

Lecture 9: Limit pricing and entry deterrence (C&W Ch. 13)

Today's Agenda

- Finishing material from last time
- A simple model of entry deterrence (Dixit, 1982).
 - Early models of entry deterrence
 - Dixit's model with rational expectations: the basics
 - The extended model
 - Conclusion

– The entrant will stay out if the price does not exceed the **limit price** (i.e., the highest price for which the entrant's profits if entering equal zero).

- So entry deterrence is possible.
- The problem with this model:
 - Why would the entrant hold the postulated beliefs?
 - Once the entrant is in the market, the incumbent won't have an incentive to charge the same price as it did before the entry. Why doesn't the entrant realize this?

A stylized entry game (Dixit, 1982)

Early models of entry deterrence

- The first formal model of entry deterrence is from the 1950's and early 1960's.
 - Bain (1956), Sylos-Labini (1962), Modigliani (1958).
 - *The BSM model of limit pricing.*
- This model was *not* based on an assumption of rational expectations:
 - Instead, it was postulated that:
 - * The entrant believes that the incumbent will produce the same level of output this period as it did last period.
- Under this assumption, the incumbent will be able to signal aggressive postentry behavior by charging a price below monopoly price today.

Dixit's model with rational expectations: the basics

- Two firms:
 - An incumbent ("I")
 - A (potential) entrant ("E").
- The entrant's two strategies:
 - To enter the market.
 - To stay out of the market.
- The incumbent's two strategies:
 - To fight the entrant if it enters (which leads to a price war).
 - To accommodate entry (which means that the firms share the market).

- Payoffs:

- If the entrant stays out:
 - * I gets π^m (monopoly profits) and E gets 0.
- If the entrant enters and I fights:
 - * both get π^w (profit level if price war).
- If the entrant enters and I accommodates:
 - * both get π^d (duopoly profits).
- We assume that

$$\pi^m > \pi^d > 0 > \pi^w.$$

- Normal (strategic) form of the game:

| | In | Out |
|--------|----------------|------------|
| Accom. | π^d, π^d | $\pi^m, 0$ |
| Fight | π^w, π^w | $\pi^m, 0$ |

- Identify the Nash equilibria of this game!

– There are two NE:

- * (Accom., In)
- * (Fight, Out)

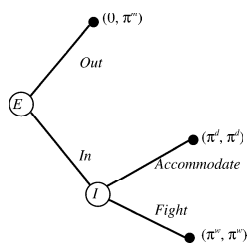
- Conclusion:

- In one of the equilibria, I is able to deter entry.
 - * I threatens to fight.
 - * E believes this threat and stays out.

- But is this NE subgame perfect?

- We haven't been explicit about the sequence of events, but suppose

- I chooses its strategy first.
- Then, having observed E's action, I chooses its strategy.



- The extensive form of the game illustrated in Fig 13.8 (borrowed from CW).

- Solve this game for a subgame perfect Nash equilibrium by backward induction:

- At its decision node, I will choose Accommodate (because $\pi^d > \pi^w$).
- Anticipating this, E will at its decision node choose In (because $\pi^d > 0$).

– Unique SPNE:

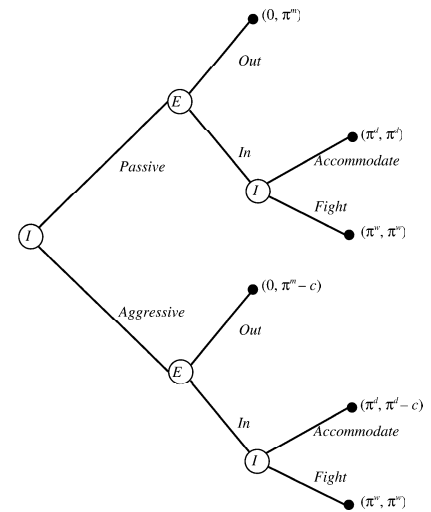
- * (Accom., Enter).

- Conclusion:

- Entry deterrence is impossible when we require rational expectations (i.e., SPNE).

The extended model

- “Now suppose the incumbent has available a prior irrevocable commitment, such as incurring cost c in readiness to fight a price war. This does not affect his payoff if a war in fact occurs, but lowers it by c otherwise.” (Dixit, 1982, p 13.)
 - The important thing with this assumption is that it makes fighting the price war more attractive, relative to accommodating.
 - Examples mentioned by C&W and Dixit:
 - * advertising costs; expanding plant capacity.
 - The cost is sunk (i.e., once, you've incurred it, you can't get the money back).
- I chooses whether to incur this cost at an early stage, before the entrant makes its move.
- The extensive form of the game is illustrated in Fig 13.9 (borrowed from CW).



– Note that E's payoff is listed first!

- Solve this game for a subgame perfect Nash equilibrium by backward induction.

Case 1

- First assume:

$$\pi^w > \pi^d - c,$$

and

$$\pi^m - c > \pi^d.$$

- Backward induction yields:

– At its two last decision nodes, I will choose:

- * Accommodate (for $\pi^d > \pi^w$)
- * and Fight (for $\pi^w > \pi^d - c$), respectively.

– Anticipating this, E will at its two decision nodes choose:

- * In (for $\pi^d > 0$)
- * and Out (for $0 > \pi^w$), respectively.

– Anticipating this, I will at its first decision node choose:

- * Aggressive (for $\pi^m - c > \pi^d$).

– Unique SPNE:

- * Incumbent:
 - Aggressive, Accommodate at upper decision node, Fight at lower decision node.
- * Entrant:
 - Out at upper decision node, Out at lower decision node.

– Unique outcome:

- * The incumbent is aggressive and manages to deter entry.

Case 2

- Assume that either

$$\pi^w < \pi^d - c,$$

or

$$\pi^m - c < \pi^d.$$

- One can check that now entry deterrence is impossible in any SPNE.

Conclusion

- Entry deterrence with rational expectations is possible if
 - The cost c is large enough to make it optimal ex post to enter the price war ($\pi^w > \pi^d - c$).
 - But still so small that it is worthwhile to pay it in order to be a monopolist rather than a duopolist ($\pi^m - c > \pi^d$).
- Is entry deterrence good for welfare in this simple model?
 - Difficult to say — too much of a reduced form. But probably not:
 - If the incumbent were *not* allowed to incur the cost c , the equilibrium outcome would be entry, duopoly profits, and no price war cost c .
 - Otherwise, the equilibrium outcome involves entry, monopoly, and payment of the price war cost c .