No lecture next Wednesday 11/22/06

There were lots of strategic investment papers in the 1980

Predation: Price below cost, force competitors out of the market. (ie Standard Oil, American Tobacco - drove out small local businesses with price wars.)

To explain predation,

1. Firms need incentive to prey
   - need long-run benefit
2. Need no better alternative

Today:

1. Signal low costs to lower buyout prices
2. Reputation model - signal preferences to deter future entry.
3. Signal jamming theory (ie Hölmstrom's career concern model)
4. Financial stories (running down rival's capital)

Reputation and cost uncertainty

assume c_i is observed here.

- $t=1$: 2 firms compete $\pi_i(q_{11}, q_{21})$
- $t=2$: Firm 1 offers to buy firm 2 at price R
- $t=3$: Firm 2 says yes or no
- $t=4$: Monopoly or duopoly competition

- Suppose firm 1's cost $c \in \{\underline{c}, \overline{c}\}$ unknown to firm 2 at $t=1$
- Prior: $\Pr[c = \underline{c}] = \underline{p}$ - beliefs by firm 2

Will have to use PBE. Can get pooling or separating equilibria depending on parametrizatio

The trivial separating equilibrium where both types price at static optimum occurs only when $\overline{c} - \underline{c}$ is sufficiently large.

<u>Prop</u>: Under certain conditions a separating PBE is

<u>Stage 1</u>:
- Type $\overline{c}$ firm chooses $q_1^1 = \overline{q}_1 \equiv BR(q_2^1; \overline{c})$
- Type $\underline{c}$ firm chooses $q_1^1 = \underline{q}_1 > BR(q_2^1; \underline{c})$
  - ie low-cost type preys.
- Firm 2 chooses $q_2^1 \in \arg\max_{q_2} \underline{p}\,\Pi_2^d(\underline{q}_1, q_2) + \underbrace{\overline{p}}_{1-\underline{p}}\,\Pi_2^d(\overline{q}_1, q_2)$

<u>Stage 2</u>:
- Firm 1 offers $R = \Pi_2^{d*}(c)$ if it followed the strategy at $t=1$ and $R = \Pi_2^{d*}(\overline{c})$ if it did not.

<u>Stage 3</u>:
- Firm 2 believes $c = \underline{c}$ and accepts any $R \geq \Pi_2^{d*}(\underline{c})$ if $q_1^1 = \underline{q}_1$
- Firm 2 believes $c = \overline{c}$ and accepts $R \geq \Pi_2^{d*}(\overline{c})$ if $q_1^1 \neq \underline{q}_1$

Stage 4: Either play monopoly or duopoly NE.

Sketch of proof

Stage 4: Obviously rational

Stage 3: Beliefs are Bayesian. Firm 2 gets R if says yes and expects $\pi_2^{d*}(c)$ if says no. Given beliefs, chooses optimally.

Stage 2: Obviously, $R = \pi_2^{d*}(c)$ is better than anything bigger. (Needn't offer anything more.) If deviate to $R' < \pi_2^{d*}(c)$, firm 2 says no

- Get $\pi_1^{m*}(c) - \pi_2^{d*}(c)$ if offer is accepted
- Get $\pi_1^{d*}(c)$ if offer is rejected
- This is true iff $\pi_1^{m*}(c) \geq \pi_1^{d*}(c) + \pi_2^{d*}(c)$

Stage 1: ◦ $\bar{c}$ type: If follow strategy, profits are: $\pi_1(\bar{q}_1; \bar{c}) - \pi_2^{d*}(\bar{c}) + \pi_1^{m*}(\bar{c})$

- only potential deviation that makes sense is to choose $q_1' = \underline{q_1}$. Get: $\pi_1(\underline{q_1}; \bar{c}) - \pi_2^{d*}(\underline{c}) + \pi_1^{m*}(\bar{c})$
- need to have $\pi_1(\bar{q}_1; \bar{c}) - \pi_1(\underline{q_1}; \bar{c}) \geq \pi_2^{d*}(\bar{c}) - \pi_2^{d*}(\underline{c})$.

◦ $\underline{c}$ type: If follow strategy, get $\pi_1(\underline{q_1}; \underline{c}) - \pi_2^{d*}(\underline{c}) + \pi_1^{m*}(\underline{c})$

- Best deviation is $q_1^* = BR(q_2'; \underline{c})$

- Profits are: $\Pi_1(q_1^*; \underline{c}) - \Pi_2^{d*}(\bar{c}) + \Pi_1^{m*}(\underline{c})$
- For PBE, need:

$$\Pi_2^{d*}(\bar{c}) - \Pi_2^{d*}(\underline{c}) \geq \Pi_1(q_1^*; \underline{c}) - \Pi_1(\underline{q_1}; \underline{c})$$

Note that we need

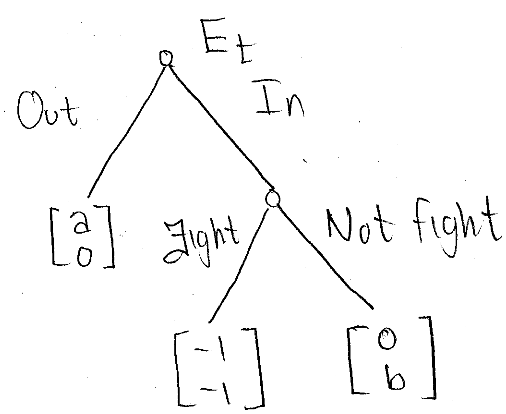
$$\underbrace{\Pi_1(\bar{q}_1; \bar{c}) - \Pi_1(\underline{q_1}; \bar{c})}_{\Pi \text{ that } \bar{c} \text{ gives up by choosing } \underline{q_1}} \geq \Pi_2^{d*}(\bar{c}) - \Pi_2^{d*}(\underline{c}) \geq \underbrace{\Pi_1(q_1^*; \underline{c}) - \Pi_1(\underline{q_1}; \underline{c})}_{\Pi \text{ that } \underline{c} \text{ gives up by choosing } \underline{q_1}}$$

<u>Remarks</u>:
- When predation only affects buyout price, it can be socially optimal.
- This can also be a model of nuissance entrance.

Reputation in multiple markets

Milgrom-Roberts:

- 2 period model. Incumbent faces entry in mkt A at $t=1$ and in mkt B at $t=2$



- Suppose with probability p, the incumbent is crazy and has fighting as the dominant strategy.

Possible equilibria

1. Separating
2. Pooling
3. Hybrid (usually the only one that exists)

Prop: If $p>0$ and $a\geq 1$, then there is no separating PBE where the rational firm 1 doesn't fight at $t=1$.

Sketch: Suppose there was:

	$t=1$		$t=2$	
Follow eq:	0	$+$	0	
If fight at $t=1$:	-1	$+$	a	>0

- fight will be rational. $\rightarrow\leftarrow$ $\square$.

Prop: Suppose $p \in (0, (\frac{b}{b+1})^2)$ and $a>1$. Then the unique PBE is:

- entrant enters at $t=1$
- rational firm 1 fights with prob $\frac{p}{b(1-p)}$
- at $t=2$, E_2 believes 1 is rational and enters if $a_1' =$ not fight
  - E_2 believes 1 crazy w/prob $\frac{b}{b+1}$ and enters with prob $1-1/a$ if $a_1' =$ fight
- at $t=2$ rational firm 1 doesn't fight.

Sketch: Know there is no separating or pooling. Thus, need 1 to mix. For this, need 1 to be indifferent. This pins down E_2's mixing probability: $1-1/a$

For E_2 to mix, needs to be indifferent where beliefs are derived by Bayes rule. Need those beliefs to be $\frac{b}{b+1}$. The unique mixing strategy by incumbent at $t=1$ that supports this is $\frac{p}{b(1-p)}$.

Remark: Predation here is about deterring entry, not driving others out of the market.

Signal Jamming

- Two firms

$t=1$	$t=2$	$t=3$
q_1^1, q_2^1 produced here	Firm 2 chooses in or out. Has scrap value F	q_1^2, q_2^2

- assume $p(q) = \tilde{A} - (q_1+q_2)$ $\tilde{A}$ random and unknown
- assume q_1^1, q_2^1 are unobservable, firms observe p

Main ideas:

1) Firm 2 exits if thinks $\tilde{A}$ is small

2] In equilibrium, firm 2's posterior at $t=2$ is

$$A = P_1 + q_1^{1*} + q_2^1$$
$$= \tilde{A} - (q_1^1 - q_1^{1*})$$

3] If $q_1^1 > q_1^{1*}$, then firm 2 thinks A is lower than it really is. This is good for two reasons:

1] exit is more likely,

2] q_2^2 is lower if 2 does not exit.

4] In equilibrium, must have $q_1^1 = q_1^{1*}$

- need to make $q_1^{1*} > BR_1(q_2^1)$

<u>Remark:</u> Predation doesn't affect exit decision of firm 2, but increases q_1^1. Thus, predation can be Pareto improving.