

EC111 Class Exercise 6
Outline Answers

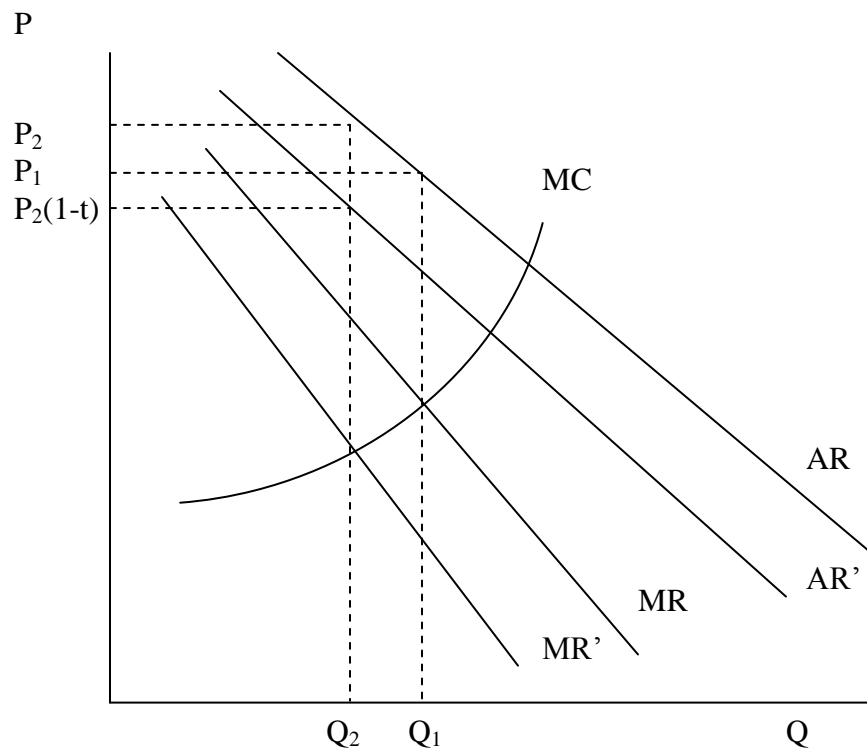
1.

(a) A proportional tax at rate t on profits means that net profit differs from gross profit. Net Profit = $(1 - t)$ (Gross profit). Since the firm cannot affect the tax rate, t , maximising net profit (which is what the firm gets) is equivalent to maximising gross profit. The firm's profit maximising decision ($MR = MC$) is not altered, so price and output are unchanged.

(b) A proportionate tax on revenues means that Net Revenue now differs from Gross Revenue: Net Revenue = $(1 - t)$ (Gross Revenue). From the firm's point of view (i.e. net of tax) this affects Average and Marginal Revenue, which now defined in net terms as:

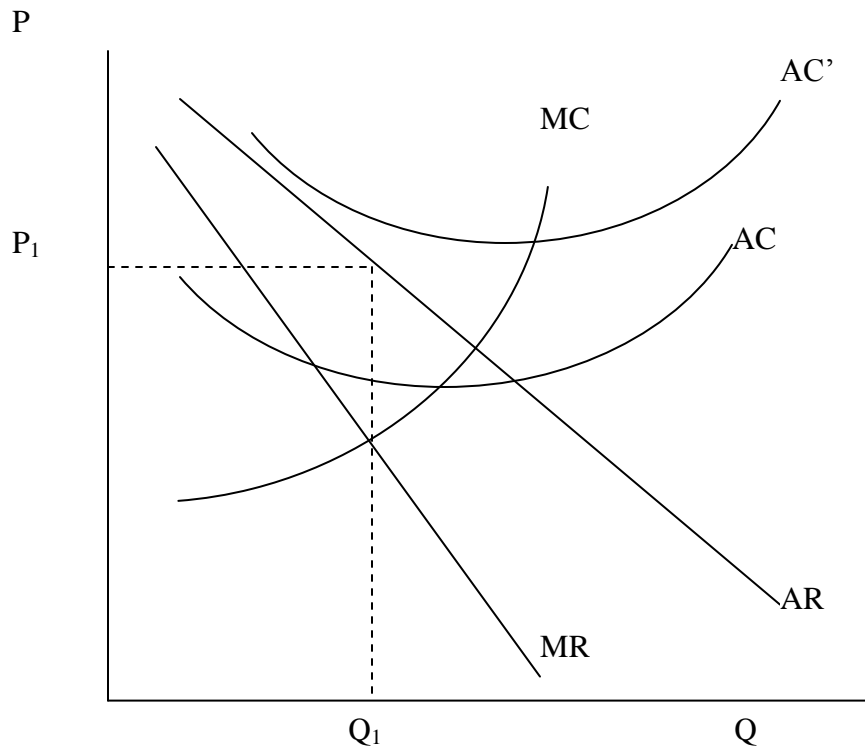
$$AR' = \frac{(1-t)(PQ)}{Q} = (1-t)AR ; \quad MR' = \frac{\Delta[(1-t)(PQ)]}{\Delta Q} = (1-t)MR$$

It is convenient to show this in a diagram with the price facing the consumer on the vertical axis.



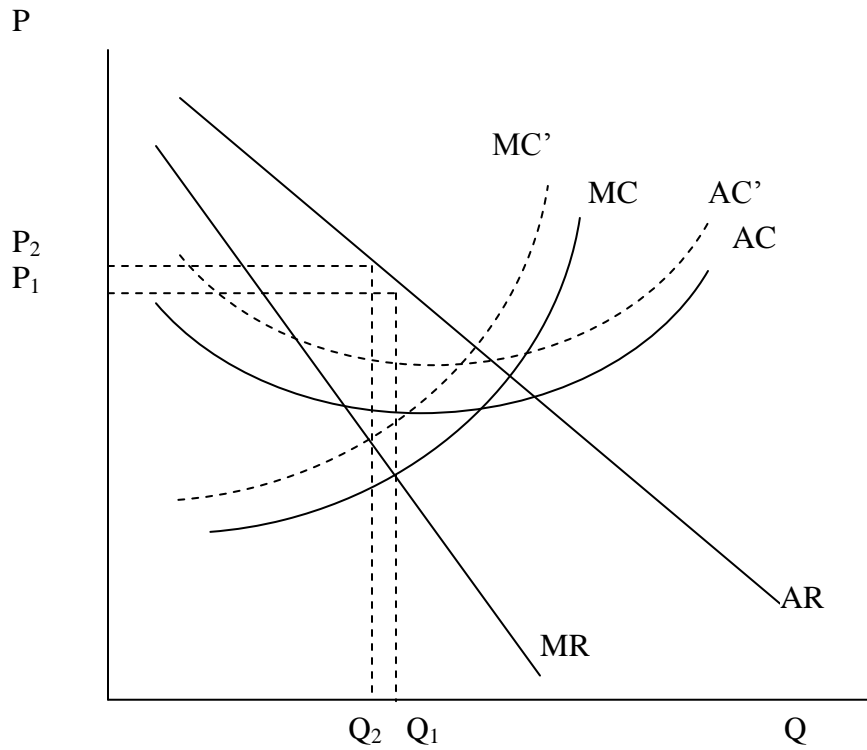
The original profit maximising equilibrium is at P_1 and Q_1 . From the producer's point of view the AR and MR shift down by the amount of the tax. The firm now sets $MC = MR'$. At the new equilibrium the price facing the consumer rises to P_2 and the quantity falls to Q_2 . Note that here, the price received by the producer after tax is $P_2(1-t)$ which is lower than P_1 .

(c) An increase in fixed costs, say as a result of an increase in factory rent, shifts up average costs in the short run and the long run. In the short run:



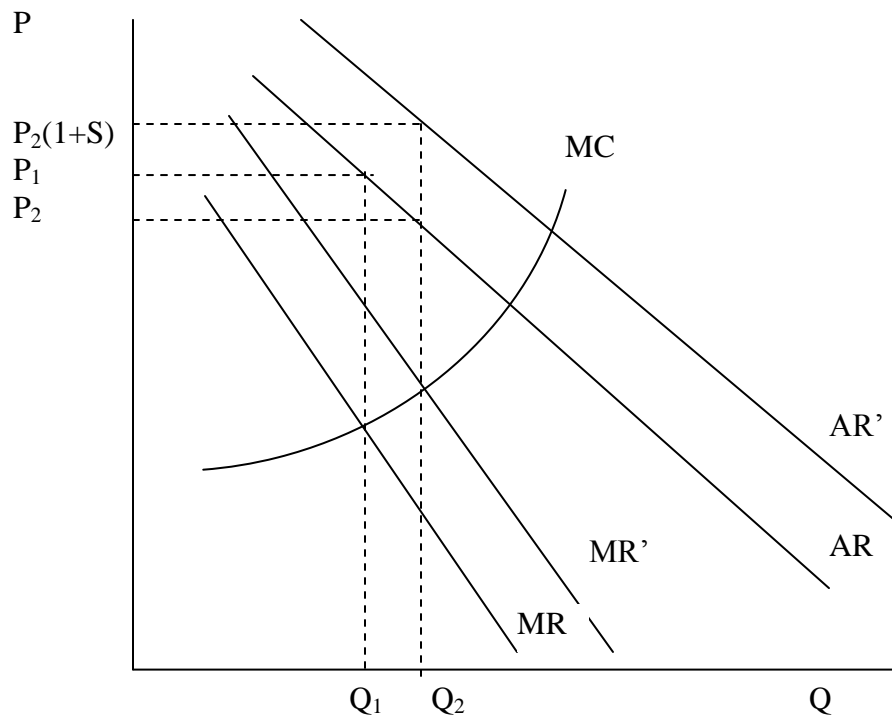
In the short run the firm still produces Q_1 because the marginal cost curve has not shifted (and neither has average variable cost, so the firm will not shut down). Long run average cost also shifts up and if LRAC is everywhere above the demand curve then the firm cannot make a profit and will eventually close.

(d) An increase in variable cost (for a given output) would be caused by an increase in the wage. MC and AC shift up:



Output falls from Q_1 to Q_2 and price rises from P_1 to P_2 . The short run and the long run would look similar: in both cases average and marginal cost shift up.

(e)



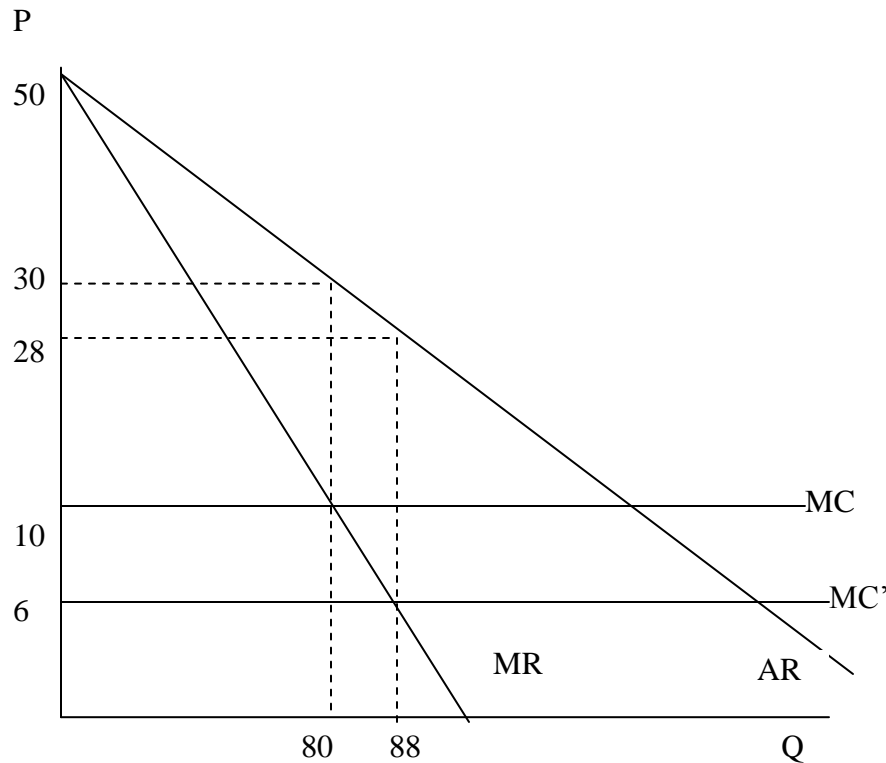
We can draw this as an upward shift in demand (or alternatively as a downward shift in the cost curves. Not that this is the opposite of the case where a tax is imposed. Here MR and AR (facing the producer) shift up to MR' and AR'. Output rises from Q_1 to Q_2 and the price facing the consumer falls from P_1 to P_2 . The price to producers increases from P_1 to $P_2(1+S)$ where S is the per unit subsidy.¹

2.

(a) $MR = MC$ implies that $50 - \frac{1}{2}Q = 10$; $Q = 80$.

From the demand curve the price is: $80 = 200 - 4P$; $P = 30$.

Profit is $(P - AC) \times Q = (30 - 10) \times 80 = 1600$.



(b) At the new $MC' = AC' = 6$ we have:

$MR = MC$ implies that $50 - \frac{1}{2}Q = 6$; $Q' = 88$.

Price: $88 = 200 - 4P$; $P' = 28$.

Profit: $(28 - 6) \times 88 = 1936$.

Profit increases by 336 (from 1600 to 1936). The cost to the firm for the invention is 400. The firm will not choose to buy it.

¹ Note one difference: the per unit subsidy (or tax) shifts the curves parallel whereas the uniform tax rate (or a uniform subsidy rate) does not because the tax per unit then depends upon the price.

To see if it would be in the interest of society as a whole for the firm to buy the invention, we need to calculate consumer surplus:

Without the invention (i.e. under (a) above) $CS = \frac{1}{2} (50 - 30) \times 80 = 800$

With the invention (i.e. $MC = 6$) $CS = \frac{1}{2} (50 - 28) \times 88 = 968$.

Social surplus is consumer surplus plus producer surplus.

Without the invention $CS + PS = 800 + 1600 = 2400$

With the invention $CS + PS = 968 + 1936 - 400 = 2504$.

Note that society as whole would be better off with the invention, even excluding any producer surplus that would accrue to the inventor (the 400 cost to the firm, net of the inventor's opportunity costs).

[It is also interesting to consider whether the invention might have been adopted if the firm were regulated by the government (e.g by fixing a price ceiling). Try this with the regulated price at $P = 10$ and then consider what the regulator might do if the innovation was adopted]