Practice Set 6 – KEY

Market Failure & Government Intervention

This set contains practice material for your own use. It is highly recommended to work on the problems on your own. Do not just read the provided solutions. Instead, try to solve the problems and use the solutions only when you are stuck. Reading problems that someone else has solved has the same value on your preparation like watching someone running a marathon on TV and then expecting to be able to run it, too! If you have questions on this set, please ask your section's teaching assistant.

1. Consider the monopoly illustrated in *Figure 1*. A regulator considers 4 alternative price ceilings: p_1, p_2, p_3 and p_4.

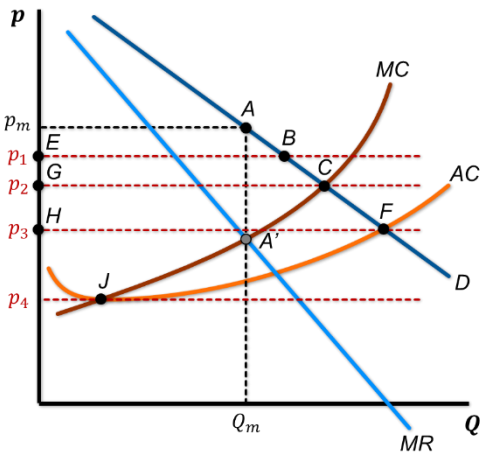

Figure 1

   (a) What would be the effect if price ceiling p_1 is imposed?

   Without the price ceiling the monopolist prices at p_m, causing a DWL equal to the area AA'C. If price ceiling p_1 is imposed, the monopoly would lower the price to p_1, decreasing the DWL. More output than Q_m will be sold in the market. CS will increase and the monopolist's profits would decrease.

   (b) Which price ceiling should the regulator impose in order to force the monopolist to produce at minimum average cost?

   Price ceiling p_4 would bring the monopolist to point J, at which AC is minimum. However, this would create a higher DWL as it would decrease consumption way below Q_m.

   (c) Which price ceiling should the regulator impose in order to maximize the efficiency in this market?

   Price ceiling p_2 would bring the monopolist to point C, at which $p = MC$. This is equivalent to the PC equilibrium, eliminates the DWL and increases consumption in comparison to the unregulated level p_m. At this price, the monopolist seems to have some positive profit as p_2 is above AC at point C. The latter assures that regulation at p_2 is also sustainable as there will be no need to subsidize this monopoly in order to keep operating.

   (d) Can the regulator impose a price ceiling that will force the monopolist to produce the quantity that corresponds to point F of the figure?

   If price ceiling p_3 is imposed and the monopolist produced the quantity that corresponds to point F, profit will be zero because $p_3 = AC$ at F. If, however, the monopolist produces less than the quantity that corresponds to F, AC will be lower than p_3 resulting in positive profits. Profit will be positive and maximum at the quantity where $p_3 = MC$, which is less than the quantity that corresponds to point F.

   (e) Is the monopoly in figure 1 a natural monopoly?

   No, it is not. This monopoly seems to be under diseconomies of scale even for quantities as low as the one that corresponds to point J. This means that splitting quantity among more than one firms could potentially decrease the per-unit cost of production.

2. Consider the monopoly illustrated in *figure 2*. A regulator considers 2 alternative price ceilings: p_1 and p_2.

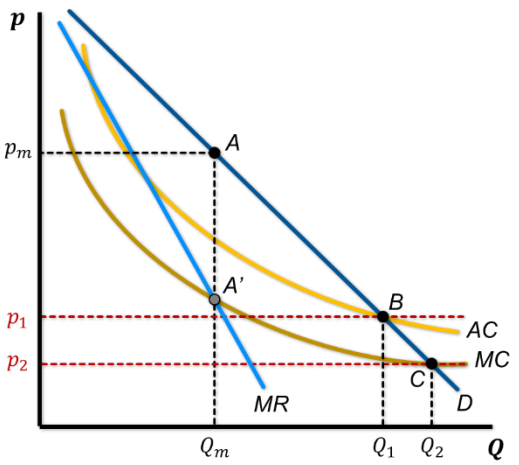

Figure 2

(a) Explain why this is a natural monopoly.

This is a natural monopoly because the AC is decreasing during the entire range of quantities that correspond to the given demand curve. This implies that any quantity on the graph can be produced at a lower AC if it is produced by a single firm, than if it is split among more than one firms. This is because, if more than one firms operated in this industry, their AC and MC costs would look identical to the monopoly's.

(b) Which price ceiling should be imposed to maximize efficiency in this market?

Maximum efficiency would be when $p = MC$. If the regulator imposes price ceiling p_2, maximum efficiency could potentially be achieved at C. However, at Q_2, the monopolist will experience losses, which will render pricing at p_2 unsustainable. Only if the regulator subsidizes the monopolist for the losses at Q_2, the monopolist will keep operating with price regulated to p_2.

(c) Which price ceiling should the regulator impose in order to maximize production, while the monopoly can still be sustainable on its own?

By imposing price ceiling p_1, the monopolist will choose to produce Q_1. At that price, $p = AC$, so the monopolist will break even while still producing above the monopoly quantity Q_m. However, at Q_1 the DWL is not entirely eliminated and production is not at maximum efficiency.

3. Production of electricity in a town requires total cost $TC = 600 + 10Q$ and marginal cost $MC = 10$. The town's demand for electricity is $p = 90 - 2Q$.

(a) Derive the price, output and profit if the market of electricity is a *monopoly*.

Marginal revenue is $MR = 90 - 4Q$. $MR = MC$ implies that $90 - 4Q = 10$ or $Q = 20$. From the demand curve we can estimate the price $p = 90 - 2 \cdot 20$ or $p = 50$. Then, profit is $\Pi = p \cdot Q - TC$ or $\Pi = 50 \cdot 20 - 600 - 10 \cdot 20$ or $\Pi = 200$.

(b) Derive the price, output and profit if the market of electricity is a *collusive duopoly*.

The monopolistic quantity would be split equally between firm 1 and firm 2. That is, $q_1 = q_2 = 10$. Price would remain at $p = 50$. Profit for firm 1 would be $\Pi_1 = p \cdot q_1 - TC_1$ or $\Pi_1 = 50 \cdot 10 - 600 - 10 \cdot 10$ or $\Pi_1 = -200$. Also, $\Pi_2 = -200$. With 2 firms, the duplication of costs makes production unprofitable. This market has too small a demand to fit 2 firms.

(c) Derive the price, output and profits if the market of electricity is a *Cournot duopoly*.

Under Cournot duopoly the firms would produce more than in collusion and perhaps they can be profitable. Let's see. Demand is $p = 90 - 2q_1 - 2q_2$. Marginal revenue for firm 1 will be $MR_1 = 90 - 2q_2 - 4q_1$. $MR = MC$ implies that $90 - 2q_2 - 4q_1 = 10$ or $q_1 = (80 - 2q_2)/4$. Since firms are symmetric, $q_1 = q_2$, so $q_1 = (80 - 2q_1)/4$ or $4q_1 = 80 - 2q_1$ or $q_1 = q_2 = 13.\overline{3}$. From the demand curve, $p = 90 - 2(13.\overline{3} + 13.\overline{3})$ or $p = 36.\overline{6}$. Profit for firm 1 would be $\Pi_1 = p \cdot q_1 - TC_1$ or $\Pi_1 = 36.\overline{6} \cdot 13.\overline{3} - 600 - 10 \cdot 13.\overline{3}$ or $\Pi_1 = -244.\overline{4}$. Also, $\Pi_2 = -244.\overline{4}$. In Cournot, quantities are higher and this helps to reduce cost per unit but price is lower and this prevents the firms from having profit.

(d) What kind of industry is this?

This is clearly a natural monopoly as the industry can be viable only if a single firm operates. The reason is that the high fixed costs (600) require production (Q) to be high enough to ensure that AC (TC/Q)

will be below the market price determined by what the consumers are willing to pay for electricity, as given by the demand curve.

(e) Derive the price, output and profits if the market of electricity is *regulated* so that $p = MC$.

If $p = 10$, the monopolist will sell quantity given by $10 = 90 - 2Q$ or $Q = 40$. Then, profit is $\Pi = p \cdot Q - TC$ or $\Pi = 10 \cdot 40 - 600 - 10 \cdot 40$ or $\Pi = -600$. Efficiency is maximum, quantity is much higher than all other market outcomes above but this monopoly must be subsidized by the regulator with 600 monetary units per period in order to be sustainable.

(f) Derive the price, output and profits if the market of electricity is *regulated* so that $p = 30$. What kind of regulation is this?

If $p = 30$, the monopolist will sell quantity given by $30 = 90 - 2Q$ or $Q = 30$. Then, profit is $\Pi = p \cdot Q - TC$ or $\Pi = 30 \cdot 30 - 600 - 10 \cdot 30$ or $\Pi = 0$. Quantity is lower than that of the maximum efficiency regulation but now the monopoly is sustainable on its own. This is $p = AC$ regulation for sustainability.

4. Explain whether any of the following statements implies a '*positive externality failure'*.

(a) "*I do not read as much as I should because I watch too much YouTube*".

An externality refers to a situation when an action affects someone irrelevant to this action. Here we have an action (watching YouTube) that causes a presumable negative effect (not reading much) but both apply to the same individual (me). Thus, this statement describes no externality.

(b) "*I do not recycle because the recycle bins are far from my home*".

The action (recycling) would positively affect someone else who would not take part in the action (the society or the environment). Thus, we have a case of a positive externality. Yet, a personal cost (going to the recycle bin) prevents the action from happening. Therefore, this is a positive externality failure.

(c) "*I do not use my car when it rains because there is more traffic*".

The action (not using my car) affects someone else who does not take part in the action (the other drivers). Thus, we have a case of a positive externality. However, this externality is not prevented from happening by a personal cost, therefore there is no failure.

(d) "*The only reason I donate blood is because I want to get the likes from uploading the relevant photo on Instagram*".

The action (donating blood) has a positive effect on someone else irrelevant to the action (the recipient of the blood). Thus, we have a positive externality. However, this externality is not prevented from happening by some personal cost, so there is no failure.

(e) "*The mayor installed a toll station on the nearby highway and now the neighborhood suffers a traffic congestion problem because cars cut through the neighborhood streets to avoid the tolls*".

The action (installing the tolls) has a negative effect on someone else irrelevant to the action (the neighborhood). Thus, we have a negative externality failure.

5. MeatMe barbeque restaurant opened next to the Vegan café. The barbeque smell from MeatMe has caused Vegan café to lose business valued at $200K, because it turns off lots of its patrons who used to sit at the patio. MeatMe could install a ventilation system that prevents the barbeque smell from reaching the neighborhood helping the Vegan café to avoid the loss of business. However, MeatMe sees no own benefit from installing the ventilation system and will not install it on its own.

(a) How can the externality be resolved if the cost of the ventilation system exceeds $200K?

The Vegan café will not want to pay more than $200K to solve a problem that costs only $200K in loss of business. The externality cannot be resolved because "the therapy is more harmful than the disease".

(b) How can the externality be resolved if the cost of the ventilation system is less than $200K?

Vegan café could offer to pay the cost of the installation. However, MeatMe could act opportunistically and demand more than the cost of the ventilation system in order to install it. If, for instance, the cost of the ventilation system is $100K, MeatMe could demand $150K for installing the system. Even in this case, the Vegan café would be tempted to accept paying because it still solves a $200K problem with only $150K. Theoretically, depending on the relative bargaining power of the two firms, the Vegan café could be asked to pay anything between $100K and $200K to MeatMe for installing the ventilation system.

You are kindly requested to report any *typos, mistakes* or *proposals* for the improvement of this practice set key at kmarinakis@smu.edu.sg.