Lecture 5: Strategic commitment
and applications to entry and exit

1. Credible commitments
2. Preemption
3. Predation
4. Taxonomy of strategic commitments
5. Some Examples of Entry Deterrence

Credible Commitments

“Paradox:” Less freedom of choice may lead to more favorable outcomes

Credible commitments have strategic value
- such commitments must be observable and irreversible, or at least perceived as such.

Credible Threat of Tough Competition May Discourage Entry or Lead to Exit

Some examples
- Burning bridges behind you
- Sunk capacity costs
- Rent durable goods instead of selling them
- Second-source license
- Military Applications
- DuPont
- IBM’s mainframe computers,
- Xerox’s plain paper copiers
- Intel’s 8086 microprocessor
Preemption

Example: DuPont in titanium dioxide industry

By expanding rapidly DuPont believed that it would discourage entry or expansion by rival firms. By 1985, five of the firms competing with DuPont had exited (3 by acquisition)

Preemption (continued): control over a scarce, essential input

- Alcoa (aluminum)
- Patents (Xerox)
- Airport takeoff and landing slots
- Long-term contracts (Nutrasweet’s long term contracts with Coke and Pepsi)

Predatory pricing (and limit pricing)

Starting paradox: It is difficult to commit to a price. How can price then deter entry / induce exit?

Chain-store paradox – predatory pricing to deter entry will not work
Predatory pricing continued:
Why the threat of setting low prices may be credible:

• Reputation building. It may be rational to behave irrationally. (American Airlines fierce price war led to demise of Braniff. AA has a reputation for toughness. Also, Monsanto retaliated against Holland Sweetner’s (HSC’s) entry into Europe by dropping price from $70 per pound to $22-$30 per pound. HSC’s capacity at the time was just 5% of world market.)

• Learning Curves (Boeing vs. McDonnell Douglas)

• Building up an Installed Base (Microsoft browser)

Avoiding Predation – An entry strategy
Judo (the “soft way”) economics

Example 1: Sunk Costs & Barriers to Entry
Let $\pi_1 = (1-K_1 K_2) K_1$, $\pi_2 = (1-K_1 K_2) K_2$.

Simultaneous Move Game (Cournot):

FOC: $1-2K_1 K_2 = 0$, $1-2K_2 K_1 = 0$. Hence $K_1^* = K_2^* = 1/3$.

$\pi_1^* = \pi_2^* = 1/9$.

Sequential Move Game (Stackelberg):

Firm 1 moves first. To find subgame perfect equilibrium, solve by backwards induction.

Period 2: $\text{FOC: } 1-2K_2 = 0 \implies K_2^* = (1-K_1)^2/2$

Period 1: $\pi_1 = (1-K_1 K_2^*) K_1 = (1-K_1^* - (1-K_1^*)/2) K_1 = .5 K_1 (1-K_1^*)$

$\text{FOC: } 1-2K_1 = 0 \implies K_1^* = 1/2, K_2^* = 1/4$.

$\pi_1^* = 1/8, \pi_2^* = 1/16$. (First mover advantage)
Clearly firm 1 earns more than it does under Cournot competition, and firm 2 earns less than it would under Cournot Competition.

Firm 1 is not on its reaction curve ex-post. The best response to $K_2=1/4$ is $K_1=3/8 < 1/2$.

Firm 1 would reduce $K_1$ after the choice of firm 2 if it could. However, then firm 2 would choose $K_2>1/4$ in anticipation of this response. Hence, firm 1 loses by being flexible.

The fact that the investment cost is sunk allows firm 1 to commit to a higher investment level. In the previous example, there is no entry deterrence. (Firm 1 can only deter entry by choosing $K_1=1$. But in such a case, firm 1’s profits are equal to zero.)

**Example 2: A Model of Entry Deterrence.**

Let $\pi_2 = \begin{cases} (1-K_1-K_2)K_2^2-F & \text{if } K_2 > 0, \\ 0 & \text{otherwise}. \end{cases}$

If firm 1 chooses $K_1=1/2$ (as in the Stackelberg setting), firm 2 chooses $K_2=1/4$ as long as it earns positive profits. Otherwise, it will not enter. In such a case, firm 2’s profits are $\pi_2^*=1/16-F$.

Hence if $F>1/16$, entry is blocked. Even when firm 1 does not try to strategically deter entry, firm 2 will not enter the market. Hence, we’ll restrict ourselves to the setting when $F<1/16$. Firm 1 can accommodate entry by choosing the Stackelberg capacity level and in doing so earns profits equal to $1/8$ as before.

But firm 1 has another choice. It can choose to strategically deter entry. Firm 2’s profits are given by $(1-K_1-K_2)K_2^2-F$. We know that firm 2’s optimal capacity choice (if it enters) is $K_2^*=(1-K_1)/2$.

Hence firm 2’s maximum profits are:

$$(1-K_1^d-K_2^d)K_2^d-F=(1-K_1)^d(1-K_1^d)/2-F=(1-K_1^d)2-F.$$  

Hence by choosing $K_1^d=1-2F^d$, firm 1 can deter entry. In such a case, $\pi_2^d=(1-K_1^d)K_2^d=2F^d(1-2F^d)$. Recall that accommodation profits are $\pi_1^a=1/8$. These profits are equal at $F=0.00536$.

If $F > 1/16$ Entry is blockaded  
$.00536 < F < 1/16$ Entry is deterred  
$F<.00536$ Entry is accommodated.
Taxonomy of business strategies - Informal

• More aggressive behavior by Firm 1 implies less aggressive behavior by Firm 2. Be tough, that is, commit to being more aggressive. Top dog strategy
  • Examples: Preempt Entry, Exclude Competitors Dupont

• More aggressive behavior by Firm 1 implies more aggressive behavior by Firm 2. Be soft, that is, commit not to being aggressive. Judo economics
  • Examples: TWA comfort class, Southwest

Taxonomy of business strategies - formal

• Detergence of Entry (Two period model):
  • $\pi_2=[K_1, x_1^*(K_1), x_2^*(K_1)]=0$
  • What strategy can firm 1 use to make firm 2’s entry unprofitable?
  • $d\pi_2/dK_1 = \partial \pi_2/\partial x_1 (\partial x_1^*/\partial K_1) + \partial \pi_2/\partial x_2 (\partial x_2^*/\partial K_1)$
    direct effect + zero – envelope thm + strategic effect
  • Strategic effect here: $K_1$ changes firm 1’s ex post action: $\partial x_1^*/\partial K_1$
  • Often the direct effect is zero
  • In such cases, $d\pi_2/dK_1 = \partial \pi_2/\partial x_1 (\partial x_1^*/\partial K_1)$
  • Investment makes firm 1 tough if $d\pi_2/dK_1<0$.
  • Investment makes firm 1 soft if $d\pi_2/dK_1>0$.
  • If investment makes firm 1 tough, it should over-invest to deter entry.

Taxonomy of business strategies - continued

• Detergence of Entry (Example):
  • First period: Firm 1 chooses investment $K_1$, which lowers its MC
  • Second period: Firms compete in quantities $(x_1, x_2)$
  • Increase in $K_1$, shifts firm 1’s reaction function to right
  • Firm 1 has incentive to produce more, which lowers marginal value of output for firm 2
  • Formally, $\partial x_1^*/\partial K_1>0$.
  • $\partial \pi_2/\partial x_1<0$ in Cournot setting
  • Hence $d\pi_2/dK_1 = (\partial \pi_2/\partial x_1) (\partial x_1^*/\partial K_1)<0$
  • Investment makes firm 1 tough (raises $x_1$, which hurts firm 2)
  • Hence, firm 1 over-invests to deter entry
Taxonomy of business strategies - continued

- Entry Accommodated (Two period model):
  - Here incentive to invest dictated by firm 1’s profit function
  - \( \pi_1 = K_1 \cdot x_1(K_1), x_2(K_1) = 0 \)
  - \( \frac{d\pi_1}{dK_1} = \frac{\partial \pi_1}{\partial K_1} + \frac{\partial x_2}{\partial x_2} \cdot \frac{\partial x_2}{\partial K_1} \)
    = direct effect + strategic effect
  - Direct effect is cost of investment
  - Strategic effect here: \( K_1 \) changes firm 2’s ex post action: \( \frac{\partial x_2}{\partial K_1} \)
  - In the case of entry accommodation,
    - firm 1 should overinvest if the sign of the strategic effect is positive
    - firm 2 should underinvest if the sign of the strategic effect is negative
  - Same example as before:
    - \( \frac{\partial \pi_1}{\partial x_2} < 0, \frac{\partial x_2}{\partial K_1} < 0 \),
    - hence strategic effect \( \frac{\partial \pi_1}{\partial x_2} \cdot \frac{\partial x_2}{\partial K_1} > 0 \), implies overinvest