Ellison and Fudenberg "Social Learning"

- There is a big lag in technology adoption.
- Two technologies: f, g
- Payoffs $\quad g_t - f_t = \theta + \varepsilon_t \qquad \varepsilon_t \sim U[-\sigma, \sigma]$
- Consider fraction x_0 intially using g.
  - fraction α considering switching

    use g if $g_t - f_t \geq \underbrace{m}_{\text{popularity weight}}(1-2x_t)$

    where x_t is fraction using f.

  - $x_0, \tilde{x}_1, \tilde{x}_2, \ldots$

Prop: If $m = \sigma$, technology adoption is efficient in the long-run.

$x_t \to 1$ if $\theta > 0$

$x_t \to 0$ if $\theta < 0$

- has ergodic distribution if $\theta = 0$.

Proof: We have "positive lock-in" if $\theta - \sigma \geq m(1-2x_t)$

$\Leftrightarrow x_t \geq \frac{1}{2} + \frac{\sigma - \theta}{2m}$

for $m = \sigma$, $\theta = 0$, this is $x_t \in [\bar{x}, 1]$, $\bar{x} < 1$

This means $x_t \geq \bar{x} \Rightarrow x_t \to 1$

$\Pr[x_{t+1} = (1-\alpha)x_t + \alpha] = \Pr[\theta + \varepsilon \geq m(1-2x_t)]$

This is true if $\theta + \varepsilon \geq m$. For $m = \sigma$, this is true if $\varepsilon \geq m - \theta = \sigma - \theta$, which has probability $\frac{\theta}{2\sigma}$.

- There is always a chance that you move upward, so with probability one, you get to $x_t \geq \bar{x}$.

<u>Prop:</u> With $m > \sigma$, the system can converge to inferior technology. With $m < \sigma$, system is ergodic if $\theta < |\sigma - m|$.

<u>Observations:</u>

- Symmetry of the errors is important.
- Need unbiased popularity observations
  - ie NFL stars might be more visible than doctors, even though there are fewer of them.

<u>Word of Mouth Communication</u>

- Two technologies
- Ask K friends $\theta_i + \varepsilon_{ij}$ - announced payoff
  - θ_i - technology i fixed effect.
- Use highest mean payoff

Observations

- Word of mouth has implicitly popularity weighting
- can get convergence to optimum, even with $K=2$. (need some minimal basis for comparison.)

Spiegler "Market for Quacks"

- N technologies. Prices $p_1, \dots, p_N$
- payoffs $\begin{cases} 1-p_i & \text{prob } \alpha_i \leftarrow \text{exogenous} \\ -p_i & \text{prob } 1-\alpha_i \end{cases}$
- $\{0,1\}$ payoffs (ie $\varepsilon_{ij} \in \{0,1\}$, $\theta_i = -p_i$)
- ask N friends, 1 using each technology

Observations:

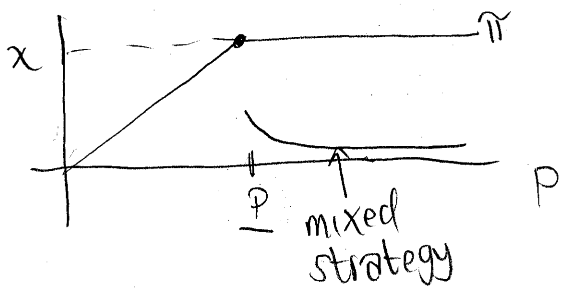
- This model has a mixed strategy equilibrium in prices.
- Prices can be lower when quality is higher

Baye and Morgan

- "Price Dispersion in the Lab and on the Internet"

Prop: Suppose that $p\,D(p)$ is monotone increasing with $\lim_{p \to \infty} p\,D(p) = +\infty$. Then for any $x>0$, the Bertrand duopoly game has a NE with $\pi_i^* = x$.

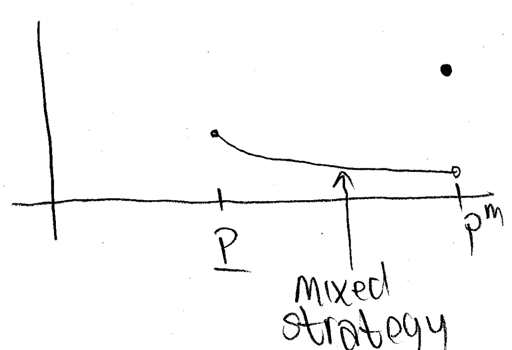
<u>Pf:</u> assume players mix on $(\underline{p}, +\infty)$, where $\underline{p}\, D(\underline{p}) = x$. $F(p) = 1 - \frac{x}{pD(p)}$



Given any $x \in (0, \pi^m)$, consider mixing with

$$F^x(p) = \begin{cases} 0 & \text{if } p \le \underline{p} \\ 1 - \frac{x}{pD(p)} & \text{if } \underline{p} < p < p^m \\ 1 & \text{if } p \geq p^m \end{cases}$$

$\underline{p}\, D(\underline{p}) = x$



<u>Observation:</u> The ex ante gain from deviating is $\frac{x^2}{2\pi^m}$.

$\Rightarrow$ In an ε Nash equilibrium, profits are $\approx \sqrt{\varepsilon}$.

<u>Akerlof - Yellen</u>: Smooth games also have this property.

e.g. In Cournot competition, if players optimize to with 0.06 of monopoly profits, then π^m is an ε-equilibrium.

<u>Defn</u>: σ^* is an <u>ε-equilibrium</u> if

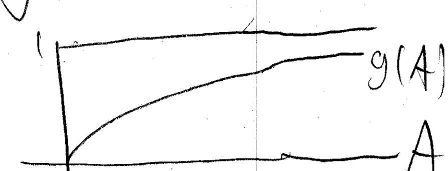
$$\pi_i(\sigma_i^*, \sigma_{-i}^*) \geq \underset{\sigma_i}{\operatorname{argmax}}\, \pi_i(\sigma_i, \sigma_{-i}^*) - \varepsilon.$$

<u>Shapiro</u>: "A Memory-Jamming Theory of Advertising."

- continuum of consumers $\theta_i \sim F$ on $[0,1]$
  - N experiences iid $\{0, v\}$, $Pr[v] = \theta_i$
- value $\{0, v\}$ from each consumption
- disutility $d \sim U[0, v]$ from buying

$\Rightarrow Q_i = E[\theta_i | r_i]$, where r_i is consumer information when doing purchase.

- Firms choose advertising spending A. Reach number of consumers $g(A)$:



- Two technologies

I) C memories chosen at random converted to good memories. (conversion)

2] Consumers forget all but S best memories (selection)

assume consumers remember 1 memory at the time of purchase. Form $E[\theta_i | r_i]$, where r_i = one memory.

Consumers know A^* (as in an equilibrium model), but cannot observe A or whether they have been affected.

Observations:

1] In the conversion model, $A^*(N)$ is unique. $A^*(N) = 0$ for N large enough.

2] In the selection model, $A^*(N)$ is unique, and $A^*(N) \not\to 0$ as $N \to \infty$ if $g'(0)$ is big enough.

3] Consumers can be better off in a positive advertising equilibrium.

- pricing is missing in this model.

Next time:

- more on advertising
- Markov processes.