Extra Questions, First Quiz, Solutions
Managerial Economics: Eco 685
Quiz Date: Thursday, September 7, 2017

Even numbered questions from the book

Question 2

The bonus guarantee says that regardless of profits, the manager gets at least part of the bonus. If profits are very low, the bonus becomes the same regardless of profits, and so the manager does not have an incentive to increase profits. If the profits are low enough so that the bonus is near the guarantee, then the manager has an incentive to pursue high risk projects that have a high chance of failure, but a small chance of very large profits. A low risk project might give better profits on average, but a lower average bonus, because the manager who chooses a high risk project is not penalized when the project fails, due to the guarantee.

Question 4 (production)

a. The production function is Cobb-Douglas, so we add the exponents:

- Crop Farms: $0.24 + 0.07 + 0.08 + 0.53 + 0.02 = 0.94$. Decreasing returns to scale.
- Hog Farms: $0.07 + 0.02 + 0.10 + 0.74 + 0.03 = 0.96$. Decreasing returns to scale.
- Dairy Farms: $0.10 + 0.01 + 0.06 + 0.63 + 0.02 = 0.82$. Decreasing returns to scale.
- General Farms: $0.17 + 0.12 + 0.16 + 0.46 + 0.03 = 0.94$. Decreasing returns to scale.
- Large Farms: $0.28 + 0.01 + 0.11 + 0.53 + 0.03 = 0.93$. Decreasing returns to scale.
- Small Farms: $0.21 + 0.05 + 0.08 + 0.43 + 0.03 = 0.80$. Decreasing returns to scale.

b. This is the output elasticity for the labor input only. General farms has the largest exponent on labor: a 1% increase in labor results in a 0.12% increase in output for general farms.

c. No, we have decreasing returns to scale, so if the firms merge total output will be less than if the firms remain apart. The firms need to get smaller, not larger.

Question 6b (production)

We have:

$$MP = \frac{\Delta Q}{\Delta \text{ input}}. \tag{1}$$

Here the input is grain and the output is milk. So:

$$MP\,(1800) = \frac{7250 - 5917}{1800 - 1200} = 2.22. \tag{2}$$

Each pound of grain in the range of 1,200 - 1,800 pounds yields an average of 2.22 pounds of milk. They rest of the numbers are:

$$MP\,(2400) = \frac{8379 - 7250}{1800 - 1200} = 1.88. \tag{3}$$

$$MP\,(3000) = \frac{9371 - 8379}{1800 - 1200} = 1.65. \tag{4}$$

Note that we have diminishing marginal product of grain.

Question 4 (costs)

a. We can just take the difference here:

$$TC\,(51) = 16.68 + 0.125 \cdot 51 + 0.00439 \cdot 51^2 = 34.473, \tag{5}$$

$$TC\,(50) = 16.68 + 0.125 \cdot 50 + 0.00439 \cdot 50^2 = 33.905, \tag{6}$$

$$TC\,(51) - TC\,(50) = 34.47 - 33.91 = 0.57. \tag{7}$$

b. This is an estimate of the marginal cost of the 51st unit of fuel. We can use the marginal cost to see if it is profitable to increase electricity production. If we can sell the electricity for more than \$0.57, we should increase production from 50 to 51.

Numbered questions from the review sheet

Question 1

a. Total fixed costs are \$16.68, the part of the total cost curve that does not depend on Q. Average total costs are:

$$ATC = \frac{TC}{Q} = \frac{16.68}{Q} + 0.125 + 0.00439Q. \tag{8}$$

Marginal costs is the derivative:

$$MC = \frac{dTC}{dQ} = 0.125 + 2 \cdot 0.00439Q = 0.125 + 0.00878Q. \tag{9}$$

b. We set price equal to marginal costs:

$$P = MC, \tag{10}$$

$$\$0.13 = 0.125 + 0.00878Q, \tag{11}$$

$$Q = 0.5694. \tag{12}$$

Question 2

The manager has an incentive to pursue high risk projects that have a high chance of failure, but a small chance of very large profits. A low risk project might give better profits on average, but a lower average bonus, because the manager who chooses a high risk project is not penalized when the project fails.

Question 3

a. We have:

$$AVC\,(50) = 2.5 \cdot 50 + 500 = \$625. \tag{13}$$

b. We have:

$$AVC = \frac{TC}{Q}, \tag{14}$$

$$\$625 = \frac{TC}{50}, \quad \rightarrow \quad TC = \$31{,}250 \tag{15}$$

c. We can multiply by Q to get total costs as in part (b):

$$TC = AVC \cdot Q = Q\,(2.5Q + 500)\,. \tag{16}$$

$$TC = 500Q + 2.5Q^2. \tag{17}$$

For marginal costs, we can use the derivative:

$$MC = \frac{dTC}{dQ} = 500 + 5Q. \tag{18}$$

For 50 cases we have:

$$MC\,(50) = \frac{dTC}{dQ} = 500 + 5 \cdot 50 = \$750. \tag{19}$$

Question 4

a. False. Economic profit is less than accounting profits, because economic profits has an extra cost, which is the value of the next best option.

b. True. Some input units will produce something, but not enough to justify hiring/using the input. These units will be used when maximizing production, but not profits.

   It is not part of the question, but you might be interested in the math behind the answer. The production maximizing level of an input sets $MP = 0$ and the profit maximum sets $MR \cdot MP = ME$ or $MP = \frac{ME}{MR}$. So the marginal product is greater when maximizing profits. Since MP diminishes as we add inputs, the input level must be lower when maximizing profits.

c. True. The fixed costs are spread over more units.

d. False. One could have a cost that does not vary with Q, but could be recovered. In the notes, we had an example of a building that was purchased for \$500K, but could be resold for \$300K. In this case, \$500K are fixed costs (does not depend on Q), but only \$200K are sunk. So \$300K is fixed but not sunk.

e. True. Sunk costs are incurred in the past and so do not vary with anything. So sunk costs do not vary with Q, and are therefore fixed.

f. False. Opportunity costs are accounting costs plus the value of the next best option, which may include opportunity costs. For example, in the homework question, the value of the next best to TV option was the grass roots, which had a value equal to the accounting profit of 2.75 (\$300 − \$2000) less a \$22K opportunity cost.

Question 5

Outsourcing helps to solve the indivisibility problem for small firms. The firm may have only enough work for a part time accountant, but finds only full time accountants are available. The outsourcing firm, however, can have an accountant service many small firms, and so provide accounting at a lower cost.

Question 6

a. False. It could be that labor is less productive, but we still want to use labor because labor is very inexpensive. Consider $MRTS = MP_L/MP_K = 1/2$ and $P_L/P_K = 1/4$. Labor is half as productive as capital, but we still prefer labor because labor costs only 1/4 as much as capital.

b. False. The price ratio here is small relative to the $MRTS$, which can occur when labor is relatively in expensive. Consider again $MRTS = MP_L/MP_K = 1/2$ and $P_L/P_K = 1/4$. We have $MRTS < P_L/P_K$ and labor is less expensive than capital.

c. False. We want to add to labor.

d. True. Spending a dollar on labor results in $1/P_L$ units of labor. The additional production is then MP_L/P_L. Similarly, a dollar spent on capital produces MP_K/P_K. Note that:

$$MRTS = \frac{MP_L}{MP_K} > \frac{P_L}{P_K}, \tag{20}$$

$$\frac{MP_L}{P_L} > \frac{MP_K}{P_K}. \tag{21}$$

So spending a dollar on labor is more productive.

In the example from part (a), labor costs \$1, so spending a \$1 on labor results in one unit of labor, which produces MP_L. Spending a dollar on capital results in 0.25 units of capital, since capital costs \$4. The change in production is $0.25MP_K$. We have:

$$MP_L > 0.25MP_K, \tag{22}$$

$$\frac{MP_L}{MP_K} > 0.25, \tag{23}$$

which holds from the original equation.

e. True. Costs are unchanged if we replace one unit of the input in the numerator (K), with the price ratio units of the input in the denominator (L). In the example from part (a), costs do not change if we replace one unit of capital with $P_K/P_L = 4$ units of labor.

Question 7

In class we mentioned that labor becomes more specialized as Q increases.

Question 8

a. We have:

$$MRTS = \frac{MP_G}{MP_E} = \frac{3}{\frac{1}{2}} = 6 > \frac{P_G}{P_E} = \frac{\$200K}{\$100K} = 2. \tag{24}$$

Programmers are more 6 times as productive, which outweighs the fact that programmers cost twice as much. Therefore, we want to add programmers.

We can therefore eliminate 6 engineers and add one programmer.

b. Eliminating 6 engineers results in a cost savings of $6 \cdot \$100K = \$600K$, while the extra programmer cost $200K. Therefore, the change reduces costs by $400K.

c. We can eliminate 2 engineers and add 1 programmer.

d. The increase in production from the programmer is 3, the decrease from losing the engineers is $0.5 \cdot 2 = 1$. Therefore, overall we gain 2 units of production.