y_{2007}} = \frac{13350}{13000} \approx 1.027 \\ \text{GDP deflator}_{2008} &= \frac{\$Y_{2008}}{Y_{2008}} = \frac{14685}{14300} \approx 1.027 \end{aligned}$$

d) Real GDP growth rate, 2006 base

$$\begin{aligned} \text{Real GDP growth}_{2007} &= \frac{Y_{2007} - Y_{2006}}{Y_{2006}} = \frac{13000 - 14900}{14900} \approx -0.128 \\ \text{Real GDP growth}_{2008} &= \frac{Y_{2008} - Y_{2007}}{Y_{2007}} = \frac{14300 - 13000}{13000} = 0.1 \end{aligned}$$

e) Inflation rate, 2006 base

$$\begin{aligned} \text{Inflation}_{2007} &= \frac{\text{GDP deflator}_{2007} - \text{GDP deflator}_{2006}}{\text{GDP deflator}_{2006}} \approx \frac{1.027 - 1}{1} \approx 0.027 \\ \text{Inflation}_{2008} &= \frac{\text{GDP deflator}_{2008} - \text{GDP deflator}_{2007}}{\text{GDP deflator}_{2007}} \approx \frac{1.027 - 1.027}{1.027} = 0 \end{aligned}$$

2) a) Nominal GDP, 2007 base — independent of base year, so same as 2006 base

$$\begin{aligned} \$Y_{2006} &= P_{S,2006}Q_{S,2006} + P_{B,2006}Q_{B,2006} = 2 \cdot 1200 + 25 \cdot 500 = 14900 \\ \$Y_{2007} &= P_{S,2007}Q_{S,2007} + P_{B,2007}Q_{B,2007} = 2.5 \cdot 1500 + 24 \cdot 400 = 13350 \\ \$Y_{2008} &= P_{S,2008}Q_{S,2008} + P_{B,2008}Q_{B,2008} = 2.5 \cdot 1650 + 24 \cdot 440 = 14685 \end{aligned}$$

b) Real GDP, 2007 base

$$\begin{aligned} Y_{2006} &= P_{S,2007}Q_{S,2006} + P_{B,2007}Q_{B,2006} = 2.5 \cdot 1200 + 24 \cdot 500 = 15000 \\ Y_{2007} &= P_{S,2007}Q_{S,2007} + P_{B,2007}Q_{B,2007} = 2.5 \cdot 1500 + 24 \cdot 400 = 13350 \\ Y_{2008} &= P_{S,2007}Q_{S,2008} + P_{B,2007}Q_{B,2008} = 2.5 \cdot 1650 + 24 \cdot 440 = 14685 \end{aligned}$$

c) GDP deflator, 2007 base

$$\begin{aligned} \text{GDP deflator}_{2006} &= \frac{\$Y_{2006}}{Y_{2006}} = \frac{14900}{15000} \approx 0.993 \\ \text{GDP deflator}_{2007} &= \frac{\$Y_{2007}}{Y_{2007}} = \frac{13350}{13350} = 1 \\ \text{GDP deflator}_{2008} &= \frac{\$Y_{2008}}{Y_{2008}} = \frac{14685}{14685} = 1 \end{aligned}$$

d) Real GDP growth rate, 2007 base

$$\begin{aligned} \text{Real GDP growth}_{2007} &= \frac{Y_{2007} - Y_{2006}}{Y_{2006}} = \frac{13350 - 15000}{15000} = -0.11 \\ \text{Real GDP growth}_{2008} &= \frac{Y_{2008} - Y_{2007}}{Y_{2007}} = \frac{14685 - 13350}{13350} = 0.1 \end{aligned}$$

e) Inflation rate, 2007 base

$$\begin{aligned} \text{Inflation}_{2007} &= \frac{\text{GDP deflator}_{2007} - \text{GDP deflator}_{2006}}{\text{GDP deflator}_{2006}} \approx \frac{1 - 0.993}{0.993} \approx 0.007 \\ \text{Inflation}_{2008} &= \frac{\text{GDP deflator}_{2008} - \text{GDP deflator}_{2007}}{\text{GDP deflator}_{2007}} \approx \frac{1 - 1}{1} = 0 \end{aligned}$$

3) The inflation rate in 2007 was calculated as

$$\text{Inflation}_{2007} = \frac{\text{GDP deflator}_{2007} - \text{GDP deflator}_{2006}}{\text{GDP deflator}_{2006}} = \frac{\text{GDP deflator}_{2007}}{\text{GDP deflator}_{2006}} - 1$$

Using the definition of the GDP deflator,

$$\text{Inflation}_{2007} = \frac{\frac{\$Y_{2007}}{Y_{2007}}}{\frac{\$Y_{2006}}{Y_{2006}}} - 1 = \frac{\$Y_{2007}}{\$Y_{2006}} \frac{Y_{2006}}{Y_{2007}} - 1$$

The nominal GDP is independent of the base year, so the only factor that can be affected by the base year is the $\frac{Y_{2006}}{Y_{2007}}$ factor.

$$\frac{Y_{2006}}{Y_{2007}} = \frac{P_{S,\text{base}}Q_{S,2006} + P_{B,\text{base}}Q_{B,2006}}{P_{S,\text{base}}Q_{S,2007} + P_{B,\text{base}}Q_{B,2007}}$$

Note that the quantities are weighted by their price in the base year. Because in 2006 books were more expensive relative to soda than they were in 2007, using a 2006 base means a difference in the quantity of books is weighed more heavily. Because the quantity of books dropped in 2007 and the quantity of soda increased, weighing books more heavily leads to a higher inflation rate for 2007 when 2006 is used as a base year than when 2007 is used as the base year.

4) For both the inflation rate and the growth rate, the only factor dependent on the base year is

$$\frac{Y_{2007}}{Y_{2008}} = \frac{P_{S,\text{base}}Q_{S,2007} + P_{B,\text{base}}Q_{B,2007}}{P_{S,\text{base}}Q_{S,2008} + P_{B,\text{base}}Q_{B,2008}}$$

as shown above. In 2008, the quantities produced of books and soda both grew by the same relative amount, 10%. So, although the prices from the base year affect their relative weighting, this has no impact because both quantities increased by the same percentage.

Problem 3:

1) The endogenous variables are C (determined by the first equation given), X (determined by the demand equation $Z = C + I + G$), Y (determined by the equilibrium condition $Y = Z$), and Y^d (determined by its definition $Y^d = Y - T$).

2)

$$Z = C + I + G$$

$$Y = Z$$

3)

$$Y = Z = C + I + G$$

$$Y = (c_0 + c_1 Y^d) + I + G$$

$$Y = c_0 + c_1(Y - T) + I + G$$

$$Y - c_1 Y = c_0 + I + G - c_1 T$$

$$Y = \frac{c_0 + I + G - c_1 T}{1 - c_1}$$

$$Y = \frac{200 + 400 + 150 - 0.6 \cdot 150}{1 - 0.6} = \frac{660}{0.4} = 1650$$

$$C = Y - I - G = 1650 - 400 - 150 = 1100$$

4)

$$Y' = \frac{c_0 + I + G - c_1 T}{1 - c_1}$$

$$Y' = \frac{140 + 400 + 150 - 0.6 \cdot 150}{1 - 0.6} = \frac{600}{0.4} = 1500$$

$$C' = Y' - I - G = 1500 - 400 - 150 = 950$$

5)

$$Y - c_1 Y = c_0 + I + G' - c_1 T$$

$$G' = (1 - c_1)Y - c_0 - I + c_1 T$$

$$= (1 - 0.6)1650 - 140 - 400 + 0.6 \cdot 150 = 660 - 140 - 400 + 90 = 210$$

6)

$$Y - c_1 Y = c_0 + I + G - c_1 T'$$

$$c_1 T' = c_0 + I + G - (1 - c_1)Y$$

$$T' = \frac{c_0 + I + G - (1 - c_1)Y}{c_1} = \frac{140 + 400 + 150 - (1 - 0.6)1650}{0.6} = \frac{30}{0.6} = 50$$

7) Changing G gives a budget deficit $G' - T = 210 - 150 = 60$. Changing T gives a budget deficit $G - T' = 150 - 50 = 100$. The budget deficit is larger for the tax cut, because the tax cut required to increase total demand back to its original value is larger than the increase in government spending that has the same effect. This is because only $c_1 = 60\%$ of the money returned to consumers as a tax cut contributes to total demand, while the full increase in government spending contributes to total demand.

8) Changing G gives consumption level $C = Y - I - G' = 1650 - 400 - 210 = 1040$. Changing T gives consumption level $C = Y - I - G = 1650 - 400 - 150 = 1100$. The tax cut gives a higher consumption level, which is no surprise because both the tax cut and government spending increase were chosen to give the same total demand, and the tax cut achieves this total demand by increasing only consumption C (I and G remain unchanged), whereas the spending increase also increases G , requiring less increase in consumption.

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