MOT1421
Economic Foundations
Week Two (November 2020)

November 16, 2020

PERFECT COMPETITION & MONOPOLY
SELF-TEST: ANSWERS

The self-assessment consists of 10 Questions.
Each Question has a weight of 1. Your maximum score therefore is 10.
A score of 6 means that you have successfully passed the test.
This self-assessment is self-scoring.

Question 1

First, we calculate the equilibrium price in this market which is the price at which market demand = market supply. Hence, we have: $Q^D = 600 - 3 \times P = Q^S = 200 + 2 \times P$. This gives: $5 \times P = 400 \rightarrow P = 80$.

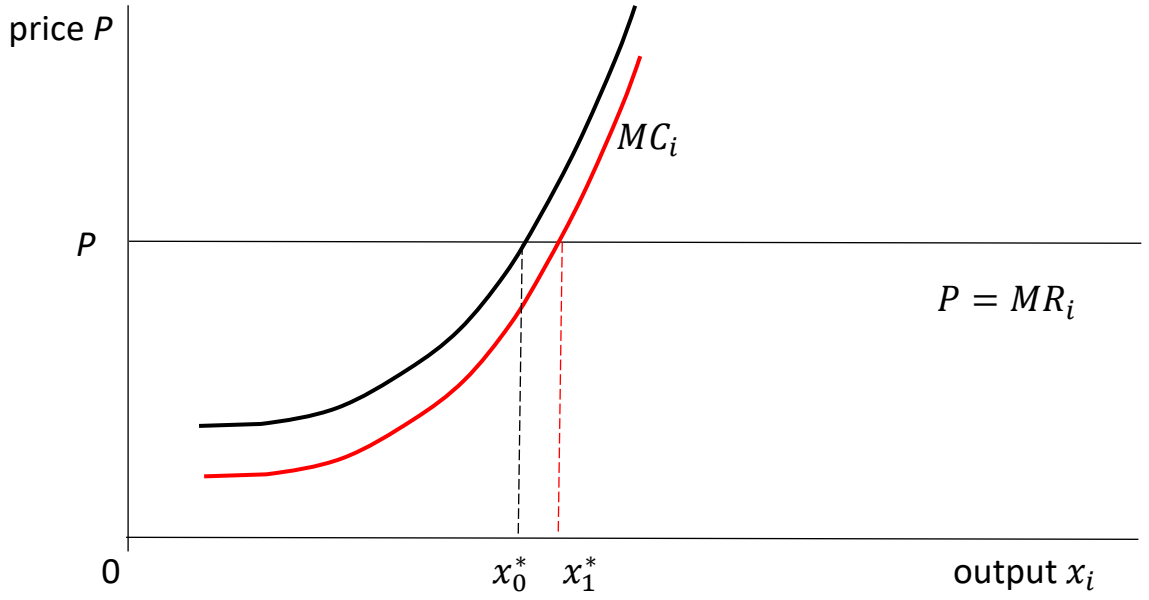
This means that $Q^D = Q^S = 360$ million goods. The equilibrium price is the marginal revenue for each firm in this market; hence $MR_i = 80$.

Marginal cost is equal to: $MC_i = 12 + 4 \times Q_i$. Profit maximization requires that $MR_i = MC_i$, which gives $Q_i = 17$ thousand goods. This is the profit-maximising level of output for each individual firm.

There are $\frac{360 \times 10^6}{17000} = 21176$ firms (rounded) in this market.

Question 2

Consider the following figure for a firm in a competitive industry:



Suppose there is technological progress which reduces average and marginal cost for all firms in this industry.

a. The marginal cost curve shifts down.
b. The profit-maximising level of output increases from x_0^* to x_1^*.
c. The long-run impact on (super-normal) profits will be zero. If this reduction in marginal cost leads to positive super-normal profits in the short run, new firms (= entrants) will come into this market. Market suppy will rise, the market price will de lowered, until it is true for each firm that MC = AC = Price. Firms will be left with only 'normal profits'.

Question 3

Asymmetric information is a problem in any market in which the supplier has an information advantage vis-à-vis the buyers. Examples are the market for second-hand cars; markets for complex financial products (derivatives); and the real estate market (where brokers have more knowledge than sellers and buyers).

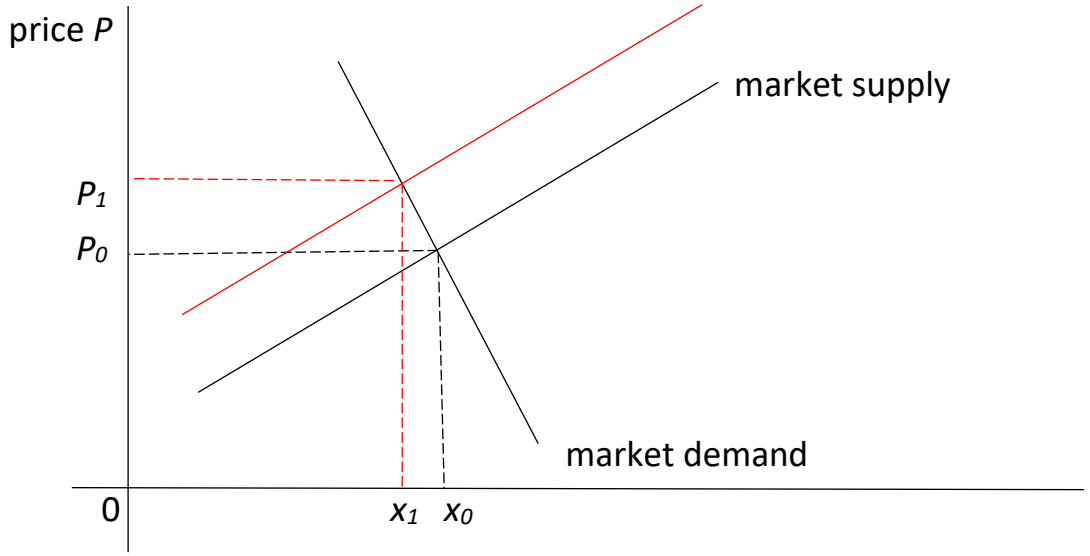
Question 4

A public good is non-exclusive and non-rival.

- 'non-exclusivity' means that the producer (who incurred costs to produce the good) cannot exclude non-paying consumers from using the good, once it has been produced. As a result, the producer cannot recoup the cost of production. An example: once a dike (to protect people against flooding) has been produced, one cannot exclude new people who did not pay for the construction of the dike, from settling in the now protected area.
- 'non-rivalry' means that one more item of the good can be produced and consumed against zero marginal cost of production; the extra item of this good does not involve the use of scarce resources (inputs, energy, labour, capital) which could have been used for other – rival – purposes. Example: the concert of a street musician. One more listener can "consumer" the concert at zero marginal cost to the street musician.

Question 5

The internalisation of the pollution cost means that for each level of output, the cost and therefore the price will be higher. The price will rise from P_0 to P_1; as a result, demand and supply will decline from x_0 to x_1. When consumers have to pay the full cost (i.e. including the external cost), demand will be lower; hence, market supply be will reduced.



Question 6

A monopolist faces a demand for its product given by: P = 30 – ½ Q.
Its total cost takes the following form: $TC = 10 + 2Q^2$.
We first define total revenue: $TR = P \times Q = 30Q - ½ Q^2$. Hence, marginal revenue is: MR = 30 – Q. Marginal cost is: MC = 4Q. Profit maximization by the monopolist requires the following condition to be met: MR = MC →

30 – Q = 4Q → Q = 6; P = 27. TR = 6 x 27 = 162. $TC = 10 + 2 \times 6^2 = 82$. Super-normal profits = 80.

Question 7

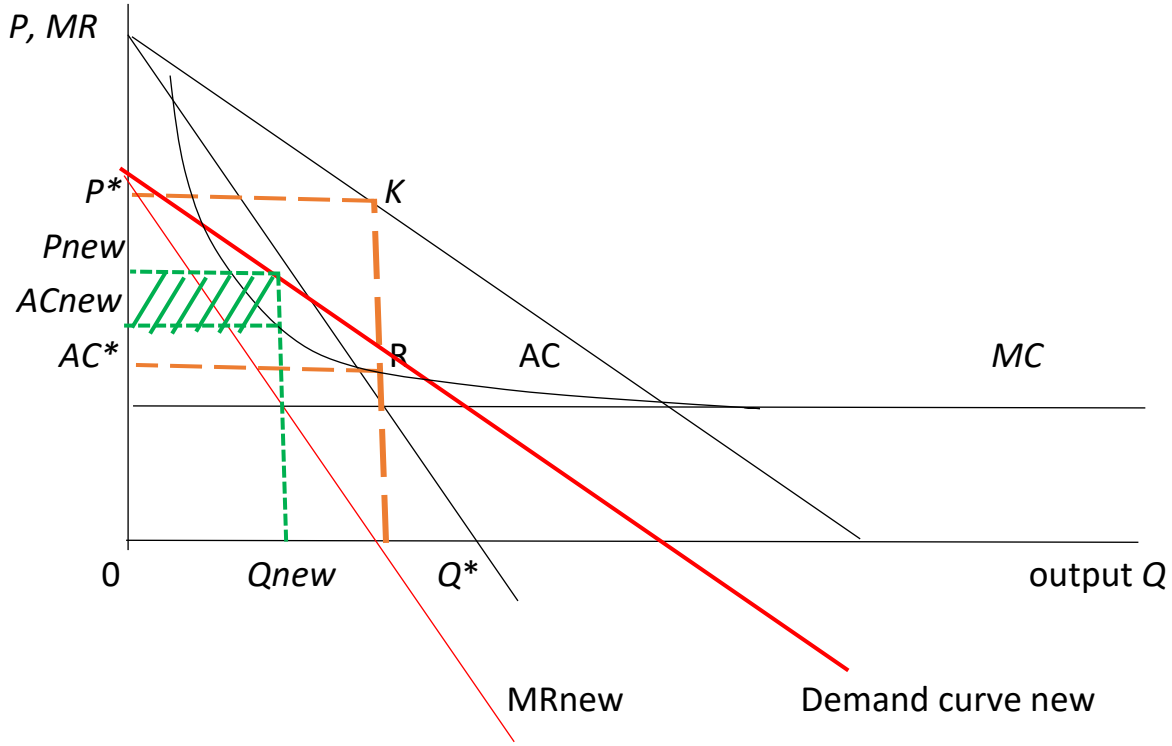
We first define total revenue $TR = 1200Q - 10 Q^2$. MR = 1200 – 20Q.
$TC = 2000 + 200Q + 15 Q^2$. MC = 200+ 30Q. Condition for maximum profits is that MR = MC → 1200 – 20Q = 200 + 30Q → Q = 20; P = 1000.
TR = 20000; TC = 2000 + 4000 + 15 x 400 = 12000. Super-normal profits = 8000.

Question 8

A public utility holds a monopoly on the supply of good PQR. The demand for this good is given by: P = 800 – Q. The monopolist has the following total cost function: $TC = - 2000 + 620 Q + Q^2$.
Break-even occurs when TR = TC.
$TR = P \times Q = 800 Q - Q^2 = TC = - 2000 + 620 Q + Q^2$.
This gives: $2 Q^2 - 180 Q - 2000 = 0$ → $Q^2 - 90 Q - 1000 = 0$ →
(Q + 10) (Q – 100) = 0 → Q = – 10 (not possible) or Q = +100.
The monopolist will produce 100 units at the break-even point.
The break-even price is 700. TR = 70000;
$TC = 2000 + 620 \times 100 + 100^2 = -2000 + 62000 + 10000 = 70000$.

Question 9

The incumbent firm is making a supernormal profit equal to area P*AC*RK. Now let us assume that a big new firm enters this market. The market become a duopoly. The entry of the new firm leads to the following change in the graph:



The first thing to recognise is that after the entry of the new firm, the red curve is the new (post-entry) demand curve facing the erstwhile monopolist. Corresponding to the new (red) demand curve, we can identify a new (red) Marginal Revenue (MR) curve. (The old MR-curve is no longer relevant, because the market has become smaller for this firm).

Profit maximisation occurs when MR = MR. The profit maximising level of output becomes *Qnew* (which is lower than *Q*)*. The new profit-maximising price is *Pnew*. The new price is lower than *P**, because the entrant is also catering to this market – forcing the incumbent firm to lower its price (if it wants to achieve maximum profits). Lower output means average cost AC are higher: ACnew > *AC**. Super-normal profits are equal to the green area. Post-entry, super-normal profits are squeezed from three sides:

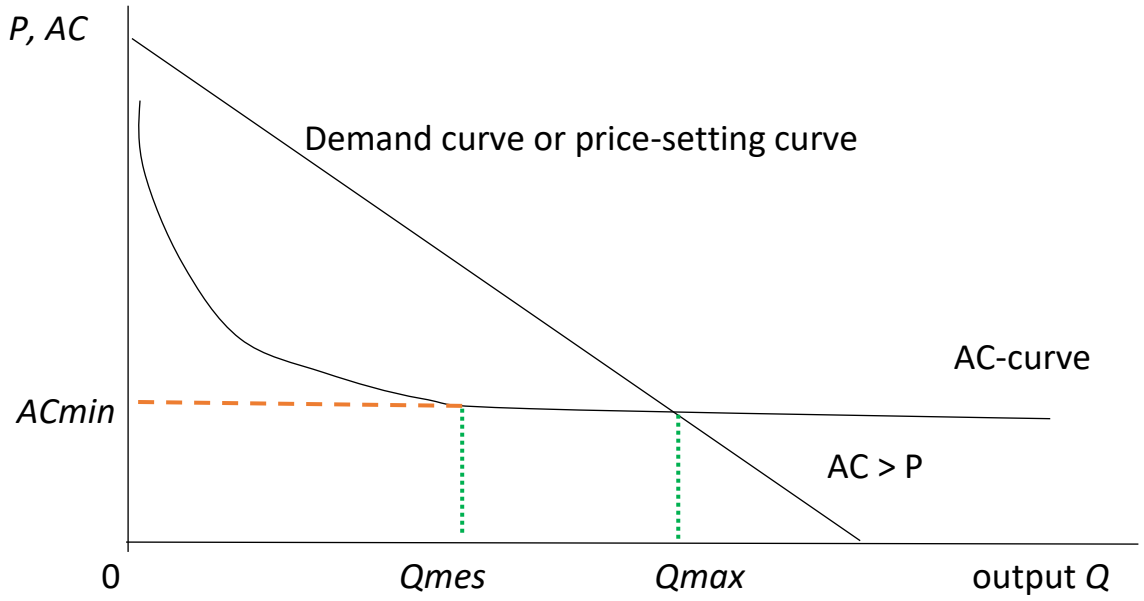
- The entrant forces down the market price from *P** to *Pnew*.

- The incumbent firm has to reduce output from *Q** to *Qnew* to (still) maximise profits.
- Average cost of production increase from *AC** to *ACnew*.

Question 10

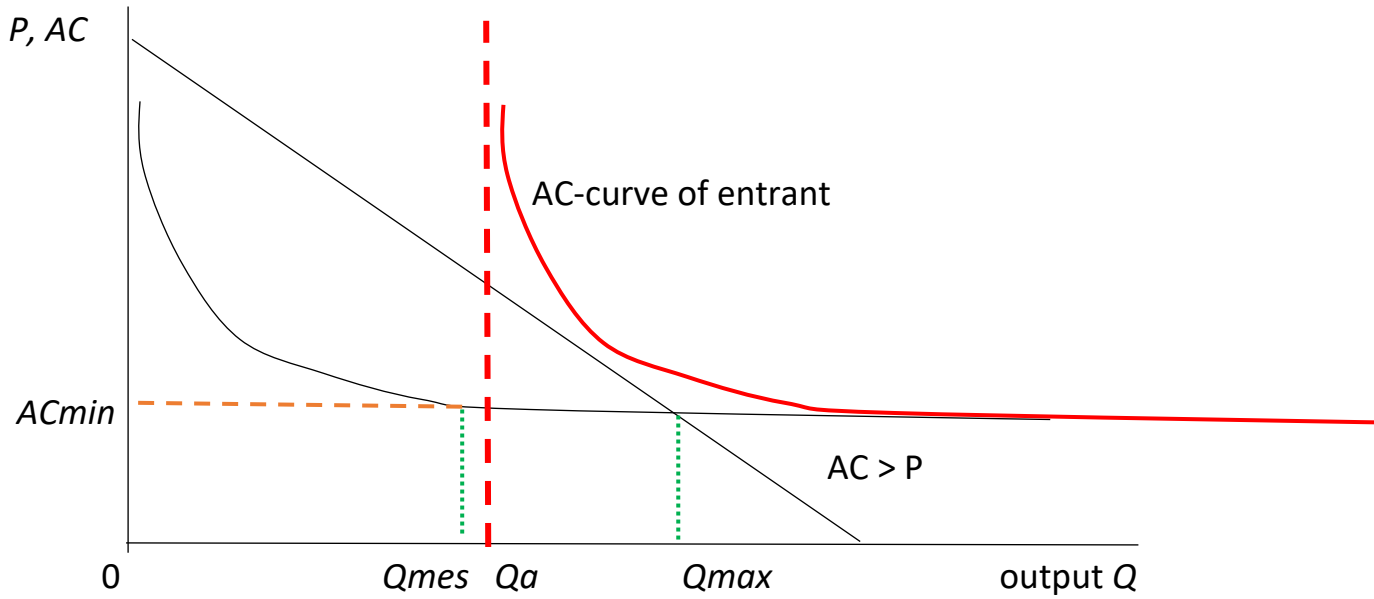
What is a natural monopoly? See Figure 11.2 in the book.

Consider the following graph. In the point of intersection between the demand curve and the AC-curve P = AC. The corresponding level of output is called *Qmax*: firms will not produce more, because if they want to sell their production, consumers are willing to buy only at a price lower than the AC. *Qmax* is the break-even level of output where TR = TC. *Qmes* is called the minimum efficient scale of production because at this level of output, AC reach their minimum (after which the AC-curve is horizontal). By producing more, firms run down their AC-curve until *Qmes*.



Now suppose firm A started this market and stepped up production beyond *Qmes*. Firm A operates at minimum average cost *ACmin*. An entrant into this market, assuming it uses the same technology as firm and therefore has the same AC-curve, begins to operate at a small scale and at high AC. The entrant

has a cost disadvantage vis-à-vis firm A, which it can only remove by increasing output and running down its own AC-curve. Let us look at the next graph to see what happens and let us assume firm A is producing *Qa*.



The residual market (= the market left for the entrant) starts at *Qa*. At low levels of output, the AC of the entrant are high – see the red AC-curve of the entrant. The entrant increases output and runs down its AC-curve, but the residual market is too small and does not allow the entrant to reduce its AC below the price-line P. Hence, the entrant cannot make super-normal profits. As a result, no entrant (operating with the same technology as the incumbent firm) will enter this market. The market is left to firm A – and turns into a natural monopoly.

A natural monopoly arises when the maximum size of the market *Qmax* is relatively small compared to minimum efficient scale of production *Qmes*. This occurs in markets for telecommunications and energy; here *Qmes* is high, because the fixed costs of creating the infrastructure for the telecommunication and energy networks is high, while the maximum size of the market *Qmax* may be relatively low.

End of self-test Week 2