KEY

ECO 610-401 2nd Test Fall 1998

1. (20 pts.) A firm produces digital watches on a single production line serviced during one daily shift. The total output of watches depends directly on the number of labor-hours employed on the line. Maximum capacity of the line is 120,000 watches per month; this output requires 60,000 hours of labor per month. Total fixed costs come to $600,000 per month, the wage rate averages $8 per hour, and other variable costs (materials, etc.) average $6 per watch. The marketing department's estimate of demand is P = 28 – Q/20,000, where P denotes price in dollars and Q is monthly demand.
   a) How many additional watches can be produced by an extra hour of labor? What is the marginal cost of an additional watch? As a profit maximizer, what price and output should the firm set? Is production capacity fully utilized? What contribution does this product line provide?
   b) The firm can increase capacity up to 100 percent by scheduling a night shift. The wage rate at night averages $12 per hour. Answer the questions in part (a) in light of this additional option.

(a) $\frac{120,000}{60,000} = 2$ additional watches per labor-hour

Marginal cost = $6 material + $4 labor = $10

$P = 28 - Q/20,000$; $TR = P \cdot Q = 28Q - Q^2/20,000$

$MR = \frac{dTR}{dQ} = 28 - Q/10,000$

$MR = MC \Rightarrow 28 - Q/10,000 = 10$; $Q/10,000 = 18$

so $Q^* = 180,000$

But capacity = 120,000, so produce Q = 120,000

and set $P = 28 - Q/20,000 = \$22$

Profit contribution = $(22 - 10)\,120,000 = \$1,440,000$

(b) Marginal cost now equals $6 + $6 = $12 per watch

$MR = MC \Rightarrow 28 - Q/10,000 = 12$

so $Q^* = 160,000$ [produce 120,000 on day shift and 40,000 on night shift]

$P = 28 - Q/20,000 = \$20$

Profit contribution = $(20 - 10)\,120,000 + (20 - 12)\,40,000$

= $1,200,000 + $320,000

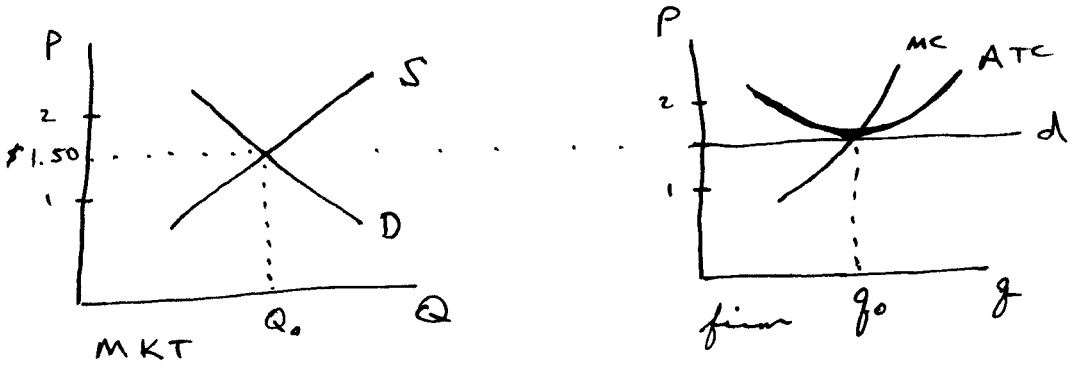
= $1,520,000

2. (10 pts.) After Burton Denson graduated with honors from the American Trucking Academy, his proud (and rich) parents gave him a new $350,000 tractor-trailer rig. At a recent class reunion of ATA alums, Burton boasted to some fellow truckers that his revenues were typically $25,000 per month, while his operating costs (fuel and maintenance) amounted to only $18,000 per month. The other truck drivers are all employees of various trucking companies, and bemoaned the fact that they are only averaging $5,000 per month in salary and benefits, while Burton is taking home $7,000. They wish that they had rich parents so that they could be in business driving their own rigs like Burton. Since you are attending the class reunion with your spouse, who is also an alum of the ATA, you overhear this conversation. Your spouse turns to you and says, "OK Mr./Ms. MBA student, I'm driving trucks across the country to put you through school, what do you think of this guy's reasoning? Why don't we take the $350,000 we have in mutual funds and cash it in, and buy me a rig of my own. Then I can quit driving for J. B. Hunt Trucking Co. and work for myself like Burton." How do you answer your spouse? (Hint: this questions calls for an evaluation of the economic profitability of being an independent trucker.)

Burton has not considered the opportunity cost of his time ($\simeq$ $5000 per month) nor has he factored in the interest income foregone on $350,000 that is tied up in his business. In addition, presumably his rig is depreciating — with use and with time. All of those things together suggest that he is probably suffering economic losses. So your spouse should continue working for J B Hunt and you should keep the mutual fund.

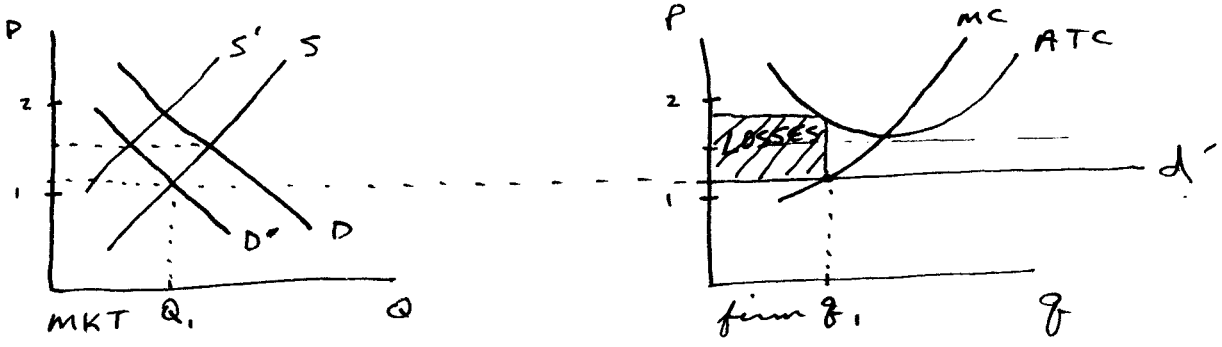
3. (20 pts.) Your company produces agricultural equipment. Since you are in charge of forecasting sales, you are very interested in what happens in markets for various agricultural products. One market that has seemed to be stable lately has been the market for tobacco. You see a significant decline in the demand for tobacco looming on the horizon. Now for the question. Assume that the market for tobacco is initially in long-run equilibrium, at a price of $1.50 per pound. Analyze in a step-by-step manner the short-run and long-run effects of a permanent decline in the market demand for tobacco. What prediction do you make about (a) the short-run price of tobacco; (b) the long-run price of tobacco; (c) short-run profitability of tobacco farming; (d) long-run profitability of tobacco farming; and (e) the number of tobacco farmers. Use diagrams to explain your answers.

Initially, long-run equilibrium:



at $P = \$1.50$, typical tobacco farmer earns zero economic profit.

Now market demand declines. As illustrated, that causes price to fall and tobacco farmers to suffer economic losses. Over time, losses will cause some farmers to exit the market:



As firms exit, price rises due to the shift to the left of the market supply curve. Eventually we expect price to rise back to $1.50, where remaining tobacco farmers will earn zero economic profit.

4. (30 pts.) As VP for Operations of Fallen Arch Coal Co., you commission a study of all the coal mines that your company operates. Data are collected on quarterly output of coal in tons, seam thickness in inches in each mine, and the number of labor hours worked in each mine per quarter. Past experience indicates that a Cobb-Douglas production function represents the production technology well. Your research assistants regress the natural log of output on the natural logs of seam thickness and labor. The results are displayed below:

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	2	10272.08609	5136.04304	11768.238	0.0001
Error	8149	3556.48939	0.43643		
C Total	8151	13828.57548			

Root MSE	0.66063	R-square	0.7428
Dep Mean	9.52143	Adj R-sq	0.7428
C.V.	6.93835		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.137826	0.09553368	1.443	0.1491
LNSEAM	1	0.463110	0.02446942	18.926	0.0001
LNHRS	1	0.855962	0.00597948	143.150	0.0001

a) Write the equation for a Cobb-Douglas production function. Derive the expressions for the marginal product of labor and the marginal product of seam thickness.

b) For a typical Fallen Arch coal mine, seam thickness equals 60 inches, and 45 workers each work 40 hours for 13 weeks each quarter. Compute the marginal products of both seam thickness and labor.

c) Suppose the wage rate for additional labor hours is $25 per hour and it costs $3000 per quarter to lease coal deposits that are one inch thicker than the ones your company is currently mining. What do you think about your company's current input mix? Are you minimizing cost?

(a) $Q = A S^{\alpha} L^{\beta}$

$MP_L = \frac{dQ}{dL} = \beta A S^{\alpha} L^{\beta-1}$

$MP_S = \frac{dQ}{dS} = \alpha A S^{\alpha-1} L^{\beta}$

$\alpha = .463$

$\beta = .856$

$\ln A = .138$

so $A = e^{.138} = 1.148$

$L = (45)(40)(13) = 23{,}400$

(b) $MP_L = (.856)(1.148)(60^{.463})(23{,}400^{-.144})$

$MP_L = 1.54$ tons per hour

$MP_S = (.463)(1.148)(60^{-.537})(23{,}400^{.856})$

$MP_S = 324.12$ tons per inch

(c) cost minimization if $\frac{MP_L}{P_L} = \frac{MP_S}{P_S}$

$\frac{1.54}{25} \stackrel{?}{=} \frac{324.12}{3000}$

$.0616 \stackrel{?}{\doteq} .1080$

No, we are using too much labor relative to seam thickness.

5. (20 pts.) As the only owner of a satellite dish in your neighborhood, you are the monopoly supplier to anyone who wants to watch the upcoming World Wrestling Federation championship match, which is only available on pay-per-view. You decide to charge your neighbors an admission fee if they want to come over and watch the match at your house. From past experience you know that the demand schedule is as represented below. Since these people drink your beer, eat your food, and tear up your house, there are costs involved in supplying this service. Your total cost schedule is also represented below. (a) What price should you charge and what output will you produce if you want to maximize profits? (b) If you have to pay a fixed fee of $10 to the satellite company in order to receive an unscrambled signal, would you still be willing to go ahead with this? (c) Illustrate your decision in a demand/marginal revenue/marginal cost diagram and show price, output, and profits from this venture.

Price	Quantity	TR	MR	Total Cost	MC	ATC
-	0	0		0		
$10.00	1	10	10	$8.00	8.00	8.00
9.80	2	19.60	9.60	15.00	7.00	7.50
9.60	3	28.80	9.20	21.00	6.00	7.00
9.40	4	37.60	8.80	27.50	6.50	6.87
9.20	5	46.00	8.40	34.50	7.00	6.90
9.00	6	54.00	8.00	41.80	7.30	6.97
8.80	7	61.60	7.60	49.35	7.55	7.05
8.60	8	68.80	7.20	57.00	7.65	7.12
8.40	9	75.60	6.80	65.00	8.00	7.22
8.20	10	82.00	6.40	74.00	9.00	7.40
8.00	11	88.00	6.00	84.00	10.00	7.64
7.80	12	93.60	5.60	95.00	11.00	7.92

(a) MR = MC for profit maximum. This occurs somewhere around an output of Q = 7:

$P = 9 \quad Q = 6 \quad \pi = TR - TC = \$12.20$

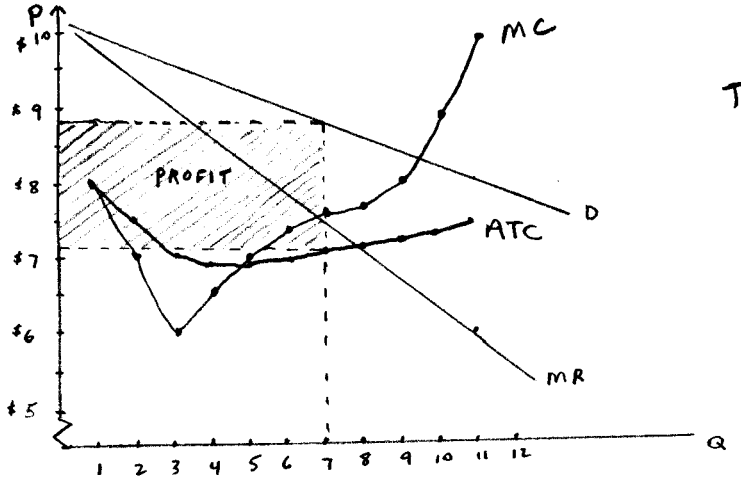
π MAX ⇒ $P = 8.80 \quad Q = 7 \quad \pi = \$12.25$

$P = 8.60 \quad Q = 8 \quad \pi = \$11.80$

so charge $P = \$8.80$, produce $Q = 7$, and you will have $12.25 in profit.

(b) A fixed fee of $10 would still leave you with economic profit of $2.25, so do it.

(c)



$\pi = 7(\$8.80 - \$7.05) =$ 

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2nd Test
Fall 2000

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Multiple Choice: Circle correct answer, 3 pts. each.

1. As Insight Communications' vice president in charge of special subscription cable TV channels, you must decide how to set prices for new services. A marketing study reveals that at a price of $5.00 per month, demand elasticity for the new movie channel, HBO XXIV, is 0.5. Hence you should:

B
a. set price at $5.00 per month.
(b) set price above $5.00 per month.
c. set price below $5.00 per month.
d. you do not have enough information to determine whether you should raise or lower price.

2. Which of the following best fits the definition of a perfectly competitive market?

B
a. personal computers.
(b) lettuce.
c. cable TV.
d. retail clothing stores.

3. Suppose enrollment declines sharply at the University of Kentucky. Demand for restaurant meals drops and prices fall. Restaurants located in the vicinity of campus begin to suffer economic losses. What does the future hold for the fast-food industry around campus?

A
(a) Some restaurants will go out of business. Surviving restaurants will experience increasing demand and will raise their prices. Long-run economic profits will be zero.
b. New restaurants will enter the market to replace existing restaurants. The number of meals served will not change much.
c. With reduced demand, restaurants will raise their prices. Higher prices will attract new firms into the industry.
d. Economic losses will drive some restaurants out of business. As firms exit, prices will fall. The lower prices will cause the remaining restaurants to be more efficient.

4. Situation A: P=$5, AFC=$2, AVC=$7; Situation B: P=$7, AFC=$9, AVC=$5. The firm should:

B
a. shut down in both situation A and situation B
(b) shut down in situation A but produce in situation B
c. produce in situation A but shut down in situation B
d. produce in both situation A and situation B

5. In raising alligators, you find that in the short run your revenues and costs vary with output in the following manner:

Quantity	48	49	50	51	52	53	54	55	56
Total Revenue	$9600	$9800	$10000	$10200	$10400	$10600	$10800	$11000	$11200
Marginal Cost	$150	$160	$170	$185	$200	$220	$245	$275	$310

What output should you produce if your goal is to maximize short-run profits?

C
a. 48
(c) 52
b. 50
d. 54

6. The reason why we can be confident that the short-run market supply curve in a perfectly competitive industry slopes upward to the right is:

B
a. because of the law of eventually diminishing marginal utility.
(b) because of the law of diminishing marginal returns.
c. because it is a horizontal summation, not a vertical summation.
d. because of entry and exit of firms from the industry.

7. In seeking an answer to the question "Why do firms exist?", Nobel Prize winner Ronald Coase focused on

A
a. Transactions costs
b. Team production
c. Asset specificity
d. Principal-agent problems

8. A monopolist faces market demand: $P = 6000 - 10Q$, and has total cost: $TC = 500 + 5Q^2$. The profit-maximizing price and output are

$TR = P \cdot Q = 6000Q - 10Q^2$
$MR = 6000 - 20Q$
$TC = 500 + 5Q^2$
$MC = 10Q$
$MR = MC \Rightarrow 6000 - 20Q = 10Q \Rightarrow Q = 200$

A
a. P=4000, Q=200
b. P=5000, Q=100
c. P=3000, Q=300
d. P=2000, Q=400

9. Suppose that the orange growers in southern California are successful in forming a cartel with the help of the U.S. Department of Agriculture. They agree to act in unison and to market their navel oranges under the Sunkist brand name. Compared to the competitive market that existed before the cartel was formed, the Sunkist cartel will result in

D
a. Higher price and higher output
b. A lower price for navel oranges but an increase in orange sales
c. No change, since growing oranges is a natural monopoly
d. Higher price and lower output

10. A firm produces 120 units of output at an average cost of $2.00 per unit and 130 units at an average cost of $2.10 per unit.

$TC_{120} = 240$ $\quad TC_{130} = 273$ $\quad > 33$
$MC = \frac{\Delta TC}{\Delta Q} = \frac{33}{10} = 3.30$

D
a. Total variable cost must be equal to $273
b. Marginal cost is $0.10
c. Marginal cost is $43
d. Marginal cost is $3.30
e. Marginal cost is $10

Short answer questions and problems. Answer in the space provided.

11. (5 pts.) When team production methods are used, shirking becomes a problem. The shirking problem can be solved by appointing a monitor. But who will monitor the monitor? In one sentence, explain how this issue is resolved in a classical capitalistic firm.

The monitor/owner is the residual claimant, and thus gets to keep any increase in profit that comes about from a reduction in shirking.

12. (5 pts.) The modern corporation is characterized by a separation of ownership from control. This creates a principal-agent problem between stockholders and managers. In twenty-five words or fewer, explain one (1) way this principal-agent problem can be solved.

(1) Stock options can be used to tie the manager's salary to the profit performance of the firm.
(2) Stockholders can vote current managers out of office at the next annual meeting if they are underperforming.
(3) The threat of a hostile takeover will cause managers to stay on their toes.

13. (30 pts.) You own and operate an Arby's restaurant. Your production function is given by $Q=10K^{.5}L^{.5}$, where Q represents the number of meals per hour produced in your restaurant and K and L refer to inputs of capital and labor per hour.

a. Derive expressions for the marginal product of capital and the marginal product of labor.
b. If capital is fixed at K = 8 in the short run, how much labor must you use if you want to produce 120 meals per hour?
c. Suppose the prices per unit of labor and capital are w = \$6/hour and v=\$6/hour. Does the combination that you are using in part (b) minimize the cost of producing 120 meals per hour? In your answer you should use the marginal product expressions that you derived in part (a), and illustrate with an isoquant-isocost diagram.

(a) $Q = 10 K^{1/2} L^{1/2}$

$MP_L = \frac{dQ}{dL} = 5 K^{1/2} L^{-1/2}$

$MP_K = \frac{dQ}{dK} = 5 K^{-1/2} L^{1/2}$

(b) $Q = 120 = 10 (8)^{1/2} L^{1/2}$

$12 = 8^{1/2} L^{1/2}$

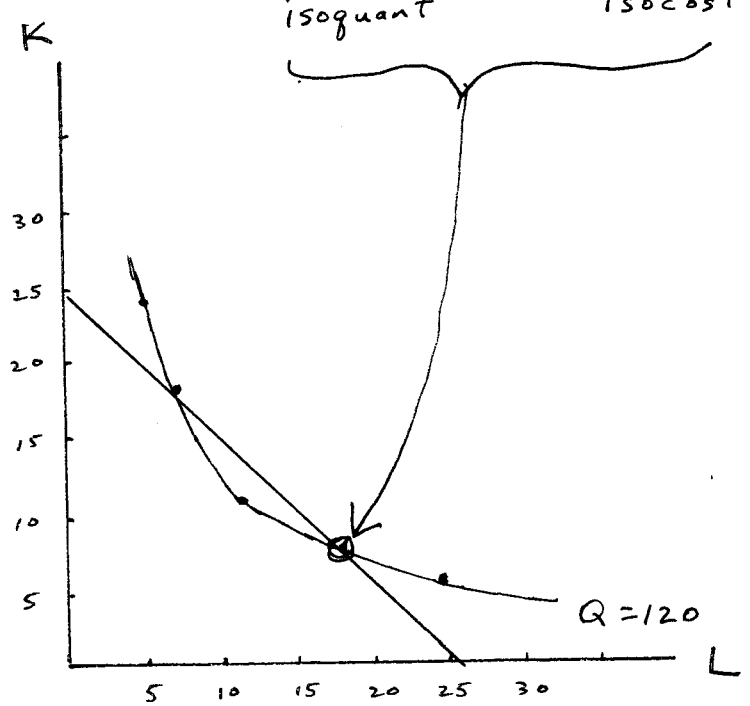
$144 = 8L$

$L = 18$ if $K = 8$ and $Q = 120$

(c) does $\frac{MP_L}{MP_K} \stackrel{?}{=} \frac{w}{v} \Rightarrow \frac{5 K^{1/2} L^{-1/2}}{5 K^{-1/2} L^{1/2}} \stackrel{?}{=} \frac{6}{6} \Rightarrow \frac{K}{L} \stackrel{?}{=} 1$

$\underbrace{\frac{K}{L} = \frac{8}{18}}_{\text{slope of isoquant}} \neq \underbrace{\frac{6}{6} = \frac{w}{v}}_{\text{slope of isocost}}$

(c)



isoquant for Q = 120

$120 = 10 K^{1/2} L^{1/2}$

$12 = K^{1/2} L^{1/2}$

$144 = K \cdot L$

K	L
8	18
18	8
12	12
6	24
24	6

14. (15 pts.) On the other side of your professor's family tree, brother-in-law Bubba owns a restaurant/bar in Fort Walton Beach, Florida. On a recent visit Bubba shared the following information:

Income Statement for Bubba's Bar

Costs		Revenues	
Wholesale cost of food and beer	$40,000	Sales of food and drinks	$130,000
Wages and salaries (including $20,000) for himself)	$50,000		
taxes and insurance	$12,000		
interest paid on bank loans $100,000 @ 10%	$10,000		
	$112,000		

Bubba has $50,000 of his own money invested in the bar. He anticipates that business will continue like this for the foreseeable future. Bubba also has a standing offer of $30,000 to manage another bar in Fort Walton Beach. Suppose a national restaurant/bar chain offers Bubba $150,000 to sell his bar, which would enable him to pay back the $100,000 bank loan and recoup his own $50,000. Should he take the offer? (Hint: what are Bubba's economic profits?)

Bubba's accounting profit = $130,000 − $112,000 = $18,000

Implicit Costs not accounted for in the above:

① opportunity cost of his time = $10,000
($30,000 − $20,000 he pays himself)

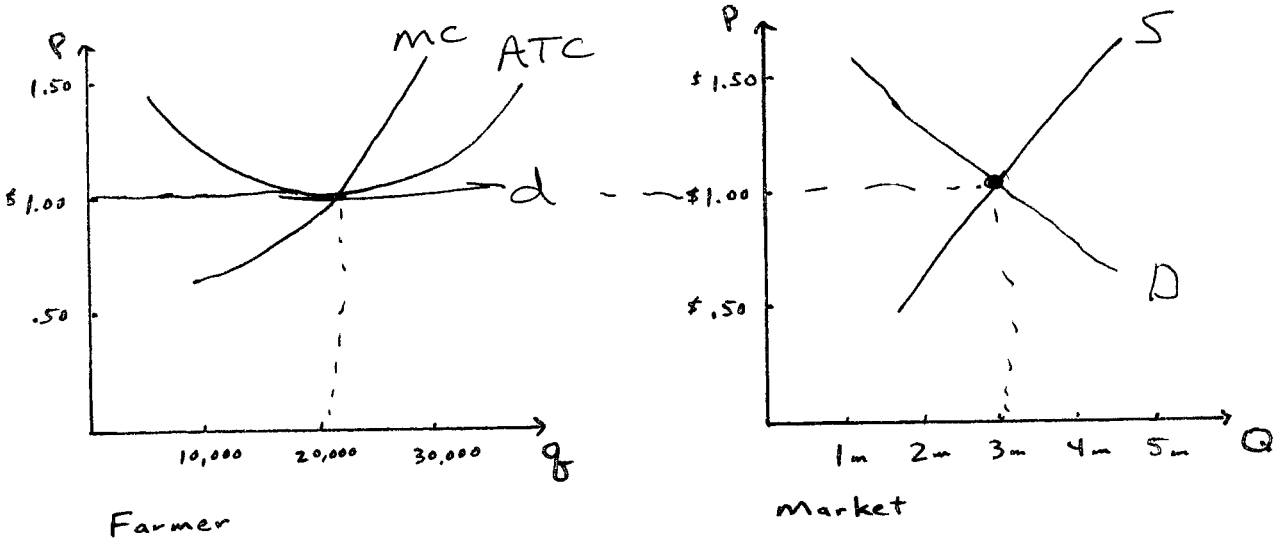
② interest earnings foregone on his investment ($50,000 @ 10%) = $5,000

So economic profits are $3000, after implicit costs are subtracted.

If Bubba were to sell the bar and go to work for someone else, he would bring home $35,000 per year ($30,000 salary plus $5000 interest earnings). That is $3000 less than he currently is making ($20,000 salary plus $18,000 profit).

15. (15 pts.) Catfish farming is a thriving industry in the southeastern United States. The industry is currently in long-run equilibrium. The market price of catfish is $1.00 per pound. 3 million pounds of catfish are produced each year. A typical catfish farmer produces 20,000 pounds of catfish per year.

a. Illustrate this initial situation in the diagrams below:



b. The catfish industry is an increasing cost industry. A glut of alligator meat on the market causes the market demand for catfish to decline. Now for your analysis:

- What will happen to the price of catfish in the short run?

  it will fall.

- What will the short-run profit outlook be for catfish farmers?

  they will suffer short run economic losses

- Five years from now, will there be more, the same number, or fewer catfish farmers?

  some will exit, so fewer farmers

- What will the profit outlook be for catfish farmers who are in the industry five years from now?

  long run outlook – zero economic profit

- Will the price of catfish be equal to, higher than, or lower than $1.00 five years from now?

  since this is an increasing cost industry, a decline in market output will lead to a lower price in long run equilibrium.