14.13 Lecture 11

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From Last Time

- Let α represent the share of sophisticated consumers in the marketplace.

- $\alpha = 0$ all the consumers are naive

$$\Pi_1 = (p + \widehat{p}\mathbf{1}_{\widehat{p} \le V})D(-p + p^*)$$

- $\alpha = 1$ all the consumers are sophisticated

$$\Pi_1 = (p + \widehat{p}\mathbf{1}_{\widehat{p} \le e})D(-p - \min(\widehat{p}, e) + p^* + \min(\widehat{p}^*, e))$$

- in the general case

$$\begin{aligned} \Pi_1 &= (1-\alpha)\ (p + \widehat{p}\mathbf{1}_{\widehat{p} \le V})D(-p + p^*) \\ &+ \quad \alpha\ (p + \widehat{p}\mathbf{1}_{\widehat{p} \le e})D(-p - \min(\widehat{p}, e) + p^* + \min(\widehat{p}^*, e)) \end{aligned}$$

Symmetric Nash Equilibrium

- As the firms are symmetric, we are interested in characterizing a symmetric equilibrium where all the firms choose the same prices

$$(p^*, \widehat{p}^*)$$

- Assume all the other firms choose $(p^*, \widehat{p}^*)$, firm 1 will solve

$$(p^o, \widehat{p}^o) = \arg\max_{p,\widehat{p}} \Pi_1(p, \widehat{p}; p^*, \widehat{p}^*)$$

- $(p^*, \widehat{p}^*)$ is a symmetric equilibrium if $(p^o, \widehat{p}^o) = (p^*, \widehat{p}^*)$

Step 1 Observe that $\widehat{p}^o \in \{e, V\}$

1. suppose $\widehat{p}^o \in (e, V)$, there exists a profitable deviation as

$$\widehat{p}^o \in (e, V) \Rightarrow \Pi_1(p^o, \widehat{p}^o) < \Pi_1(p^o, V)$$

indeed

- the sophisticates do not consume the add-on, they will not be affected by an increase in $\widehat{p}$,
- the naives still buy at $\widehat{p} = V$.

2. suppose $\widehat{p}^o > V$, there exists a profitable deviation as

$$\widehat{p}^o > V \Rightarrow \Pi_1(p^o, \widehat{p}^o) < \Pi_1(p^o, V)$$

indeed

- the sophisticates do not consume the add-on, and they will still not consume it if priced at V,

- the naives will start buying it at $\widehat{p} = V$.

3. suppose $\widehat{p}^o \in [0, e)$, there exists a profitable deviation as for a small $\epsilon > 0$ such that $\widehat{p}^o + \epsilon < e$

$$\widehat{p}^o \in [0, e) \Rightarrow \Pi_1(p^o, \widehat{p}^o) < \Pi_1(p^o - \epsilon, \widehat{p}^o + \epsilon)$$

indeed

- the demand from the sophisticates is unchanged,
- the per consumer profit is unchanged,
- more naives will consume as $-p^o + p^* < -p^o + \epsilon + p^*$.

$$\Longrightarrow \widehat{p}^o \in \{e, V\}$$

Step 2: Optimal $\widehat{p}$

- in equilibrium $\widehat{p}^o$ and $\widehat{p}^* \in \{e, V\} \Rightarrow \min(\widehat{p}^o, e) = \min(\widehat{p}^*, e) = e$

$$\Rightarrow \Pi_1 = \left[p + \widehat{p}\left((1-\alpha) + \alpha \mathbf{1}_{\widehat{p} \le e}\right)\right] D(-p + p^*)$$

- maximization over $\widehat{p}$

$$\begin{aligned} \widehat{p} &= e \Rightarrow \Pi_1 = [p + e]\, D(-p + p^*) \\ \widehat{p} &= V \Rightarrow \Pi_1 = [p + (1-\alpha)V]\, D(-p + p^*) \end{aligned}$$

hence

$$\begin{aligned} e &\geq (1-\alpha)V \Rightarrow \widehat{p}^o = e \\ e &\leq (1-\alpha)V \Rightarrow \widehat{p}^o = V \end{aligned}$$

- call $\alpha^\dagger = 1 - \frac{e}{V}$

$$\begin{aligned} \alpha &\geq \alpha^\dagger \Rightarrow \widehat{p}^o = e \\ \alpha &\leq \alpha^\dagger \Rightarrow \widehat{p}^o = V \end{aligned}$$

charge a high price on the add-on if the fraction of rational consumers is low enough.

Step 3: Optimal p

- $$\max_p \left[p + \mathsf{max}(e, (1-\alpha)V)\right] D(-p + p^*)$$

$$\mathsf{FOC} \quad : \quad 0 = D(-p + p^*) - \left[p + \mathsf{max}(e, (1-\alpha)V)\right] D'(-p + p^*)$$

- In a symmetric equilibrium, $p = p^*$ satisfies the FOC. Hence

$$0 = D(0) - \left[p^* + \mathsf{max}(e, (1-\alpha)V)\right] D'(0)$$

- Call $\mu = \frac{D(0)}{D'(0)}$

$$p^* = \mu - \mathsf{max}(e, (1-\alpha)V)$$

proposition *Call*

$$\alpha^{\dagger} = 1 - \frac{e}{V}. \tag{1}$$

and

$$\mu = \frac{D(0)}{D'(0)}. \tag{2}$$

If $\alpha < \alpha^{\dagger}$, *equilibrium prices are*

$$p = -(1-\alpha)V + \mu \tag{3}$$

$$\widehat{p} = V \tag{4}$$

and only naive agents consume the add-on.
If $\alpha \geq \alpha^{\dagger}$, *prices are*

$$p = -e + \mu \tag{5}$$

$$\widehat{p} = e \tag{6}$$

and all agents consume the add-on.

- Firms set high mark-ups in the add-on market.

- If there aren't many sophisticates, the add-on mark-ups will be inefficiently high: $\widehat{p} = V > e$.

- High mark-ups for the add-on are offset by low or negative mark-ups on the base good.

- To see this, assume market is competitive, so $\mu \simeq 0$.
  - Loss leader base good: $p^* \approx -(1-\alpha) V < 0$.

- If there aren't many sophisticates, the add-on market is inefficient. The sophisticates pay a cost e to get the add-on but the firm is able to produce it at 0 cost.

- Examples: printers, hotels, banks, credit card teaser, mortgage teaser, cell phone, etc...

- The shrouded market becomes the profit-center because at least some consumers don't anticipate the shrouded add-on market and won't respond to a price cut in the shrouded market.

- Total profits in equilibrium

$$
\begin{aligned}
\Pi_i &= [p^* + \max(e, (1-\alpha)V)]\, D(-p^* + p^*) \\
&= \mu D(0) \\
&= \frac{\mu}{n} \text{ with } n \text{ firms}
\end{aligned}
$$

- Total Industry profits are $\sum_{i=1}^{n} \Pi_i = \mu$

- Total industry profits, are indepdendent of α, V, e.

1 Does advertising solve the problem?

We will refute the following view:

> Furthermore, manufacturers in a competitive equipment market have incentives to avoid even this inefficiency by providing information to consumers. A manufacturer could capture profits by raising its [base-good] prices above market levels (i.e., closer to cost), lowering its aftermarket prices below market levels (i.e., closer to cost), and informing buyers that its overall systems price is at or below market. In this fashion, the manufacturer could eliminate some or all of the deadweight loss, attract consumers by offering a lower total cost of ownership, and still capture as profits some of the eliminated deadweight loss. In other words, and unlike traditional monopoly power,

the manufacturers have a direct incentive to eliminate even the small inefficiency caused by poor consumer information (Shapiro 1995, p. 495).

1.1 Curse of education (& Advertising)

- Advertising makes more consumers anticipate the aftermarket.

- “When you choose a printer, remember to take into account the aftermarket for printer cartridges. Our cartridge prices are low relative to our competitors.”

- If no firm advertises, then α is low.

- If at least one firm advertises, α rises to $\alpha' \in (\alpha, 1]$.

- Is it profitable for firm 1 to deviate when $\alpha < \alpha^\dagger$?
  - firm 1 advertises
  - firm 1 charges $(p', \widehat{p}')$ which solve
$$\max_{p'} \Pi_1 = \left[p' + \max(e, (1-\alpha)V)\right] D(-p' + p^*)$$
  -
$$\begin{aligned} \alpha &< \alpha^\dagger \Rightarrow \max(e, (1-\alpha')V) < \max(e, (1-\alpha)V) \\ &\Rightarrow \Pi_1 < \left[p' + \max(e, (1-\alpha)V)\right] D(-p' + p^*) \text{ for any } p' \\ &\Rightarrow \max_{p'} \Pi_1 < \max_{p'} \left[p' + \max(e, (1-\alpha)V)\right] D(-p' + p^*) = \frac{\mu}{n} \end{aligned}$$

    the profit is lower than without advertising.

We take the prices from the previous proposition and call them the *Shrouded Market Prices*.

proposition *If* $\alpha < \alpha^{\dagger}$, *the Shrouded Market Prices support an equilibrium in which firms choose not to advertise.*

- Why doesn't Shapiro's advertising argument apply?

- Sophisticated consumers would rather pool with the naive consumers at firms with high add-on prices than defect to firms with marginal cost pricing of both the base good and the add-on.

- Consider the case in which the firm has no market power, so $\mu = 0$.

- If sophisticate gives her business to a firm with *Shrouded Market Prices*,

$$
\begin{aligned}
\text{sophisticated surplus} &= -p + V - e \\
&= (1-\alpha)V + V - e \\
&> (1-\alpha)V + V - (1-\alpha)V \\
&= V.
\end{aligned}
$$

- By contrast, if sophisticate gives her business to a firm with zero mark-ups on both the base good and the add-on, the sophisticate surplus will only be V.

- This preference for pooling reflects the sophisticate cross-subsidization by naive consumers.

- Sophisticates benefit from “free gifts” ($25 start-up deposit, DVD player) and avoid high fees.

2 Conclusions:

- **Shrouded attributes** without advertising,
  - Firms set monopoly prices for add-ons.
  - Add-ons are profits centers.
  - Base product may be a loss leader.

- **Shrouded attributes** with advertising,
  - Firms will not advertise bad-news attributes, and will price them at monopoly price (gas charges).

- Curse of educating the consumer: educated consumers prefer to go to firms that attract uneducated consumers because of a cross-subsidy.So if a firm educates the consumers, it loses, as it attracts low or negative profit consumers.

- Hence, we except attributes to remain shrouded, even if competition is very strong.