

Midterm (75 minutes)

1. Consider an income-expenditure model in which spending depends on disposable (after-tax) income:

$$\begin{aligned}y &= e \\e &= a + b(y - t), \quad 0 < b < 1 \\t &= c + fy, \quad 0 < f < 1\end{aligned}$$

where y is income, e is spending, t is taxes, and a , b , c , and f are exogenous parameters.

- a. Solve for y .

- b. Determine the spending multiplier, $\frac{dy}{da}$.

- c. Prove that this spending multiplier either increases or decreases as f increases.

- d. Explain your answer to part (c), using words, not math.

2. A country levies a tax on the sale of gasoline; for example 50¢ a gallon. The quantity sold S is inversely related to the tax rate t :

$$S = S[t] \quad , \quad \frac{dS}{dt} < 0$$

If the tax rate is set so as to maximize tax revenue, $R = tS$, what will be true of the elasticity of sales

$$\square = \frac{dS}{dt} \frac{t}{S}$$

- a. Derive your answer mathematically.

- b. Explain why your answer makes sense logically.

3. Consider a firm that sells a unique product in two geographically distinct markets under different labels for different prices:

$$P_1 = 155 - Q_1$$

$$P_2 = 205 - 2Q_2$$

where the prices are denoted by P and the quantities by Q. Its total cost of production is

$$C = 95 + 5(Q_1 + Q_2)$$

- a. Find the profit-maximizing quantities.

- b. At the profit-maximizing point, what is the marginal revenue from producing one more unit of Q_1 ?

- c. At the profit-maximizing point, what is the marginal revenue from producing one more unit of Q_2 ?

- d. Explain why your answers to (b) and (c) are either the same or different.

4. Consider a firm whose assets and earnings at time t are described by these equations:

$$A_t = 32e^{0.05t}$$

$$E_t = 0.2A_t$$

a. What is the value of assets at time $t = 0$?

b. What is the percentage rate of growth of assets?

c. What is the percentage rate of growth of earnings?

d. What is the percentage rate of growth of the ratio of earnings to assets $\frac{E_t}{A_t}$?

5. Using the model in the previous exercise,

a. Write down an equation for the present value V_t of earnings at time t .

b. Does the present value of earnings increase or decrease as time passes?

c. How is the percentage change in dividends D related to the percentages changes in $\frac{D}{E}$, $\frac{E}{A}$, and A ? (For example, one possible answer might be that the percentage change in D is approximately equal to the percentage change in $\frac{D}{E}$ multiplied by the percentage change in $\frac{E}{A}$, minus the percentage change in A .)