Market Power & Marginal Revenue

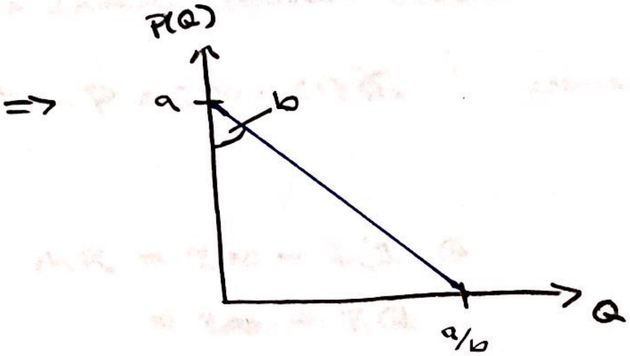
(*) Consider a linear demand curve

$$P(Q) = a - bQ$$

① $P(Q) = 0$ $\Rightarrow Q = \frac{a}{b}$

② $Q = 0$ $\Rightarrow P(Q) = a$

$\Rightarrow$



Note: $a \uparrow \Rightarrow Q \uparrow$

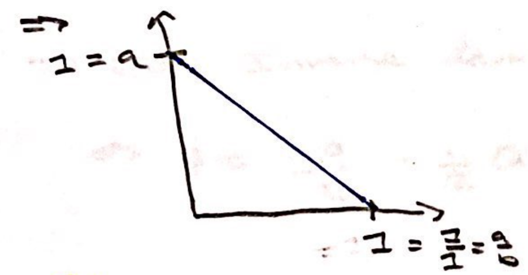
$b \uparrow \Rightarrow Q \downarrow$

becomes more negative

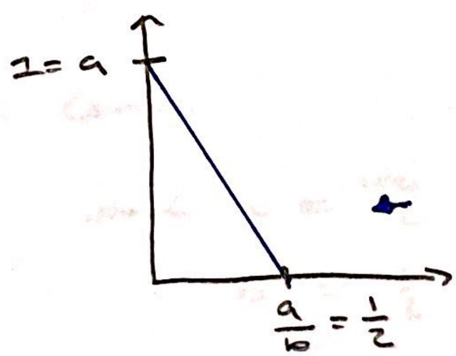
$\Rightarrow$ If b increases, demand becomes more inelastic, and thus, shifts inward.

$\boxed{\text{Ex}}$ ① $a = 1,\ b = 1$

$\Rightarrow$



② $a = 1,\ b = 2$



$\Rightarrow$ (*) Consider a Firm facing the linear demand curve

$\Rightarrow$ Decision is:

$$\max_{q \geq 0} P(q)q - C(q) - F$$

$\Rightarrow$ * Calculus *

$$\frac{\partial \pi}{\partial q} = \frac{\partial P(q)}{\partial q} q + P(q) - \frac{\partial C(q)}{\partial q} = 0$$

$$\Rightarrow \quad P + \frac{\partial P(q)}{\partial q} q = \frac{\partial C(q)}{\partial q}$$

$$\Rightarrow \quad \underbrace{\underset{\oplus}{P} + \underset{\ominus}{\frac{\Delta P}{\Delta q}} \underset{\oplus}{q}}_{MR} = \underbrace{\underset{\oplus}{\frac{\Delta C}{\Delta q}}}_{MC}$$

slide 9.2 (9/10)

Q1

$Q = 200 - P$

Know $MR = a - 2bQ$

$\Rightarrow$ Get Inverse demand curve

$\Rightarrow P = 200 - (1)Q$ where $a = 200$

$b = 1$

$\Rightarrow MR = 200 - 2(1)Q$

$= 200 - 2Q$

slide 9.2 (10/10)

Q2 $Q = 100 - 2P$ Know $MR = a - 2bQ$

$\Rightarrow$ Get Inverse demand curve

$\Rightarrow P = \frac{100}{2} - \frac{1}{2}Q$ where $a = \frac{100}{2} = 50$

$b = \frac{1}{2}$

$\Rightarrow MR = 50 - (2)(\frac{1}{2})Q$

$MR = 50 - Q$

$\Rightarrow$ @ $Q^* = 10$ $\Rightarrow MR = 50 - Q^*$

$= 50 - 10$

$\Rightarrow MR^* = 40$

where Q^* is the equilibrium supply & demand quantity.

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Apple Example

slide
9.3 (4/10)

$MC = 200$

$Q(P) = 200 - 0.2P$

$\Rightarrow P(Q) = \frac{200}{0.2} - \frac{1}{.2} Q = \frac{200}{(1/5)} - \frac{1}{(1/5)} Q$

$p(Q) = 1000 - 5Q$ where $a = 1000$, $b = 5$

$\Rightarrow MR = 1000 - 2(5) Q$

$MR = 1000 - 10Q$

$\Rightarrow$ Profit maximizing Q (ie Q^*) is

$MR = MC$

$\Rightarrow 1000 - 10Q = 200$

$\Rightarrow 800 = 10Q$

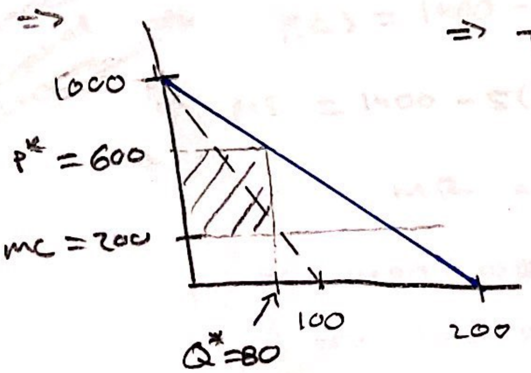
$\Rightarrow Q^* = \frac{80\cancel{0}}{1\cancel{0}} = 80$

$\Rightarrow P(Q^*)^* = 1000 - 5Q^*$

$= 1000 - 5(80)$

$= 1000 - 400 = \$600$

$\Rightarrow$



$\Rightarrow \pi^* = (600)(80) - (200)(80)$

$= (600 - 200)(80)$

$= (400)(80)$

$= \$32,000$

Response to a Change in Marginal Costs (MC) — Slide 9.4 (1/7)

Suppose an accident at a factory of an Apple supplier leads to an increase in the marginal cost of iPad production

$\Rightarrow$ $MC_1 = 200$ but now $MC_2 = 250$

$\Rightarrow$ using the same MR curve

$$MR = MC_2$$

$$\Rightarrow 1000 - 10Q = 250$$

$$\Rightarrow 10Q = 750$$

$$\Rightarrow Q^* = 75$$ ↓ decreased

$$\Rightarrow P(Q^*) = 1000 - 5(75)$$

$$= 1000 - 375 = \$625$$ ↑ increased

Response to a change in Marginal Revenues (MR) — Slide (4/7)

Suppose we have an increase in the consumer's preference for iPads

$\Rightarrow$ Demand shifts Right

$\Rightarrow$ a increases from 1000 to 1400

New Q $\Rightarrow$ $Q = 280 - 0.2P$

Notice all we did was increase the intercept.

$$\Rightarrow .2P = 280 - Q$$

Inverse Demand curve $\Rightarrow$ $P(Q) = 1400 - 5Q$

$$\Rightarrow MR = 1400 - 5(2)Q = 1400 - 10Q$$

$$\Rightarrow MR = MC$$

$$\Rightarrow 1400 - 10Q = 200$$

$$\Rightarrow 10Q = 1200 \Rightarrow Q^* = 120$$

$$\Rightarrow P(Q^*) = 1400 - 5(120)$$

$$= 1400 - 600$$

$$= \$800$$

Response to the Price Sensitivity of Consumers

Slide 9.4 (6/7)

Say, $Q(P) = 200 - \frac{1}{2}P$ instead of $Q(P) = 200 - \frac{1}{5}P$

$\Rightarrow \frac{1}{2}P = 200 - Q$ 〃 $\frac{1}{5}P = 200 - Q$

$\Rightarrow \underbrace{P(Q) = 400 - 2Q}$ $\Rightarrow \underbrace{P(Q) = 1000 - 5Q}$

Inverse Demand New, where $a = 400$, $b = 2$

Inverse Demand Old, where $a = 1000$, $b = 5$

Notice the decrease in the slope of the demand curve.

$\Rightarrow$ More elastic $\Rightarrow \varepsilon_D \to \infty$

For New Demand

$MR_{NEW} = 400 - 2(2)Q$

$MR_N = 400 - 4Q$

$\Rightarrow MR = MC$

$\Rightarrow 400 - 4Q = 200$

$\Rightarrow 4Q = 200$

$Q^* = 800$

$\Rightarrow P(Q^*) = 400 - 2(800)$

$= 400 - 1600 = -1200$ ← Not feasible. Firms do not produce.

This is not feasible, so try again ⟶ $\Rightarrow$

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@ $b = \frac{1}{4}$

$\Rightarrow Q(P) = 200 - \frac{1}{4}P$

Inverse Demand

$\Rightarrow \frac{1}{4}P = 200 - Q$

$\Rightarrow P = 800 - 4Q \leftarrow$ $a = 800$, $b = 4$

$\Rightarrow MR = 800 - 2(4)Q$

$= 800 - 8Q$

$\Rightarrow MR = MC$

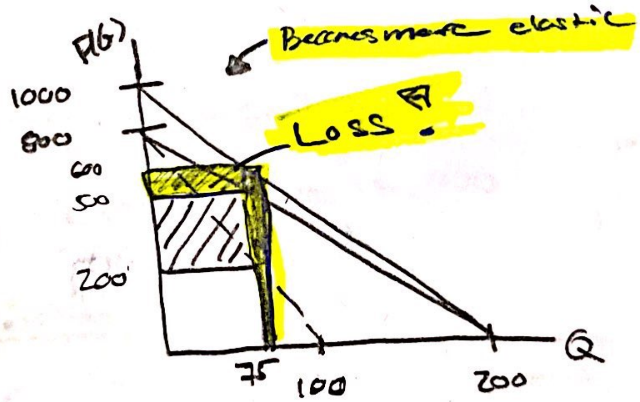
$\Rightarrow 800 - 8Q = 200$

$\Rightarrow Q^* = \frac{600}{8} = 75$

$\Rightarrow P(Q^*) = 800 - 4(75)$

$\Rightarrow P^* = 800 - 300 = \$500$

$\Rightarrow$



$\Rightarrow$ % of market lost

OLD $\Rightarrow \frac{600 - 200}{600} = \frac{400}{600} = \frac{2}{3}$ Markup

New $\Rightarrow \frac{500 - 200}{500} = \frac{300}{500} = \frac{3}{5}$ Markup

Comparing

$\frac{2}{3} - \frac{3}{5} =$

$\frac{10}{15} - \frac{9}{15} = \frac{1}{15}$

Loss in Markup

Welfare

Producers Surplus (PS)

Recall, $P(Q) = 1000 - 5Q$, $MC = 200$

$\Rightarrow MR = 1000 - 10Q \Rightarrow Q^* = 80$, $P(Q^*) = \$600$

$\Rightarrow$ If there are no competitors monopoly price is \$600

$\Rightarrow p^m = \$600$

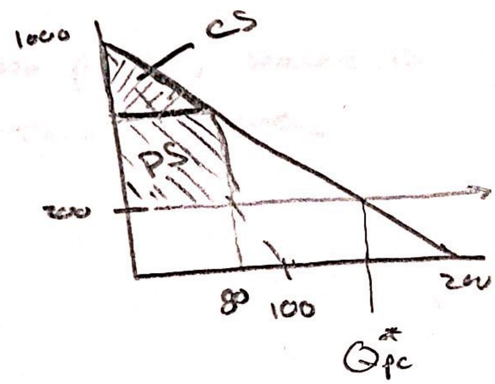
$\Rightarrow PS = (600 - 200)\,80 = \$32,000$ ← Profits w/o Fixed Costs

Consumer Surplus (CS)

$\Rightarrow$ Need choke price $\Rightarrow$ set $Q = 0$

$\Rightarrow P(Q=0) = 1000 - 5(0)$
$= 1000$

$\Rightarrow CS = \frac{1}{2}(1000 - 600)\,80$
$= (200)\,80 = \$16,000$



Perfect Competition

$\Rightarrow P = MC$

$\Rightarrow P(Q) = 200 = MC$

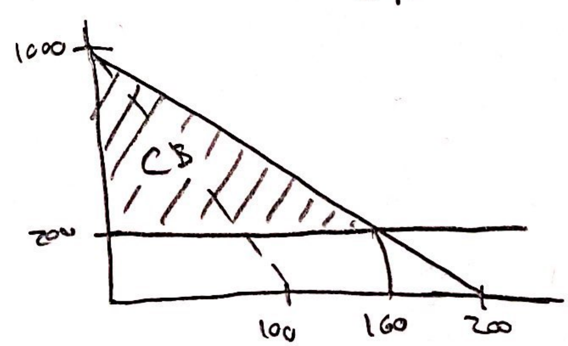
$\Rightarrow 200 = 1000 - 5Q$

$5Q = 800 \Rightarrow Q^*_{PC} = 160$

$\Rightarrow$

$\Rightarrow CS = \frac{1}{2}(1000 - 200)\,160$
$= (400)(160) = \$64,000$

$\Rightarrow$



$\Rightarrow$ CS Gain : 64,000 − 16,000 = 48,000

PS Loss : = −32,000

Net Δ

$\Rightarrow$ $\underbrace{32{,}000}_{CS^{OLD}} + \underbrace{16{,}000}_{PS^{OLD}}$ | $\underbrace{64{,}000}_{CS^{NEW}} + \underbrace{0}_{PS^{NEW}}$

= 48,00 | = 64,000

OLD NET | NEW NET

$\Rightarrow$ Total welfare | Total welfare

48,000 $<$ 64,000

$\Rightarrow$ Perfect Competition is welfare improving

$\Rightarrow$ DWL 64,000 − 48,000 = $\underline{\underline{16{,}000}}$

$\Rightarrow$ when firms enjoy market power, there is a dead weight loss in Total Welfare.

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