Model Solutions, Exam 2022-12-09.

Multiple choice questions

1. c [1] 2. c 3. b 4. b 5. c 6. e 7. b 8. b

I (a) **Empty threat** is a threat that is not in the threatener's interest to carry out once the time comes to carry it out.

(b) **Installed base** is a measure of the number customers already using a product or a service. It is relevant especially for industries where network effects are present.

(c) **Vertical differentiation** means choosing a quality level and a price level for a product to differentiate it from competing products, when consumers can all agree on the quality ranking between products but have different willingnesses to pay for it. The purpose of vertical differentiation is to obtain market power to increase profits.

II Bonk failed to understand winner's curse, where the bidder with the highest overestimate for the true value of the item (here the resale value of the house) tends to obtain the item. Even though Bonk's predictive model was on average correct about the eventual resale price of houses, there was still some prediction error, so the model must have overestimated the value of some houses and underestimated the value some others. Clearly Bonk was most often able to acquire those houses where it most overestimated their value, whereas in other cases "another house-flipper would make a better offer." This resulted in a loss for the house-flipping strategy.

III The use of studded tires imposes a negative externality because they emit particles that pollute the air for everyone in Lintukoto.

(a) Here the question is what happens if nothing is done about the externality. All consumers whose private benefit from studded tires is at least as high as their price will buy the set. The price p^* is determined in the world market, so the amount consumed (in thousands of sets) is solved from $P^D(q) = p^*$.

$$1000 - 20q = 200 \implies$$
$$\tilde{q} = 40$$

So 40k studded tire sets are consumed in Lintukoto. The external cost imposed by each purchase is the value of the externality that the marginal studded tier user imposes on Lintukoto. Let's differentiate the total damage function and plug in the

[1] Had there been sales to only one consumer type then both a) and d) would have been correct.

equilibrium level of usage.

$$\begin{aligned} C'(q) &= \frac{\partial}{\partial q} 6q^2 = 12q \\ \implies C'(\tilde{q}) &= 12 \times 40 = 480 \end{aligned}$$

The external cost imposed by the user of a studded tire set is 480 euros.

(b) Here we need to find the optimal Pigouvian tax to deal with the externality. First let's formulate total surplus as a function of quantity q. There are no (domestic) profits, so total surplus in Lintukoto is total benefit to consumers minus private costs minus total damage caused by the use of studded tires. (Tax revenue will just be a transfer inside Lintukoto and so does not affect total surplus.) As the demand curve is linear total benefit is simply the area of the trapezoid below.

$$\begin{aligned} \mathrm{TB}(q) &= \frac{P^D(0) + P^D(q)}{2} q \\ &= \frac{1000 + (1000 - 20q)}{2} q \\ &= 1000q - 10q^2 \end{aligned}$$

Taking into account private costs $p^* q = 200q$, total surplus from q sets is

$$\begin{aligned} \mathrm{TS}(q) &= \mathrm{TB}(q) - p^* q - C(q) \\ &= 1000q - 10q^2 - 200q - 6q^2 \\ &= 800q - 16q^2. \end{aligned}$$

Now that we have the objective function we can find the optimal level of consumption q by taking the first-order condition and solving it:

$$\frac{\partial \mathrm{TS}(q)}{\partial q} = 800 - 32q = 0 \implies q^* = 25.$$

At the optimum 25k studded tire sets are consumed. This is achieved with a unit tax t on studded tire sets that makes demand equal supply at the optimal quantity.

$$\begin{gathered} P^D(q^*) = p^* + t \\ 1000 - 20 \times 25 = 200 + t \implies \\ t^* = 300 \end{gathered}$$

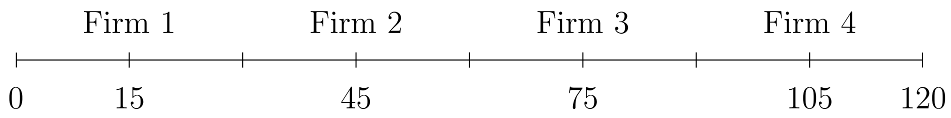
A tax of 300 euros per tire set would maximize total surplus.

IV This is a problem with horizontal differentiation. It can be described by a Hotelling line where every kilometer contains 1000 customers and conveys (5k−4k)×1000 = 1000k= 1m euros of revenue to the operator of its nearest health center. All customers choose a health center, so total revenue is fixed at 120 €m and gets divided in proportion to market shares.

(a) Both health centers locate at the midpoint of the 120 km line. To see why this is the only equilibrium, suppose one firm located anywhere to the right of the midpoint. Then the other firm would maximize its profit by locating slightly to the left of the first one, obtaining more than 50% market share. But then the first firm could increase its profit by moving just slightly to the left of the second firm, instead obtaining more than 50% market share. The only situation where neither firm can increase its profit is where both get 50% market share and there is room to grab market share by moving closer to the competitor. Taking into account the fixed cost, profits per firm are $0.5 \times 120 - 25 = 35$ million euros.

(b) In long-run equilibrium no firm can profitably enter the market or benefit from leaving the market. First let's figure out the maximum number of firms that can profitably operate in this market. Total industry revenue minus total fixed costs of n health centers is nonnegative when $120 - 25n \geq 0$, which requires $n \leq 4.8$. Hence there is room for 4 health centers.

In the symmetric long-run equilibrium the health centers are located at the midpoints of equal-sized customer segments. Segment lengths are then $120/4 = 30$ km, and their midpoints are also 30 km apart, starting at the location 15 km from the edge.



Each health center has 25% of the market and earns a profit of $0.25 \times 120 - 25 = 5$ million euros.

(c) When the number and location of health centers changes this affects welfare by changing total fixed costs of operating health centers and the total travel costs of customers. As two more health centers open up in the long run total fixed costs go up by $2 \times 25 = 50$ €m.

Travel costs are proportional to the average distance from the nearest health center. In part IVa all customers were uniformly located in a segment of length 60 km with a health center in one end; hence average distance was 30 km. In part IVb everyone was located in a segment of length 30 km with the nearest health center in the midpoint of the segment so at most 15 km away. Hence average distance was 7.5 km. The change in total travel costs is

$$\underbrace{120}_{\text{k}} \times \underbrace{(7.5 - 30)}_{\text{km}} \times \underbrace{50}_{\text{€/km}} = \underbrace{-135\,000}_{\text{€k}}$$

i.e., 135 €m. The decrease in travel costs is larger than the increase in fixed costs, so the change in total welfare is positive ($-50 + 135 = 85$ €m).