Competitive Strategy: Week 6

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.

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.
  - Matinee pricing 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

Durable Goods: Two–Period Model

- Agents have values $\theta \sim U[0,1]$. Zero cost. Discount rate δ.
- 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 θ_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,

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

Durable Goods: Two–Period Model

- The firm chooses θ_1 to maximise π. The FOC yields
$$\theta_1^* = \left(\frac{1-\delta/2}{2-\delta/2}\right)$$
Thus θ_1^* decreases in δ.
- Substituting and rearranging, total profit is
$$\pi = \frac{(2-\delta)^2}{4(4-\delta)}$$
Profit decreases in δ. 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 slash 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?