Business Economics: From zero to hero.

Lecture 1

- **Elasticity:** $\varepsilon = -\frac{dq}{dp} \cdot \frac{p}{q}$

- Marginal cost shows how much to produce, whereas average cost shows if a firm should produce at all.

- **Perfect competition:** $P = MC = C'(q)$

if $P > MC$, increase production and vice versa

- **Monopolist's price:**

Lecture 2

$$\underbrace{\frac{p^M - MC}{p^M}}_{\text{Lerner Index}} = \frac{1}{\varepsilon}$$

or $MR = MC$

Multi-product Monopoly:

$$\frac{p_1 - MC_1}{p_1} = \frac{1}{\mathcal{E}_1} - \frac{(P_2 - MC_2)\mathcal{D}_2 \mathcal{E}_{12}}{p_1 \mathcal{D}_1 \mathcal{E}_1}$$

where $\mathcal{E}_{12}$ is the cross-price elasticity of good 2 w/ respect to price 1.

Lecture 3

· Linear pricing - if you can discriminate between groups, find p_1 and p_2 maximizing $TR_1 - TC_1$ and $TR_2 - TC_2$, respectively.

$P_1\mathcal{D}_1$ $c\mathcal{D}_1 + F$

fixed costs

· Linear pricing where you cannot discriminate: p maximizing $TR - TC$, where you use the market (combined demand curve).

· Two-part pricing: 1) $P = MC$ and 2) $F =$ Consumer surplus at $P = MC$.

Block pricing – find P and F using the two-part pricing formulas. Then, charge $P \cdot D + F$ for the bundle of D units. (Find D using the price in the demand formula.)

· Maximum F that a producer can charge for price $= X$ is CS when $P = X$.

· Menu pricing – two-part pricing when the two groups are not distinguishable:

$$\Pi = \Pi_L + \Pi_H = (p_L - MC)Q_L + CS_L(p_L) + CS_H(p_H) - \underbrace{(CS_H(p_L) - CS_L(p_L))}$$

Informational rent – surplus enjoyed by a high-demand customer when he chooses a low-demand bundle.

In the formula, $CS_H(p_H)$ is a fixed number (does not depend on p_L). So,

$$\Pi = (p_L - MC)Q_L + CS_H(p_H) + 2CS_L(p_L) - CS_H(p_L)$$

$CS_H(p_L)$: CS of a high-demand customer when $p = p_L$.

Optimal pricing

1. $p_H = MC$
2. p_L is found using $\frac{d\Pi}{dp_L}$ and expressing $CS_L(p_L)$ and $CS_H(p_L)$ as a function of p_L
3. $F_L = CS_L(p_L)$
4. $F_H = CS_H(p_H) - (CS_H(p_L) - F_L)$

Lecture 4

There were no formulas in this lecture, only long explanations I feel lazy to copy. So, be patient, my child, and study the lecture fully.

Bertrand (price) competition – Lecture 5

$p_1 = p_2 = MC$, like in perfect competition

· **Hotelling competition** – Utility function is given by $U = \bar{S} - p_i - d_i t$ or $U = \bar{S} - p_i - d_i^2 t$ where d is the distance to a firm.

To find demand 4 each firm's products, solve

$$\bar{S} - p_1 - xt = \bar{S} - p_2 - (1-x)t \quad \text{or}$$

$$\bar{S} - p_1 - x^2 t = \bar{S} - p_2 - (1-x)^2 t$$ depending on the U.

Then, use $\frac{d\pi_1}{dp_1}$ and $\frac{d\pi_2}{dp_2}$ to find best response curves.

<u>Cournot competition</u> - if $P = D - q_1 - q_2$ and marginal cost is c_i:

fixed costs

$$\Pi_1 = TR_1 - TC_1 = q_1(D - q_1 - q_2) - q_1 C - F$$

$$\frac{d\Pi_1}{dq_1} \Rightarrow q_1 = \frac{D - q_2 - c_1}{2}$$

$$\frac{d\Pi_2}{dq_2} = q_2 = \frac{D - q_1 - c_2}{2}$$

Then, solve them simultaneously. (Substitute q_2's formula for q_2 in the first equation.)

<u>Sequential games</u> - When 1 firm moves before the 2nd firm (e.g. Limit pricing or Capacity Leadership), find the 2nd firms best response by $\frac{d\Pi_2}{dp_2} = 0$ or $\frac{d\Pi_2}{dq_2} = 0$. Then, use this expression

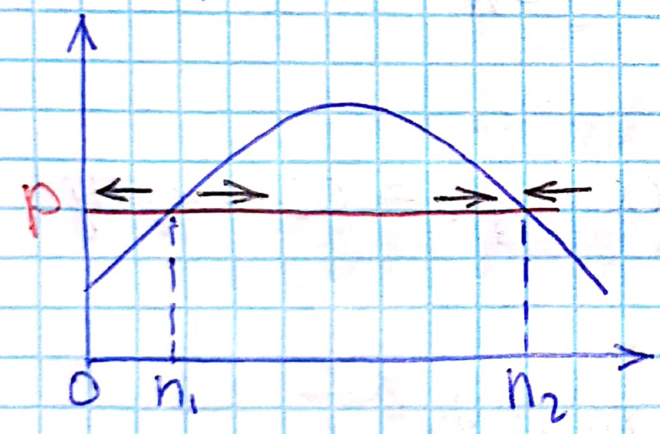
instead of p_2 or q_2 in the D function. Finally, do $\frac{d\Pi_1}{dp_1} = 0$ or $\frac{d\Pi_1}{dq_1} = 0$ w/ the new demand function.

Lecture 6

· Marginal user – user who is indifferent between buying and not buying. His utility = 0.

· Demand for a network:

$$p = a + \delta n(1-n) \quad \text{when} \quad U = a + \theta\delta n - p$$



n_1 is called the critical mass.

n_2 – sustainable eq'm

· When $U = \theta + \alpha n^e$ where $n^e = n_A + \gamma n_B$,

$g_A = \alpha[q_A + \gamma q_B]$. So,

$$p_A - g_A = p_B - g_B = \hat{p}$$

$$p_i = 1 - (q_A + q_B) + g_i \Rightarrow \text{use Cournot.}$$

Lecture 7

- When a two-sided platform has users of the following type:

$$U_i = \theta_i + \alpha_i n_j - p_i$$

θ_i → stand-alone benefit

α_i → per-user benefit

n_j → # of other type of subscribers (for advertisers, # of consumers)

Optimal pricing

$$\frac{p_A - (\overbrace{c_A - \alpha_B n_B}^{\text{opportunity cost}})}{p_A} = \frac{1}{\varepsilon_A}$$

Socially optimal price - $p_i = c_i - \alpha_j n_j$

Duopoly in 2-sided markets

$U_i' = \alpha_i n_j - p_i - \theta t$ and

$p_A = c_A + t - \alpha_B$; $p_B = c_B + t - \alpha_A$

$$\frac{p_i - (c_i - 2\alpha_j n_j)}{p_i} = \frac{1}{\varepsilon_i}$$

• A duopolist has a lower opportunity cost/lower prices than a monopolist.

• $u = \delta - \theta t - p_A$ if a customer buys from Firm A and is located in θ distance from it. $\boxed{\text{Lecture 8}}$

1) No firm uses data:

$$p_1 = p_2 = t \quad \& \quad \Pi_1 = \Pi_2 = \frac{t}{2}$$

2) Both firms use data:

$p_A(\theta) = \max\{0, t(1-2\theta)\}$ and

$p_B(\theta) = \max\{0, t(2\theta-1)\}$ for old customers and $p_1 = p_2 = t$ for new customers

3) Only firm A buys info about consumers. Firm B sets the same price p_B for all.

Firm A sets $p_A(\theta) = p_B + (1-2\theta)t$ for existing customers.

Scanned with CamScanner

When privacy cost is low, many people will be anonymous, Firm A sets a high price in the anonymous market and Firm B will capture a bigger share of this market. A will be a monopoly in the personalized market.

When privacy cost is high, few people are anonymous. Anonymous market is less biased towards A; A sets lower standard price. B lowers its price & captures a share in both anonymous and personalized markets.

• Herfindahl-Hirshman Index - $\sum_{i=1}^{N} S_i^2$, where s_i is the share of firm i. HHI is between 0 (perfect competit) and 10,000 (monopoly).

· This lecture is purely theoretical. I don't want to deter from reading & enjoying it yourself. Thus, the notes will be stopped here.

Lecture 10

TSM competition derivation

$$U_i^1 = a_i n_j^1 - p_i^1 - \theta t = \delta_i^1 - \theta t$$

Indifferent customer of type i

$$\delta_i^1 - \theta t = \delta_i^2 - (1-\theta) t$$

$$(1-\theta)t - \theta t = \delta_i^2 - \delta_i^1$$

$$-2\theta t = \delta_i^2 - \delta_i^1 - t$$

$$\theta^* = \frac{t - \delta_i^2 + \delta_i^1}{2t}$$

$$n_i^1 = D_i^1 = \{\theta : \theta \leq \theta^*\} = \theta^* \quad D_i^2 = 1 - \theta^* = n_i^2$$

$$n_A^1 = \frac{t - (a_A n_B^2 - p_A^2) + (a_A n_B^1 - p_A^1)}{2t}$$

$$= \frac{t - \alpha_A(1 - n'_B) + p^2_A + \alpha_A n'_B - p^1_A}{2t} =$$

$$= \frac{1}{2} + \frac{\alpha_A(n'_B - 1 + n'_B) - (p^1_A - p^2_A)}{2t} =$$

$$= \frac{1}{2} + \frac{\alpha_A(2n'_B - 1) - (p^1_A - p^2_A)}{2t}$$

$$\pi_1 = D'_A p'_A - D'_A C'_A + D'_B p'_B - D'_B C'_B =$$

$$= D'_A(p'_A - C'_A) + D'_B(p'_B - C'_B) =$$

$$= \cancel{\left[\frac{1}{2} + \alpha_A(2\right.}$$

$$n'_A = \frac{1}{2} + \frac{\alpha_A(2n'_B - 1) - (p'_A - p^2_A)}{2t}$$

$$n'_B = \frac{1}{2} + \frac{\alpha_B(2n'_A - 1) - (p'_B - p^2_B)}{2t} =$$

$$= \frac{1}{2} - \frac{(p'_B - p^2_B)}{2t} + \frac{\alpha_B}{2t}\left[1 + \frac{\alpha_A(2n'_B - 1) - (p'_A - p^2_A)}{t} - 1\right]$$

$$= \frac{1}{2} - \frac{p_B^1 - p_B^2}{2t} + \frac{\alpha_B}{2t} \cdot \frac{\alpha_A(2n_B^1 - 1) - (p_A^1 - p_A^2)}{t}$$

$$= \frac{1}{2} - \frac{p_B^1 - p_B^2}{2t} + \frac{\alpha_B \alpha_A \cdot n_B^1}{t^2} + \frac{\alpha_B}{2t}\left[\frac{-\alpha_A - p_A^1 + p_A^2}{t}\right]$$

$$n_B^1 \cdot \left(1 - \frac{\alpha_A \alpha_B}{t^2}\right) = \frac{1}{2} - \frac{p_B^1 - p_B^2}{2t} + \frac{\alpha_B}{2t}\left[\frac{-\alpha_A - p_A^1 + p_A^2}{t}\right]$$

$$n_B^1 \cdot \frac{t^2 - \alpha_A \alpha_B}{t^2} = \frac{1}{2} - \frac{p_B^1 - p_B^2}{2t} + \frac{-\alpha_A \alpha_B - \alpha_B p_A^1 + \alpha_B p_A^2}{2t^2}$$

$$n_B^1 = \frac{t^2}{2(t^2 - \alpha_A \alpha_B)} - \frac{t(p_B^1 - p_B^2)}{2(t^2 - \alpha_A \alpha_B)} + \frac{-\alpha_A \alpha_B - \alpha_B p_A^1 + \alpha_B p_A^2}{2(t^2 - \alpha_A \alpha_B)}$$

$$n_B^1 = \frac{t^2 - t(p_B^1 - p_B^2) - \alpha_A \alpha_B - \alpha_B(p_A^1 - p_A^2)}{2(t^2 - \alpha_A \alpha_B)}$$

$$n_A^1 = \frac{t^2 - t(p_A^1 - p_A^2) - \alpha_A \alpha_B - \alpha_A(p_B^1 - p_B^2)}{2(t^2 - \alpha_A \alpha_B)}$$

$$\pi' = n'_A(p'_A - c'_A) + n'_B(p'_B - c'_B)$$

$$\frac{d\pi'}{dp'_A} = \frac{dn'_A}{dp'_A}(p'_A - c'_A) + n'_A + \frac{dn'_B}{dp'_A}(p'_B - c'_B)$$

$$= \frac{-t(p'_A - c'_A)}{2(t^2 - \alpha_A\alpha_B)} + \frac{t^2 - t(p'_A - p^2_A) - \alpha_A\alpha_B - \alpha_A(p'_B - p^2_B)}{2(t^2 - \alpha_A\alpha_B)}$$

$$+ \frac{-\alpha_B(p'_B - c'_B)}{2(t^2 - \alpha_A\alpha_B)} = 0$$

So, $-t(p'_A - c'_A) + t^2 - t(p'_A - p^2_A) - \alpha_A\alpha_B - \alpha_A(p'_B - p^2_B)$
$-\alpha_B(p'_B - c'_B) = 0$

And using $\frac{d\pi'}{dp'_B}$, we would have

$-t(p'_B - c'_B) + t^2 - t(p'_B - p^2_B) - \alpha_A\alpha_B - \alpha_B(p'_A - p^2_A)$
$-\alpha_A(p'_A - c'_A) = 0$

By symmetry, $p'_A = p^2_A$ and $p'_B = p^2_B$.

So, $-t(p_A - c_A) + t^2 - \alpha_A\alpha_B - \alpha_B(p'_B - c'_B) = 0$

$$+t(p_A - c_A) = t^2 - \alpha_A\alpha_B - \alpha_B(p'_B - c'_B)$$

$$p_A - c_A = t - \frac{\alpha_B}{t}(\alpha_A + p_B - c_B)$$

$$p_A = c_A + t - \frac{\alpha_B}{t}(\alpha_A + p_B - c_B)$$

$$p_B = c_B + t - \frac{\alpha_A}{t}(\alpha_B + p_A - c_A)$$

$$p_A = c_A + t - \frac{\alpha_B}{t}(\alpha_A - c_B) - \frac{\alpha_B}{t}p_B =$$

$$= c_A + t - \frac{\alpha_B}{t}\cdot\left[c_B + t - \frac{\alpha_A}{t}(\alpha_B + p_A - c_A\right] =$$

$$= c_A + t - \frac{\alpha_B}{t}(\alpha_A - c_B) - \frac{\alpha_B}{t}\left[c_B + t - \frac{\alpha_A}{t}p_A\right.$$

$$\left. - \frac{\alpha_A}{t}(\alpha_B - c_A)\right] = c_A + t - \frac{\alpha_B\alpha_A}{t} + \cancel{\frac{\alpha_B c_B}{t}}$$

$$- \cancel{\frac{\alpha_B c_B}{t}} - \frac{\alpha_B \cdot \cancel{t}}{\cancel{t}} + \frac{\alpha_B\alpha_A}{t^2}p_A + \frac{\alpha_A\alpha_B}{t^2}(\alpha_B - c_A) =$$

$$= c_A + t - \frac{\alpha_B\alpha_A}{t} - \alpha_B + \frac{\alpha_B\alpha_A}{t^2}p_A + \frac{\alpha_A\alpha_B}{t^2}(\alpha_B - c_A)$$

$$p_A\left(1-\frac{\alpha_A\alpha_B}{t^2}\right)=c_A+t-\frac{\alpha_A\alpha_B}{t}-\alpha_B+\frac{\alpha_A\alpha_B}{t^2}(\alpha_B-c_A)$$

$$p_A=\frac{t^2}{t^2-\alpha_A\alpha_B}\left[c_A+t-\frac{\alpha_A\alpha_B}{t}-\alpha_B+\frac{\alpha_A\alpha_B}{t^2}(\alpha_B-c_A)\right]$$

$$=\frac{t^2}{t^2-\alpha_A\alpha_B}\left[c_A-\alpha_B-\frac{\alpha_A\alpha_B}{t^2}(c_A-\alpha_B)+\frac{t^2-\alpha_A\alpha_B}{t}\right]=$$

$$=\frac{t^2}{t^2-\alpha_A\alpha_B}\left[(c_A-\alpha_B)\left[1-\frac{\alpha_A\alpha_B}{t^2}\right]+\frac{t^2-\alpha_A\alpha_B}{t}\right]=$$

$$=c_A-\alpha_B+t$$

$p_A=c_A-\alpha_B+t$ So, $p_B=c_B-\alpha_A+t$