Advertising

Several kinds of models

1] Information
2] Signalling
3] Changing tastes (*) Difficult to do welfare analysis here.
4] Behavioral - Shapiro

Butters 1977

- N firms, unit mass of consumers
- identical goods, identical consumers with value $\bar{s}$.
- cost c of production
- advertising cost $A(x)$ to reach fraction x.

$t=1$ $t=2$

- firms choose A and p
- consumers who get at least 1 ad, buy if min $p \leq \bar{s}$.

Observations

1] Dispersed price equilibrium: mix on $[\underline{p}, \bar{s}]$

2] Symmetric equilibrium with $x^* \in (0,1)$ if $A'(0)$ small and $A'(1)$ Large.

3] $MC = MB \Rightarrow A'(x^*) = \underline{p} - c$

also, $A'(x^*) = (\bar{s} - c) \underbrace{(1-x^*)^{N-1}}_{\Pr[\text{consumer sees no other ad}]}$

4] advertising is socially efficient.

Signalling
Milgrom-Roberts 1986

t=1 t=2. t=3

- Nature chooses $q \in \{L, H\}$
  - firm sees q
- Firm chooses p, A
  - Consumers see p, A
- consumers buy
  - $\pi(p; q, q^{E2})$ consumer's expectation of q at $t=2$.

Prop: $(p_L^*, 0), (p_H^*, A^*)$, $A^* > 0$ is part of a separating Bayesian equilibrium iff

1] $p_L^* \in \arg\max_p \pi(p; L, L)$

2] $\pi(p_H^*; H, H) - \pi(p; H, L) \geq A^* \quad \forall p \neq p_H^*$

3] $\pi(p_H^*; L, H) - \pi(p_L^*; L, L) \leq A^*$

- Need $\pi(p_H^*; H, H) > \pi(p_H^*; L, H)$ by a significant amount.
  - repeat purchases can give us this
- Need $\pi(p; H, L) \approx \pi(p_L^*; L, L)$
  - limited word of mouth communication.
- Depending on π-fcns, it could be that prices

alone can signal quality

Comments

1] A can signal quality (but p can as well)

2] A has no direct social value but can be valuable in equilibrium.

3] Better model for new goods than old goods.
- this does not explain the observation that most ads are not for new goods.

Milyo - Waldfogel (1999)

- Benham (1972) - eye glass prices are 20-50% less in states in which eye glass ads are legal
  - Do ads raise or lower prices?
- Rhode Island liquor store prices
  - 1956 - May 13, 1996: illegal to advertise prices
    - 44 liquor market case
  - May 13, 1996 - present: allowed

Data:

- prices for 33 alcoholic beverages at 115 liquor stores at MA and RI
  - June 1995-1997
- MA and RI wholesale prices
- Data on ads used

- lottery ticket sales by store.

Results:

1] advertising has very little impact on prices.

2] advertised prices are about 20% lower than the price the store would normally have charged
   - Unadvertised prices the same.
   - No competitive responses.

3] advertising stores share of lottery tickets: 16.4% → 18.4%. Proxy for a small shift in demand.

Markov Processes

Defn: a time-homogeneous Markov chain is a sequence of random variables $X_1, X_2, X_3, \ldots$ such that there exists a finite set S and a function $p: S \times S \to \mathbb{R}^+$ s.t.

1] $\text{Supp}\{X_t\} = S$

2] $\Pr[X_{t+1} = z' \mid X_t = z, X_{t-1}, X_{t-2}, \ldots] = p(z, z')$

We typically write $S = \{1, \ldots, N\}$ and represent the transition function as a matrix:

$P(i,j) = p_{ji}$

Write the distribution μ_t of x_t as a vector

$$\begin{bmatrix} \mu_{t1} \\ \vdots \\ \mu_{tn} \end{bmatrix}$$

Prop: $\mu_1 = P \mu_0$

Corollary: $\mu_t = P^t \mu_0$

Defn: a Markov chain is **irreducible** if $\forall z, z' \in S$, $\exists\ t$ s.t. $\Pr[X_t = z' \mid X_0 = z] > 0$

Defn: a Markov chain is **aperiodic** if

$$\underline{GCF}\{ t \mid \Pr[X_t = z \mid X_0 = z] > 0 \} = 1 \quad \forall z.$$

greatest common factor.

Defn: a **steady state distribution** of (S, P) is a vector $\pi \in \mathbb{R}^{+n}$ s.t. $\pi = P \cdot \pi$

Prop: If (S, P) is irreducible and aperiodic, then

1. $\exists$ a unique steady state distribution π
2. $\lim_{t \to \infty} P^t \mu_0 = \pi \quad \forall \mu_0$
3. $\lim_{t \to \infty} \frac{1}{t} \sum_{\tau=1}^{t} 1\{X_\tau = z\} = \pi_z$
4. $\exists\ \lambda < 1$ s.t. $\| P^t \mu_0 - \pi \| = O(\lambda^t) \quad \forall \mu_0$.
   - converge at an exponential rate.