

**Stern School of Business
New York University**

Microeconomics
B01.1303

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Problem Set 10

1. Suppose that OPEC acts as a price leader in the crude oil market. Let the world demand be $Q = 40 - P$, where P is the price in dollars, and Q is the quantity in millions of barrels. For simplicity, assume that OPEC is composed of only one member, and that there is only one outside firm (follower). Suppose that leader and follower have the same marginal cost function $MC(q) = q$.
- (a) Find the supply curve of the follower and the residual demand (of the leader). (Hint: Remember that the follower is a competitive firm. Also remember the definition of the residual demand.)
 - (b) Find the marginal revenue of the leader, the quantity it chooses to produce, and the price it sets.
 - (c) Find the quantity produced by the follower. Assuming zero fixed costs, how do the profits of the leader and the follower compare?
 - (d) What would be the world price if the two firms acted as perfectly competitive firms? (Hint: Be careful about the definition of the world supply.)
2. Marvin's wage rate is \$10 an hour. Assume $p_C = 1$. He has no earnings other than his labor income. His utility function is

$$U(C, R) = CR^2$$

where C is the amount of money he spends on consumption, and R is the number of hours a day he spends NOT working. The marginal utility functions are

$$MU_C = R^2, \quad MU_R = 2CR.$$

- (a)
 - (i) Write an equation that describes Marvin's budget constraint.
 - (ii) How many hours a day does Marvin choose to work?
 - (iii) How much money does he spend on consumption per day?
- (b) Suppose now that Marvin has to pay income tax of 20% of his earnings. How does this change your answers in (i), (ii) and (iii)?
- (c) Suppose the government spends the money from the taxes it collects to make lump

sum “income support payments.” The government pays Marvin a lump sum of \$16 per day and taxes his income from work at 20%. Again, write down Marvin’s budget constraint and the number of hours he chooses to work. How much taxes does he pay per day?

- (d) The government now decides to introduce a progressive tax system. It taxes Marvin nothing for the first \$40 a day that he earns and then taxes him at 40% on everything he earns beyond that \$40 per day. Draw a diagram depicting Marvin’s budget with leisure on the horizontal axis and consumption on the vertical axis.
- (e) At what point does the budget have a kink? Write equations for the two lines that bound the budget constraint.
- (f) How many hours per day will Marvin choose to work? How much tax will he pay per day.