

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

**Solutions Available Wednesday, November 1**

1. Hogwarts is organizing a two-day wizarding conference. You have been hired as a consultant to help them organize the conference. The exhibition will include speakers and exhibits on the latest spells and potions. The costs for the exhibition are given below. You have been asked to come up with pricing strategies for the exhibition. Hogwarts expects 500 wizards to attend the two-day event. For simplicity, you can assume that all attendees will come to both days.

Day 1:	Use of exhibit hall space:	5,000 Galleons <sup>1</sup>
	Speaker fees:	500 Galleons
	Brochures:	2 Galleons per wizard
	Luncheon:	10 Galleons per wizard
	Evening reception:	20 Galleons per wizard
Day 2:	Use of exhibit hall space:	5,000 Galleons
	Speaker fees:	1,000 Galleons
	Box lunch for participants	10 Galleons per wizard
	Snacks:	3 Galleons per wizard

- If 500 wizards will attend the conference, what are the average fixed costs per attendee?
- If 500 wizards attend, what are the average variable costs per attendee?
- What admission price must Hogwarts charge for the two-day event to break even if 500 wizards attend?
- To increase attendance, you suggest offering a reduced rate to wizards who do not want to attend the reception on day 1. You estimate that this will increase attendance by 125 (e.g. 500 wizards will attend everything, as before, and 125 additional wizards will come and not attend the reception). What is the new average fixed cost?
- What is the average variable cost for those wizards that do not attend the reception?
- Based on your answers on the previous pages, find the prices to charge (1) those who will attend the reception, and (2) those who won't attend the reception, so that the exhibition will break even (assuming, as above, that 500 wizards will still choose to attend both the exhibition and reception, and that 125 wizards will attend the exhibition without attending the reception).

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<sup>1</sup> For those unfamiliar with the term, a Galleon is the traditional currency of the wizardry community.

2. Wanda's Witchcraft Accessories (WWA) manufactures broomsticks for witches (she's been very busy lately!) The broomstick industry consists of many competitors, and they are not allowed to cast spells on potential entrants to the market, so there is freedom of entry and exit. Of course, witches know all about what the various broomstick manufacturers offer, and all broomsticks are identical. WWA has the following cost structure:

Q	TC	MC	ATC	AVC
0	\$30	--	--	--
1	\$40	\$10	\$40	\$10
2	\$55	\$15	\$27.5	\$12.5
3	\$75	\$20	\$25	\$15
4	\$100	\$25	\$25	\$17.5
5	\$140	\$40	\$28	\$22
6	\$200	\$60	\$33.33	\$28.33

- a) What are the fixed costs for the firm? How do you know this?
- b) For the following market prices, find the equilibrium quantity and profits. Be sure to explain how you arrived at your answers.  
i) \$40, ii) \$25, iii) \$15, iv) \$10
- c) What price is a long run equilibrium price for this industry? How do you know this?
3. This question asks you to consider the market for vitamins in the United States. For this question, please assume that there are many small vitamin manufacturers in the U.S. market, so that the market is perfectly competitive.
- a) Begin by depicting the market for vitamins in long-run equilibrium. Using two diagrams, one to represent the market for vitamins, and a second to represent the costs of a typical vitamin manufacturer, illustrate the current price, quantity and profits of a typical vitamin manufacturer. Explain why you have drawn the curves as you did.
- b) Suppose that Congress succeeds in passing health care reform, and that the reform includes a provision mandating a daily vitamin for all U.S. citizens. Show how such a mandate affects the market equilibrium, price, and short-run profits of a typical vitamin manufacturer. Using one diagram for the vitamin market and a second for a typical firm, illustrate below.
- c) Will the scenario you have described in part (b) be a stable long-run equilibrium? Why or why not? Once again using separate diagrams for both the industry and a typical firm, illustrate the new long run equilibrium for the vitamin market.
- d) To avoid the possibility you discuss in (c), the vitamin industry has proposed a licensing scheme. Only licensed vitamin manufacturers will be allowed to sell vitamins in the United States, and the number of licenses available will be limited. How would such a licensing requirement affect your answer to part (c)? Why?
- e) Economists often call lobbying efforts to obtain restrictive regulations such as the licensing requirement "rent seeking" behavior. Why do you think this is? What is the most that the vitamin industry would be willing to spend on such lobbying?

4. TundraTown, located in northern Canada, is a leading producer of frozen vegetables. Because of their northern location, farmers in TundraTown have an important advantage over other vegetable farmers: their vegetables freeze before they are picked. However, their remote location also means that transportation costs are high, as the vegetables are currently shipped by sleigh to markets in southern Canada and the United States. To help alleviate these travel costs, the leaders of TundraTown propose building a municipal airport. Using airplanes, rather than sleighs, to transport the frozen vegetables will cut the costs of transportation in half. You have been asked by the town leaders to analyze the long term effects of the airport.

To answer the following questions concerning this legislation, please use the following facts:

- Farmers sell their frozen vegetables in a competitive world market for \$2/pound. TundraTown farmers have no influence over the price of frozen vegetables.
  - Each farm in TundraTown is 200 acres. Farmers rent the farmland from local landowners.
  - Each acre produces 100 pounds of frozen vegetables.
  - An individual farmer can provide all the necessary labor to grow the frozen vegetables. However, each farmer needs a special tractor equipped for winter conditions. These tractors sell for \$3,000 each. Because of the harsh winter conditions, the tractors must be replaced each year. In addition, it costs \$2,000 for the seeds, fertilizer, and other equipment needed to grow the vegetables.
  - Currently, it costs \$0.50 to ship 1 pound of frozen vegetables to market.
  - After building the airport, it will cost only \$0.25 to ship 1 pound of frozen vegetables to market.
  - Residents of TundraTown who do not farm are employed at the local call center. These workers earn \$20,000 per year. Working at the call center is considered neither more nor less pleasing than farming.
- a) How much revenue do farmers earn selling frozen vegetables before the airport is built?
- b) Except for the rent charged to farmers by the local landowners, what are the costs of selling these frozen vegetables before the airport is built? Be sure to include all costs relevant to an economist, and explain how you calculated them.
- c) What rent will the farmers be charged for their land? How do you know this?
- d) How do the costs of selling frozen vegetables change after the airport is built? Calculate the new total costs, other than the rent charged by local landowners.
- e) What happens to the rent charged to farmers after the airport is built? In the long run, does the airport project do anything to raise the income of farmers? Why or why not?

5. To reduce reliance on their local electric utility, the city of Mount Washington has decided to build their own municipal power plant. They must now decide what price to charge consumers. After some careful research, you estimate the following demand curve for electricity:

$$P = 400 - 3Q$$

where Q represents the quantity of electricity used per month, measured in megawatt hours (MWh). The marginal costs of electricity generation are \$40 per MWh. The fixed costs of running the power plant come to \$5,000 per month.

- a) Because the municipal power plant is the only source of electricity for local residents, the city can act like a monopolist provider of electricity. Councilman Alexander argues that acting as a monopolist and maximizing profits from the power plant will bring in needed revenue to the city. Find the amount of electricity purchased per month, along with the price per month, if the city maximizes profits as a monopolist. Illustrate on a graph.
- b) How much profit does the city make if it acts as a monopoly?
- c) Redraw your graph from part (a). On it, please show the consumer surplus that consumers receive and the deadweight loss from this pricing strategy. Note that you do not need to calculate the values for these areas, but simply must show where they are represented on the graph.
- d) Councilwoman Eliza believes that the city is providing a vital public service, and so should provide electricity without any deadweight loss. To completely eliminate the deadweight loss, what should the price of electricity be? How much electricity will citizens purchase at that price? Will the city make money, break even, or lose money at that price? Explain.
- e) Councilman Aaron is not happy with either plan. He does not like the deadweight loss and large profit from monopoly pricing, but is also not happy with the outcome of part (d). Can you suggest a compromise pricing strategy that could reconcile these concerns? (Note: you do not need to calculate any numbers here. Just give a general explanation of an alternative pricing strategy that could work.)