Entry and Incumbent Advantage

- Traditional model of entry deterrence: incumbent's threat is not **credible**.
- Dixit model of entry deterrence
- Other entry deterrence methods:
  1. Predatory pricing
  2. Raising rivals' costs

Traditional model of entry deterrence 1

Incumbent threatens to make entry unprofitable for entrant:

Traditional model of entry deterrence 2

Problem: incumbent's threat is not **credible**. Following through is not a Nash equilibrium strategy of the subgame when firm 2 enters.

Note: {Fight, Don't Enter} is a NE, however!

Models which have subgame perfect equilibria in which entry is deterred. Models have two features:

1. Advantage: incumbent moves first
2. Commitment: incumbent must follow through with its threat regardless of its rival's action. Focus on how incumbent can make his threats credible.

Dixit model 1

Main idea: Incumbent can build capacity (sunk cost) to deter entry

Change the model slightly:

1. Entry can be deterred if capacity level k_1 exists where $\pi_2^c(k_1) < 0$.
2. However, if $\pi^m(k_1)$ is "too low" (i.e., deterrence is too expensive), incumbent prefers not to deter.

Dixit model 2

- Market demand: $p = a - bQ$, where $Q = q_1 + q_2$.
- Assume that production requires two inputs: labor (at w per unit) and capacity (at r per unit).
- Firm 1's advantage lies in ability to install capacity k_1 before entrant
- Firm 1's total costs (if it installed k_1 units of capacity):

$$C(q) = \begin{cases} rk_1 + wq + r(q - k_1) & \text{if } q > k_1 \\ rk_1 + wq & \text{if } q < k_1 \end{cases} \tag{1}$$

  Hence, firm 1's *marginal* costs are lower when producing under capacity (graph MC).
- Firm 2's costs of entering market and producing:

$$C(q) = (w + r)q + F \tag{2}$$

  Advantage: firm 2 has no chance to build capacity before competing.
- Credible: look for SPE where entry is deterred. Solve backwards:
  1. Subgame where firm 2 enters; incumbents has installed k_1 capacity units
  2. Subgame where firm 2 decides whether to enter
  3. Subgame where firm 1 decides capacity level k_1

Dixit model 3: Subgame where firm 2 enters

Cournot quantity-setting game after firm 1 has installed k_1 capacity units.

- Firm 2's best-response function: $BR_2(q_1) = \frac{a-(w+r)-bq_1}{2b}$
- Firm 1's best-response function:

$$\max_{q_1} \pi_1 = \begin{cases} (a - b(q_1 + q_2) - w - r)q_1 & \text{if } q_1 \geq k_1 \\ (a - b(q_1 + q_2) - w)q_1 - rk_1 & \text{if } q_1 < k_1 \end{cases} \rightarrow$$

$$BR_1(q_2) = \begin{cases} \dfrac{a - (w + r) - bq_2}{2b} & \text{if } q_1 \geq k_1 \\ \dfrac{a - w - bq_2}{2b} & \text{if } q_1 \leq k_1 \end{cases}$$

- Graph.
- By building capacity, firm 1 commits to producing more output; it is his best-response to produce these higher levels of output
- If capacity costs not sunk (irretrievable), this "threat" is not credible. You can build and dismantle capacity as the need arises, so that $BR_1(q_2) = \dfrac{a - (w + r) - bq_2}{2b}$.

Dixit model 4: Subgame where firm 2 enters

- NE: intersection of best-response curves (q_1, q_2)
- Firm 1 will never set $q_1 \neq k_1$:
  1. if $q_1 < k_1$: wasted capacity
  2. if $q_1 > k_1$: can just build $k_1 = q_1$ to begin with
- So in NE: $q_1 = k_1$, and $q_2 = BR_2(k_1) = \dfrac{a - (w + r) - bk_1}{2b}$
- $Q = \dfrac{a - (w + r) + bk_1}{2b}$; $\quad p = \dfrac{a + (w + r) - bk_1}{2}$
- Profits:

$$\pi_1(k_1) = k_1 \left(\frac{a - (w + r) - bk_1}{2} \right)$$

$$\pi_2(k_1) = \left(\frac{(a - (w + r) - bk_1)^2}{4b} \right) - F$$

Dixit model 5: subgame where firm 2 decides whether to enter

- We have solved for NE of subgame if firm 2 enters. Now go backwards: when will firm 2 enter?
- Firm 2 enters only when

$$\pi_2 = \left(\frac{(a - (w + r) - bk_1)^2}{4b} \right) - F > 0$$

or

$$k_1 < \frac{a - (w + r) - 2\sqrt{bF}}{b} \equiv q_1^l.$$

q_1^l is the **limit quantity**.

- Graph. When is entry deterrence possible?
  1. If $q_1^l > q_a$, entry always occurs. BR_1 and BR_2 cannot cross at q_1^l, so no equilibrium exists in which firm 1 can produce q_1^l. Firm 2 will always enter. **Entry accommodation.**
  2. If $q_1^l < q_c$, firm 2 never enters, since it never makes positive profits even in symmetric Cournot outcome. **Blockaded entry.**
  3. Entry deterrence possible only when $q^c \leq q_1^l \leq q^a$. Restrict ourselves to this case.

Dixit model 6: Subgame where firm 1 chooses k_1

Now go backwards again: what k_1 will firm 1 choose in first stage? Two possibilities:

1. Install $k_1 = q_1^l$, deter entry, and get monopoly profits $\pi^m(q_1^l) = \pi_1(BR_1(0), 0; q_1^l)$. (graph)
2. Allow entry and build capacity $k_1 \neq q_1^l$. Get profits of $\pi_1(k_1, BR_2(k_1))$. Best alternative to being monopolist is to be Stackelberg leader, so $k_1 = q_1^s$.

Now will firm 1 prefer to set capacity equal to q_1^l or k_1^s?

Compare Stackelberg profits $\pi_1(k_1, BR_2(k_1))$ to monopoly profits $\pi_1(BR_1(0), 0; q_1^l)$. Choose q_1^l and deter if $\pi_1(BR_1(0), 0; q_1^l) > \pi_1(k_1, BR_2(k_1))$.

Note: If $q_1^s > q_1^l$, prefer to deter entry.

Summary: Given that $q^c < q_1^l < q^a$, SPE specifies:

1. For firm 1, install q_1^l if $\pi_1(BR_1(0), 0; q_1^l) > \pi_1(k_1, BR_2(k_1))$, and q_1^s otherwise
2. For firm 2, enter if $k_1 < q_1^l$

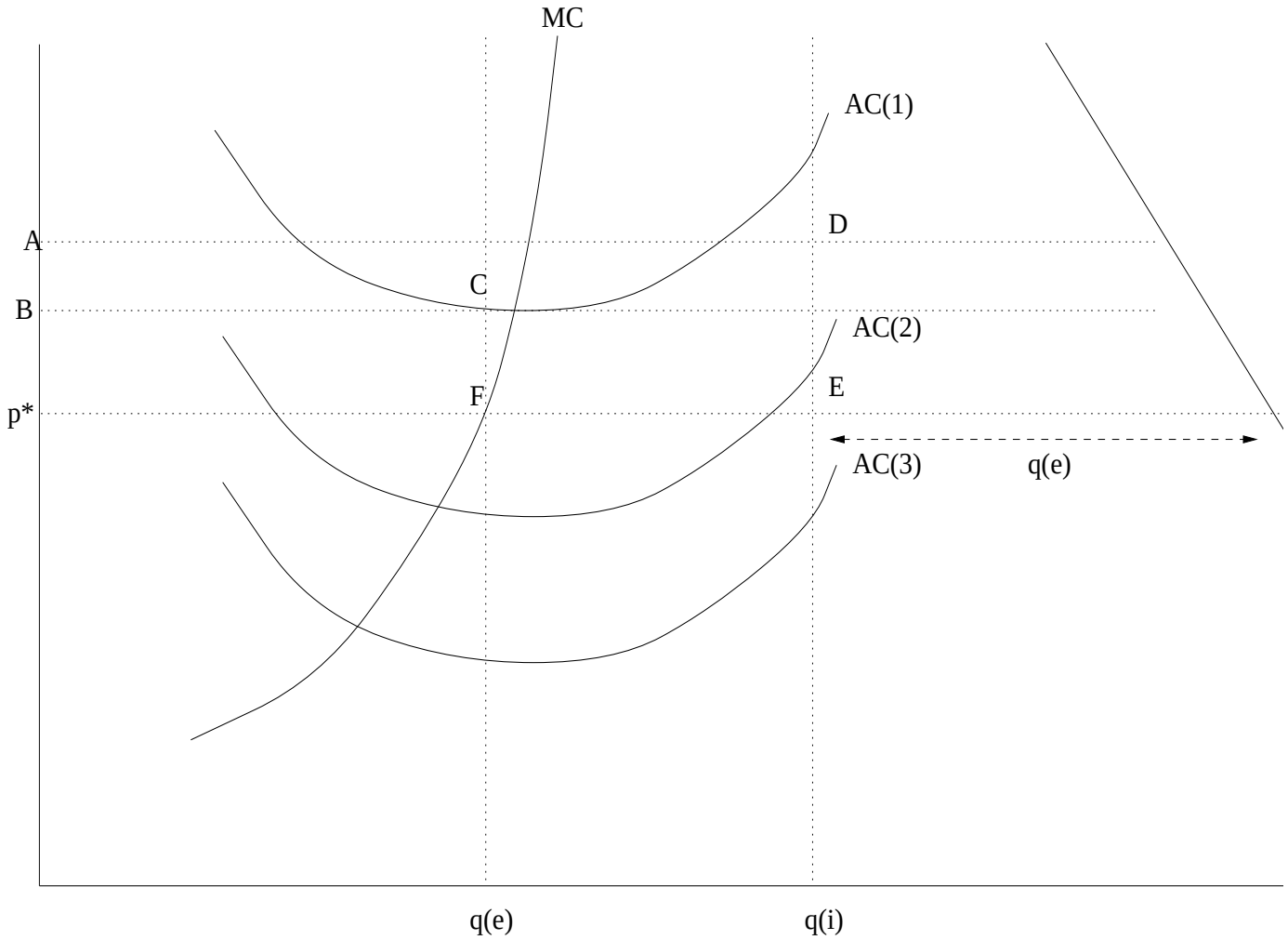
Dixit model 7

- Dixit model is one example of **limit pricing**: committing to a price or output level so that entrant finds it unprofitable to enter market.
- Other examples of behavior that incumbent engages in to maintain advantage:
  1. Predatory pricing: lowering price to drive rivals out of market
  2. Raising rivals' costs. Closely related to "poison pills".

Predatory pricing 1

- Incumbent prices below competitor's cost, and drives it out of business.
- Single-period case (game tree): identical to "traditional" limit pricing model, except that entrant is already in the market.
  1. Formally: incumbent threatens to produce to keep market price at (say) $P*$, below rival's AC.
  2. If entrant believes this, it is price taker and produces on its MC curve, at $q(e)$. Incumbent must produce $q(i)$ to depress price to $P*$.
  3. Graph, assuming identical firms. Incumbent suffers larger losses than rival!
- With identical firms, predation is not likely to be credible threat

Illustration: Predatory Pricing (Carlton/Perloff)



Predatory pricing 2

Some ways incumbent can have advantage which makes predation threat credible:

- Size differences: Larger incumbent firm has access to funds which smalled rival doesn't. Can make predation a preferred strategy in the long-term.
- Imperfect information: uncertainty about incumbent's costs. Graph. If incumbent's costs are $AC(3)$, then even at quantity $q(i)$ it is making positive profit. But if incumbent really has lower cost, entrant shouldn't be in the market to begin with!

Raising rivals' costs 1

Incumbent may deter entry (or drive rivals out) by activities which raise its rivals' costs of production.

Incumbent advantage already assumed: difficult to disentangle

- competitive business practices of dominant firm
- malignant behavior towards rivals

Example: Microsoft forces PC manufacturers who pre-install Windows OS to bundle it with Internet Explorer.

- Raises its rival's (Netscape) selling costs
- But is this competitive business practice, or malignant behavior?

Raising rivals' costs 2

General schematic diagram.

In general, for a RRC strategy to be credible, you need $\pi^m - C > \pi^d$.

Raising rivals' costs 3

- Government regulation: quotas verses tariffs. Industry may prefer quotas because limited number of import licenses locks potential rivals out of market.
- "Sleeping patents": incumbent has more incentive to invent and patent (but never produce) potential substitutes to its product. Preemptive-innovation. Is buying out small firms a related phenomenon?
- Raise consumer switching costs: frequent flyer miles, preferred customer cards, etc. Rivals must price lower to overcome consumers' brand loyalty.

Some conclusions

- Two components of entry deterrence model:
  1. Incumbent advantage: incumbent can take action before rival reacts
  2. Credibility: incumbent's threat must be a NE of the subgame which follows rival's entry
- Limit Pricing and Predatory Pricing
- Raising Rival's Costs: $\pi^m - C > \pi^d$.