PAI 897 **Professor David Popp**
Solutions to Problem Set #5 **Fall 2023**

1. a) The fixed costs are the costs that do not change as the number of attendees changes. This includes the exhibit hall space and speaker fees. The total fixed costs are 11,500 Galleons (= 5,000 + 500 + 5,000 + 1,000). If 500 wizards attend, the average fixed costs are 11,500/500 = **23 Galleons**.

b) Variable costs are the costs that do change as the number of attendees changes. These are all the costs labeled "per wizard." Total variable costs per wizard are **45 Galleons**. This is the average variable cost. Note that since these are per wizard costs, you do not need to divide by the number of attendees. The average variable cost is the same no matter how many attend. Because it is the same, it is also the marginal cost of an attendee.

c) To break even, the price must equal the average total cost. This is equal to the average fixed cost plus the average variable cost. Thus, to break even, charge a price of **68 Galleons**.

d) There will now be 625 wizards attending the conference. The new average fixed cost is 11,500/625 = **18.40 Galleons**.

e) For wizards not attending the reception, the remaining variable costs are the brochures, lunches and snacks. These come to **25 Galleons** per wizard.

f) In both cases, each group should be charged their average cost of attendance. This is the new average fixed costs plus the appropriate average variable cost.

For wizards attending the reception, they should be charged **63.40 Galleons** (= 18.40 + 45).

For wizards not attending the reception, they should be charged **43.40 Galleons** (= 18.40 + 25).

This is an example of how price discrimination can help all consumers. By increasing attendance and lowering the average fixed cost, attendees who do attend the reception also benefit from a lower price.

2. a) Fixed costs are $30. We know this because the firm must pay these costs even if it produces no output.

b) From the description of the broomstick market, we conclude that Wanda's Witchcraft Accessories operates in a perfectly competitive market. Thus, Wanda is a price taker. Since her actions will have no influence on the price, she decides to produce as long as the price is greater than or equal to the marginal cost. Thus, if the price falls in between two marginal costs, choose the lower quantity, since the higher one will cost more money than it will make. In each case, her profits are total revenue - total cost, where total revenue equals price x quantity.

i) Since this is a perfectly competitive firm, the equilibrium quantity is found in each example by finding where MC = P. In this case, Q = 5. Profits = TR – TC = (5)(40) – 140 = $60.

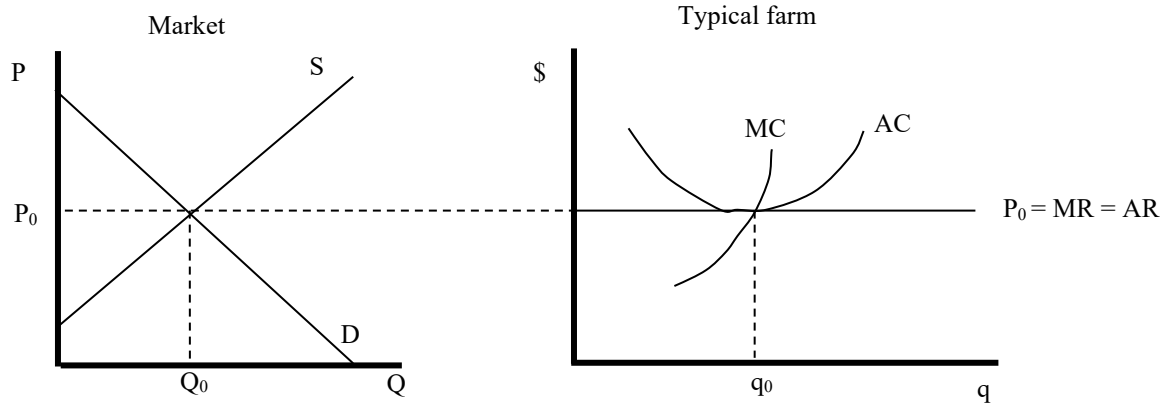
ii) With a price of $25, Wanda produces 4 broomsticks. Profits are (4)(25) – 100 = $0.

iii) With a price of $15, Wanda produces 2 broomsticks. Profits are (2)(15) – 55 = -$25. Note that there are losses here. However, since Wanda's losses are less than her fixed costs, she should stay in business. Notice that the price is greater than the average variable cost at this point. Intuitively, Wanda stays in business because she is making enough money to cover her variable costs and at least some of her fixed costs.

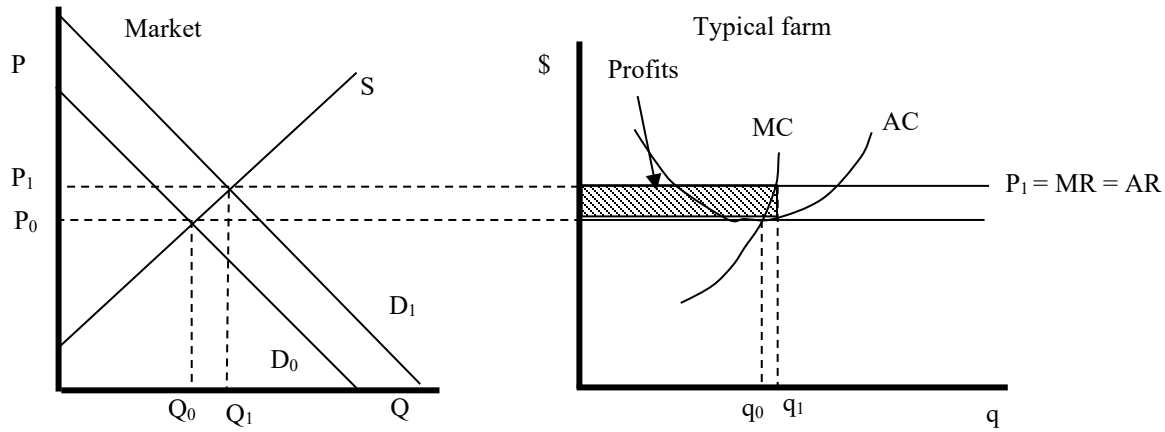
iv) At a price of $10, Wanda is indifferent between operating or shutting down, as she will just cover her variable costs. We know this because the price equals the lowest AVC for any quantity. If she does operate, it would be at a quantity of 1 broomstick. At this point, her profits would be (1)(10) – 40 = -$30. Thus, she will be out $30 whether she decides to shut down or to operate.

c) In the long run equilibrium, all firms are making zero profits, and are thus at the minimum of their average total cost curves. In this case, this occurs at a quantity of 4 broomsticks, at a price of $25. [Note that although the average total cost is also at 25 at a quantity of 3 broomsticks, this occurs because we are working with whole numbers only. Since MC < P at a quantity of 3, Wanda can produce the fourth broomstick without losing money.]

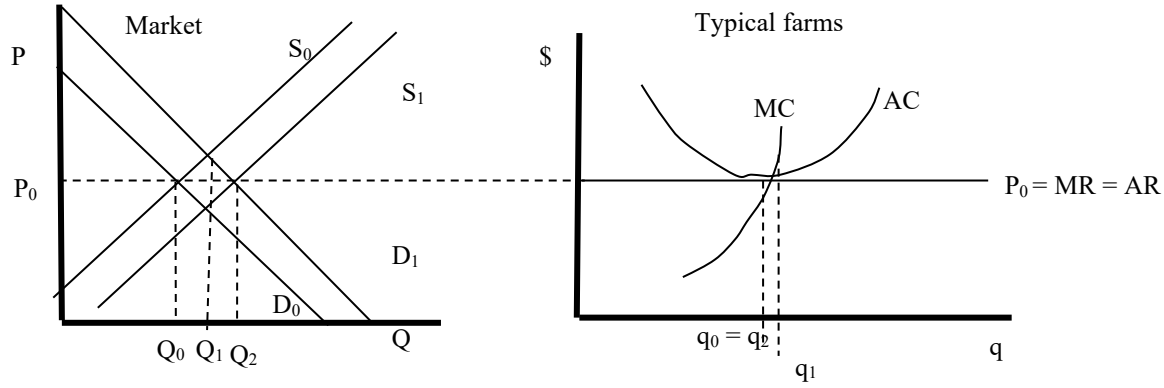
3. a) In long-run equilibrium, firms are making zero economic profits. The price must be equal to the marginal cost at the point where MC intersects the AC curve.



b) The mandate increases demand for vitamins, so the demand curve shifts to the right. In the short run, increased demand leads to a higher equilibrium price and quantity. Each firm produces more vitamins than did before, and earns positive economic profits.



c) No, it will not be a stable long-run equilibrium. Since vitamin manufacturers are now making positive economic profits, more firms will enter the market, shifting supply out. As a result, the price of vitamins will fall. This will occur until the price returns to its original level, with vitamin manufacturers once again making zero economic profit.



d) By restricting the number of manufacturers, supply will not be able to shift out (or at least the amount by which it shifts out will be limited). Because of this, licensed manufacturers will continue to earn an economic profit.

e) The positive profits earned in part (d) are an example of economic rent. Intuitively, the extra value from the licensing restriction is now capitalized into the price of vitamin manufacturing plants. If a firm owner decided to sell his plant, it would sell for a higher price than before, when the plant earned zero economic profits.

Since the policies that result from this lobbying result in economic rent, economists often refer to such behavior as "rent seeking." The most an industry would be willing to spend on rent seeking is the total value of the profits to the industry.

4. a) Each farm has 200 acres, and each acre produces 100 pounds of frozen vegetables. Thus, each farm produces 20,000 pounds of frozen vegetables (=200 x 100). Frozen vegetables sell for $2/pound. Thus, the total revenues from selling frozen vegetables are **$40,000**.

b) The total costs include:

tractor	$3,000
seeds, etc.	$2,000
shipping	$10,000
opportunity costs	$20,000
TOTAL	$35,000

The first two costs are self-explanatory, as they are simply taken from the information given in the problem. The shipping costs are $0.50 times the number of pounds of vegetables grown (= 0.5 x 20,000). The opportunity cost is the salary the farmers give up by deciding to spend a year farming, rather than working at the local call center. If farmers could not earn at least this much money, they would rather work at the call center than farm.

c) Farmers will be charged **$5,000** for their land. After considering all the costs in part (b), these farmers still make $5,000 profit (= $40,000 - $35,000). If making positive profits were possible, additional farmers would want to enter the market. Thus, to have zero economic profits, the rent that farmers must be charged for their land should equal their remaining profits. Intuitively, the land is worth $5,000 per year, because it enables farmers to make $5,000 more per year than they could at the call center.

d) After the airport is built, shipping costs fall to $0.25 per pound. With 20,000 pounds of frozen vegetables per farm, this comes to $5,000 (= 0.25 x 20,000). Total costs (excluding rent) fall to $30,000:

tractor	$3,000
seeds, etc.	$2,000
shipping	$5,000
opportunity costs	$20,000
TOTAL	**$30,000**

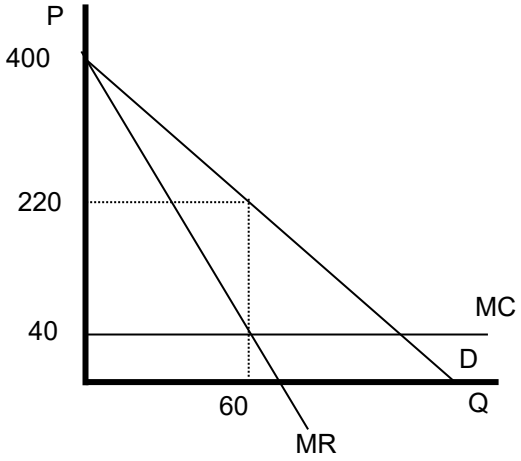
e) The airport raises the value of farmland. Thus, demand for farmland will increase, driving up its price. Rent will increase until farmers once again make zero economic profit. This occurs with a rent of **$10,000** (= $40,000 - $30,000). Note that, in the long run, it is the landowners, not the farmers, who benefit from the airport.

5. a) Profits are maximized where MR=MC. If the city acts as a monopolist, the marginal revenue curve will bisect the demand curve. Thus, MR = 400 – 6Q.

$$MR = 400 - 6Q = 40 = MC$$
$$360 = 6Q$$
$$Q = 360/6 = \mathbf{60}$$

To get the price, we need to look at the demand curve, to see how much citizens are willing to pay for 60 MWh of electricity. We get:

$$P = 400 - 3(60)$$
$$\mathbf{P = \$220}$$



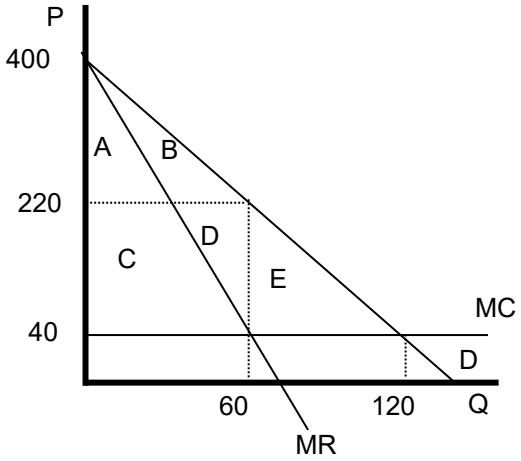
The graph for this market is shown below. Note that the equilibrium quantity is found where MC=MR, and the price is found from the demand curve. The price charged is how much consumers are willing to pay for 60 MWh of electricity.

b) To calculate the profit, note that we need to consider the fixed cost. Thus, profit is not just the producer surplus from the graph. Rather, we must calculate profit as total revenue minus total cost. Total costs include the per unit costs (= 60 MWh at \$40/per MWh) plus the fixed costs:

$$profit = TR - TC$$
$$profit = PxQ - TC$$
$$profit = (220)(60) - 40(60) - 5000$$
$$profit = \mathbf{\$5{,}800}$$

c) Consumer surplus is the area above the price and below demand. It is equal to areas A and B. Although you didn't need to calculate the area, for those who are curious, it is a triangle with base of 60, and a height of 180 (= 400-220). Thus, consumer surplus = 0.5(60)(180) = **$5,400**.

The deadweight loss is area E on the graph. Again, for those who are curious, this area is a triangle with base of 60 (= 120-60) and a height of 180 (= 220-40). Thus, the deadweight loss = 0.5(60)(180) = **$5,400**. Note that you need the quantity sold in perfect competition, which we will find in part (d), to calculate this area.



d) To completely eliminate this deadweight loss, the city should set the price equal to marginal cost. We find the new quantity by equating marginal cost and demand:

$$400 - 3Q = 40$$
$$360 = 3Q$$
$$\mathbf{Q = 120}$$
$$\mathbf{P = 40}$$

Unfortunately, at this price, the city will lose money, because of the fixed costs:

$$\text{profit} = TR - TC$$
$$\text{profit} = PxQ - TC$$
$$\text{profit} = (40)(120) - 40(120) - 5000$$
$$\text{profit} = \mathbf{-\$5{,}000}$$

e) The problem with marginal cost pricing is that it does not cover the fixed costs of providing electricity in Mount Washington. One solution would be average cost pricing, where the price equals the average cost of each MWh of electricity provided. This way, the price covers both the marginal cost of $40 per MWh and each person's share of the fixed costs, allowing the city to break even. While there is some deadweight loss associated with average cost pricing, the deadweight loss will be less than with monopoly pricing.

Another possibility is to consider price discrimination. For example, low income users could be charged the marginal cost of electricity generation, and higher income users could be charged a higher price. This second price simply needs to be high enough so that it covers the fixed costs as well as the marginal costs of the municipal power plant. Another price discrimination idea suggested by several students is to vary the price by time of day. Users could be charged more to use electricity during peak demand periods, such as hot summer days. Not only does this pricing scheme bring in more money when demand is high, it also discourages households from using electricity when the power plant is under stress from heavy demand.

Finally, tiered pricing is another option. Each MWh could be priced at marginal cost, but users could also be charged an annual connection fee. The connection fee could be set based on the number of households to cover the fixed costs of the municipal power plant.