Chapter 8 Price Dispersion and Search Theory

- Price Dispersion
- Search Theory

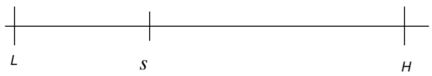
Price Dispersion

- Fact: (Price Dispersion) Prices of identical products often vary from one store to another
- Explanation:
  - Acquiring information on prices is costly to consumers, and consumers always weigh the cost of searching against the expected price reduction associated with the search process
  - Consumer with a high value of time will rationally refrain from searching for the information on lower prices and buy the product from the first available store
  - Consumers with a low search cost will find it beneficial to engage in a search in order to locate the store selling the lowest price

A Model of Price Dispersion

- Consider an economy with a continuum of consumers, index by s on the interval $[L,H]$ according to their cost for going shopping ($H>3L>0$)
- Consumers indexed by a high s are high time-valued consumers, whose cost of searching for the lowest price is high
- There are three stores selling a single product at zero cost.
  - One store, denoted by D is called discount store, selling the product for a unit price of p_D
  - Two stores, denoted ND, are expensive (not discount) stores, are managed by a single ownership that set a uniform price, p_{ND} for the two nondiscount stores

A Model of Price Dispersion (cont')



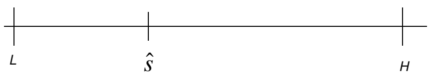
Average product price

$$\bar{p} = \frac{p_D + 2p_{ND}}{3}$$

The loss function of consumer type s

$$L^s = \begin{cases} p_D + \alpha s & \text{if search and purchases at a discount store} \\ \bar{p} & \text{if purchases at a store randomly} \end{cases}$$

A Model of Price Dispersion (cont')



There exists a consumer denote by $\hat{s}$ who is indifferent to the choice between searching and shopping at random

$$p_D + \alpha s = \frac{p_D + 2p_{ND}}{3} \Rightarrow \hat{s} = \frac{2(p_{ND} - p_D)}{3}$$

A Model of Price Dispersion (cont')

The discount store's decision

The demand function

$$Eb_D = s - L + \frac{H - \hat{s}}{3} = \frac{H}{3} - L + \frac{4(p_{ND} - p_D)}{9\alpha}$$

The profit function

$$E\pi_D = p_D Eb_D = p_D\left[\frac{H}{3} - L + \frac{4(p_{ND} - p_D)}{9\alpha}\right]$$

Pricing strategy

$$\Rightarrow p_D = BR_D(p_{ND}) = \frac{3\alpha(H - 3L)}{8} + \frac{p_{ND}}{2}$$

A Model of Price Dispersion (cont')

The expensive store's decision

The demand function

$$Eb_{ND} = \frac{2(H-\hat{s})}{3} = \frac{2H}{3} + \frac{4(p_D - p_{ND})}{9\alpha}$$

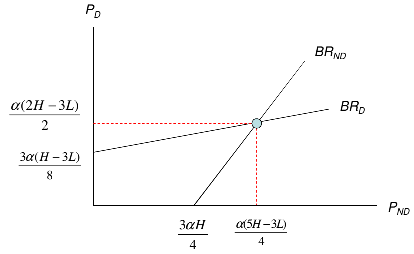
The profit function

$$E\pi_{ND} = p_{ND} Eb_{ND} = p_{ND}\left[\frac{2H}{3} + \frac{4(p_D - p_{ND})}{9\alpha}\right]$$

Pricing strategy

⇨ $$p_{ND} = BR_{ND}(p_D) = \frac{3\alpha H}{4} + \frac{p_D}{2}$$

A Model of Price Dispersion (cont')



Price dispersion equilibrium

A Model of Price Dispersion (cont')

Equilibrium price

$$p_D^e = \frac{\alpha(2H-3L)}{2} \qquad p_{ND}^e = \frac{\alpha(5H-3L)}{4} \qquad \hat{s}^e = \frac{H+3L}{6}$$

⇨ $$\frac{\partial p_D^e}{\partial \alpha} > 0; \frac{\partial p_{ND}^e}{\partial \alpha} > 0; \frac{\partial (p_{ND}^e - p_D^e)}{\partial \alpha} > 0; \frac{\partial \hat{s}^e}{\partial \alpha} = 0$$

Equilibrium demand

$$Eb_D = \frac{2(2H-3L)}{9} > \frac{5H-3L}{18} = \frac{Eb_{ND}}{2}$$

⇨ The expected number of shopper in discount store is greater than the expected number of shoppers at a expensive store

A Model of Search Theory

- Consider a city with n types of stores selling identical product, The price charged by each store of type i is $p_i = i$
- Suppose the consumer visits a store and receives a price offer of p
- Define $v(p)$ as the consumer's expected price reduction from visiting one additional store, while having a price offer p in hand

$$v(p) = \frac{p-1}{n} + \frac{p-2}{n} + \cdots + \frac{1}{n} = \frac{p^2 - p}{2n}$$

A Model of Search Theory (cont')

The loss function of the customer

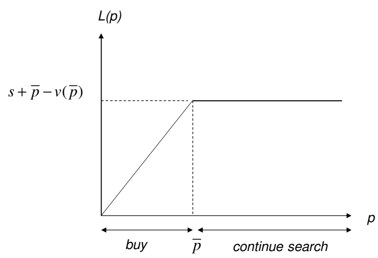
$$L(p) = \begin{cases} p & \text{if buys} \\ s + p - v(p) & \text{if search one more time} \end{cases}$$

The reservation price $\bar{p}$ is defined as $v(\bar{p}) = s$

$$v(\bar{p}) = \frac{\bar{p}^2 - \bar{p}}{2n} = s$$

⇨ $$\bar{p} = \frac{1 + \sqrt{1 + 8ns}}{2} \qquad \frac{\partial \bar{p}}{\partial s} > 0; \quad \frac{\partial \bar{p}}{\partial n} > 0; \quad \bar{p}_{s \to 0} = 1$$

A Model of Search Theory (cont')



A Model of Search Theory (cont')

Denote σ the probability that a customer will not buy when he or she randomly finds visits a store

$$\sigma = \frac{n - \bar{p}}{n} = 1 - \frac{1 + \sqrt{1 + 8ns}}{2n}$$

Denote μ the expected number of store visits

$$\Rightarrow \quad \mu = \sum_{t=1}^{\infty} t\sigma^{t-1}(1-\sigma) = \frac{1}{1-\sigma} = \frac{2n}{1+\sqrt{1+8ns}}$$