Miguel Class

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All models are wrong, but some are useful.

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Chapter 1 Pricing

1.1 Monopoly

1.1.1 Base Case

The firm decides its price p to maximize $\Pi(p) = p \cdot D(p) - C(D(p))$, where $D(\cdot)$ is the demand function and $C(\cdot)$ is the cost function.

The monopoly problem is maximizing the profit

$$\max_{p} \Pi(p) = p \cdot D(p) - C(D(p))$$

The F.O.C. (first-order condition) is

$$\frac{\partial \Pi(p)}{\partial p} = D(p) + pD'(p) - C'(D(p))D'(p) = 0$$

and the S.O.C. (second-order condition) is

$$\frac{\partial \Pi^2(p)}{\partial p^2} < 0$$

The F.O.C. gives that

$$\begin{aligned}
(p - C')D' &= -D \\
p - C' &= -\frac{D}{D'} \\
\underbrace{\frac{p - C'}{p}}_{\text{Lerner Index}} &= -\frac{D}{D'p} \\
&= -\frac{1}{\frac{dD}{dp}\frac{p}{D}} = -\frac{1}{\frac{\frac{dD}{D}}{\frac{dp}{p}}} := \frac{1}{E}
\end{aligned}$$

where $\frac{\frac{dD}{D}}{\frac{dp}{p}} < 0$ is the elasticity of demand with respect to price. The absolute value of the elasticity is denoted by E.

E is supposed to be greater than 1, otherwise, the optimal price is negative.

In the demand function $D(p) = kp^{-E}$, where the elasticity is constant. Its elasticity is $-E$.

The monopolist gives the production that is lower than social-optimal to maximize the profit (dead weight loss).

Rent dissipation can give larger dead weight loss.

1.1.2 Multiple Products

$$\max_p \sum_{i=1}^{N} p_i D_i(p) - C(D_1(p), ..., D_N(p))$$

Related Demand and Separable Costs: $C(D_1(p), ..., D_N(p)) = C_1(D_1(p)) + ... + C_N(D_N(p))$. The optimal pricing in this case satisfies

$$\frac{p_i - C_i'}{p_i} = \frac{1}{E_{ii}} - \sum_{j \neq i} \frac{(p_j - C_j')D_j E_{ij}}{R_i E_{ii}}$$

where $E_{ij} = \frac{\partial D_i}{\partial p_j} \frac{p_j}{D_i}$ and R_i is the revenue.

Intuition: In the case of substitutes/complements, we want to increase/decrease the price of products compared to the one product case. (Positive/negative externality by increasing price of substitutes).

Similar Intuition: Consider a two-period model that the demand at second period depends on the price at first period (assuming $\frac{\partial D_2}{\partial p_1} < 0$).

1. $q_1 = D_1(p_1); C_1(q_1)$
2. $q_2 = D_2(p_2, p_1); C_2(q_2)$

Then, $\frac{p_1 - C_1'}{p_1} < \frac{1}{E_1}$ (the negative externality).

Independent Demands and Related Costs:

Example 1.1

Different intensity of demand across periods.

1. Period 1: Low demand. $q_1 = D_1(p_1)$.
2. Period 2: High demand. $q_2 = D_2(p_2)$, where $D_1(p) = \lambda D_2(p)$ for some $\lambda < 1$.
3. Marginal cost of Production is c and the Marginal cost of capacity is γ.

Bibliography