Competitive Strategy: Week 7

Dynamic Pricing

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Capacity Choice

- Consider building a stadium for the Olympics.
- Demand is given by \( p(q) = a - q \).
- Firm chooses capacity \( K \).
  - Capacity costs \( c \) per unit.
  - After capacity built the marginal cost is zero
- Profit maximisation problem

\[
\max_{q,K} p(q)q - cK \quad \text{s.t.} \quad q \leq K
\]

- Set capacity equal to quantity, \( K = q \). Hence \( \max_q (p(q) - c)q \).
  - Standard monopoly problem: set \( MR(q) = c \),
  - With linear demand \( q = (a - c)/2 \) and \( p = (a + c)/2 \).
Peak–Load Pricing

• Suppose there are two periods: High and Low demand
  – Demand given by \( a_i - q \) where \( a_i \in \{a_L, a_H\} \)

• Profit maximisation problem:

\[
\max_{q_1, q_2, K} (a_L - q_L)q_L + (a_H - q_H)q_H - cK \quad \text{s.t.} \quad q_L, q_H \leq K
\]

• Case 1: Suppose capacity binds in high period only.
  – Solution: \( q_L = a_L/2 \) and \( K = q_H = (a_H - c)/2 \).
  – Prices: \( p_L = a_L/2 \) and \( p_H = (a_H + c)/2 \)
  – Requires \( q_L \leq K \), i.e. \( a_H - a_L \geq c \).

• Key idea: Charge capacity when capacity constraint binds.

Example:
- Discounted electricity prices at midnight
- Happy hours at bars
- $1 baseball tickets on Wednesday
- Cheap seaside hotel rooms in March.
- Matinees at cinemas
- Cheap cell phone calls in the afternoon

Peak–Load Pricing cont.

• Case 2: Suppose capacity binds in both periods.
  – Solution: \( K = q_L = q_H = (a_H + a_L - c)/4 \).
  – Prices: \( p_L = (3a_L - a_H - c)/4 \) and \( p_H = (3a_H - a_L - c)/4 \).
  – Requires \( q_L \leq a_L/2 \), i.e. \( a_H - a_L \leq c \)

• Examples
  – Discounted electricity prices at midnight
  – Happy hours at bars
  – $1 baseball tickets on Wednesday
  – Cheap seaside hotel rooms in March.
  – Matinees at cinemas
  – Cheap cell phone calls in the afternoon
Yield Management

- Assumptions:
  - Customers are arriving over time
  - Have capacity constraint for total number who are served.
- Examples: airlines, hotels, the superbowl, package holidays.
- Tradeoff:
  - Sell cheap seat today
  - Retain option value of seat.

Yield Management cont.

- Two types of customers
  - Some willing to pay full fare $p_F$
  - Some only willing to pay discounted prices $p_D$
- There are $q$ seats left on the plane.
- Baseline: charge full price $p_F$ to all customers.
  - Let $s$ be probability plane sells out.
  - Let $n$ be probability next customer is low value.
- If charge next customer $p_D$ what happens?
  - Gain revenue $p_D$.
  - Lose revenue $(ns + (1 - n))p_F$.
- Each period $s$ rises (falls) if do (do not) make sale.
Durable Goods Monopoly and Declining Prices

- Consider the problem of Xerox
- There is a demand for Xerox copiers
  - Initially sell to high valuation customers
  - Next year sell to customers with lower valuations
- Problem: Customers anticipate prices will fall
  - Customer delay purchases until price falls
  - Monopolist competes with future selves
- The Coase Conjecture
  - When the good is infinitely durable the monopolist will have no market power
  - Price instantly falls to marginal cost

Eco380, Competitive Strategy

Durable Goods: Two-Period Model

- Agents have values $\theta \sim U[0, 1]$. Zero cost. Discount rate $\delta$.
- Suppose sell to $[\theta_1, 1]$ in period 1.
  - Profit in period 2 is $\pi_2 = (\theta_1 - p_2)p_2$
  - Optimal price $p^*_2 = \theta_1/2$
- Type $\theta_1$ is indifferent between buying in periods 1 and 2. Hence
  $$ (\theta_1 - p_1) = \delta(\theta_1 - p_2) $$
  Rearranging, $p_1 = (1 - \delta/2)\theta_1$
- Total profit from both periods,
  $$ \pi = (1 - \theta_1)(1 - \frac{\delta}{2})\theta_1 + \delta \left(\frac{\theta^*_1}{4}\right)^2 $$

Eco380, Competitive Strategy
Durable Goods: Two-Period Model

- The firm chooses $\theta_1$ to maximise $\pi$. The FOC yields

$$\theta_1^* = \left( \frac{1 - \delta/2}{2 - \delta/2} \right)$$

Thus $\theta_1^*$ decreases in $\delta$.

- Substituting and rearranging, total profit is

$$\pi = \frac{(2 - \delta)^2}{4(4 - \delta)}$$

Profit decreases in $\delta$. If $\delta = 1$, then $\pi = 1/12$. If $\delta = 0$ then $\pi = 1/4$ as in static monopoly.

- Key: firm can’t commit not to reduce price.

- General result: if firm can commit to any price path, the best they can do is $p_1 = p_2 = 1/2$ (static monopoly).

Durable Goods Monopoly: Solutions

- What does this model apply to?
  - Classic durable goods (e.g. cars)
  - Durable goods with resale (e.g. prams)
  - Durable services (e.g. movies)

- Solution 1: Reputation (e.g. record companies).

- Solution 2: Renting (e.g. Xerox)
  - Each period sell static monopoly quantity.

- Solution 3: Best-price provision (e.g. Chrysler)
  - If firm lowers price then customers get rebate.
  - Firm never any incentive to lower price below monopoly price since lose money in rebates.
Durable Goods and Holdup

- Durable goods firms face two types of commitment problems:
  - They wish to lower prices to keep making sales (see above)
  - They can holdup their customers.
- Example 1: Servicing and supplying accessories.
  - After buy car owner still needs parts if it breaks.
  - Customers usually don’t sign contract over part prices.
  - Firm has holdup customers and increase parts prices.
  - Solution: licence manufacturing of parts, or use standard parts, to keep prices competitive.
- Example 2: New models
  - When Apple launches iPod nano, value of iPod falls.
  - Firm has excessive incentive to introduce new products.

Experimentation

- Firm wishes to sell a unique good (e.g. one of a kind dress).
  - At time $t$ charge $p(t)$
- Each period a buyer chooses to buy or not.
  - Each buyer has the same value $v$
  - Firm does not know the valuation.
- Optimal policy: start price high and lower slowly.
  - Solve through backwards induction.
- What if have good each period to sell?
  - Price may go up or down.
  - But should move prices around to experiment.
Inventories

- Why need inventories?
- Input inventories: ordering has fixed costs.
  - Fix prices. A random number of sales, $q_t$, occur in period $t$.
  - Firm should adopt $(S,s)$ rule. When inventories, $I_t$, fall below $s$ then put in order to bring $I_t$ back to $S$.
  - If order only possible once a month then use yield management within the month.
- Output inventories: smoothing production.
  - Suppose firm likes to keep production constant (e.g. convex costs)
  - Transitory demand increase: build up inventories and raise prices.
  - Permanent demand increase: increase production.

Assignment

- Read “Hooked on Discounts”, The Economist, 9th July 2005.
- Why did GM slashed prices?
- What was the immediate impact on sales?
- What do you think will happen to sales next quarter? Will GM’s market share be less than 41%? Will it be less than 33%?
- Is GM’s strategy a good idea?