Model Solutions, Exam 2022-10-18

Multiple choice questions

1. b 2. b 3. b 4. a 5. e 6. d 7. a 8. a 9. b

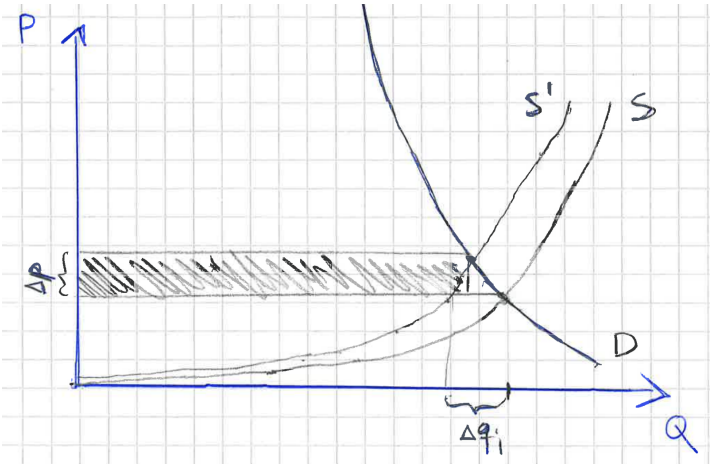
I (a) When a **private good** is consumed by someone this reduces its consumption value for other consumers, who can also be excluded from consuming it. Food, for example, is a private good.

(b) The **certainty equivalent** of an uncertain outcome like a gamble is the least amount of money a person is willing to take for sure instead of that gamble. It depends on the gamble and that person's risk preferences.

(c) When a tax is levied on a market, the prices faced by both suppliers and consumers are both affected regardless of who is legally obliged to pay the tax. **Incidence of taxation** describes how the tax burden is actually shared between these parties.

(d) **Lumpy costs** are like fixed costs but may be paid at some positive level of output. For example, the setting up an additional facility to expand production is a lumpy cost that would have to be paid regardless of how much output is produced there.

II The strike reduces the supply of fine paper and thus increases its world market price. The profits that this company earns from its other fine paper mills could go up by more than the loss of profits from that it suffers at the mill that is closed by the strike. This would be the case if demand is sufficiently inelastic and the supply by other companies is not too elastic.



The company benefits from the strike if its share of the increase in industry profits (the shaded box) is larger than the reduction in profits it suffers on the output of the closed mill (on the reduction in supply Δq_i).

Additional comment. This is the same mechanism that was seen in PS 1 part 4c. The recent change in demand is immaterial for the explanation, but, without it, it would have been a mystery why the company had not closed the mill earlier.

III (a) Total surplus in a market is the sum of consumer and producer surplus. It is maximized in competitive market equilibrium. To find it let's equate supply and demand:

$$\begin{aligned} & P^D(Q) = P^S(Q) \\ \iff & 100 - 2Q = 4 + Q \\ \implies & Q^* = 96/3 = 32 \\ \implies & P^* = P^D(Q^*) = 100 - 2 \times 32 = 36. \end{aligned}$$

Total surplus is maximized when Molvanians consume 32 tons of cabbage per month at a price of 36 Strubl/kg.

(b) To find out the tax revenue as a function of the unit tax t let's solve for the equilibrium quantity in the presence of a tax.

$$\begin{aligned} & P^D(Q) = P^S(Q) + t \\ \iff & 100 - 2Q = 4 + Q + t \\ \implies & Q_t(t) = Q = 32 - \frac{1}{3}t \end{aligned}$$

Tax revenue as a function of the level of the unit tax is then

$$T(t) = tQ_t(t) = 32t - \frac{1}{3}t^2.$$

(This is the Laffer curve for cabbage in Molvania.) After the coup the government will maximize $T(t)$, not caring at all about consumer or producer surplus. Take the first order condition and solve for the maximizer:

$$\begin{aligned} & \frac{\mathrm{d}T(t)}{\mathrm{d}t} = 32 - \frac{2}{3}t = 0 \\ \implies & t^* = 48. \end{aligned}$$

The resulting tax revenue is $T(48) = 32 \times 48 - (1/3) \times 48^2 = 768$ (in 1000s Strubl/month). Consumer surplus is the triangular area bounded by the demand curve and the consumer price. We know that consumption is is $Q_t(48) = 32 - 48/3 = 16$ tons/month, so consumer price must be $P^D(16) = 100 - 2 \times 16 = 68$ Strubl/kg. Hence monthly consumer surplus is $\mathrm{CS} = 0.5 \times [(100 - 68) \times 16] = 256$ (1000s Strubl).

(c) Since the supply curve slopes upward there is some producer surplus as long as anything is produced. The highest price at which quantity produced is zero is the choke price for the supply of cabbage: $P^S(0) = 4$. Therefore SHPR Molvania first achieves its goal of producer surplus elimination when the price ceiling falls to 4 Strubl/kg. As no cabbage is then produced consumer surplus is also eliminated.

IV (a) The pool is a public good because it never gets crowded. It is efficient to serve all users whose reservation value is greater or equal to the marginal cost, €2. This is achieved by setting the price of a visit at €2. The reservation values of potential visitors are distributed uniformly between 0 and 10 euros, so 80% of them have values that exceed €2, which amounts 800 daily visitors on weekdays and $0.8 \times 2000 = 1600$ on weekends. As there is no need to worry about fixed costs and the pool is producing positive surplus every day it is indeed efficient to keep the pool open every day.

(b) Maximization of total weekly welfare under the constraint of budget balance is achieved by average cost pricing. The price of pool visits will now be above marginal cost, but not any higher than it need be.

When the price is $p \in [0, 10]$ then a fraction $(10 - P)/10$ of potential visitors will pay a visit. Hence the daily demand is $Q_d^D(P) = N \times (1 - 0.1P)$ on days with N potential visitors. Total weekly demand for pool visits is therefore

$$Q^D(P) = (5 \times 1000 + 2 \times 2000) \times (1 - 0.1P) = 9000 - 900P.$$

The fixed cost of keeping the pool open is 7000 €/week. Average cost in €/visit is $\text{AC}(Q) = \text{FC}/Q + \text{MC} = 7000/Q + 2$. Finally, let's find out which price is consistent with average cost pricing.

$$\begin{aligned} &\frac{\text{FC}}{Q^D(P)} + \text{MC} = P \\ \implies &\text{FC} = (P - \text{MC})Q^D(P) \\ \implies &7000 = (P - 2)(9000 - 900P) \\ \implies &900P^2 - 10800P + 25000P = 0 \end{aligned}$$

The sensible solution to this quadratic equation is the average cost price, $P_{AC} \approx 3.13$. (The other solution is higher, thus leading to lower consumer surplus while also balancing the budget).

Additional comment. Breaking even day by day would result in a lower price on weekends than on weekdays. This would result in lower consumer surplus than charging the same price every day. To see why this must be so, notice that then the highest-value customer who does not visit the pool on a weekday would value a visit by more than the lowest-value customer who does visit on a weekend. Just by changing the pricing it is possible to swap their visiting decisions pairwise, without any impact total cost.