ECN 594: Entry and Market Structure

Nicholas Vreugdenhil

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Plan for today

1. What determines market structure?
2. Free entry condition
3. Entry with Cournot: worked example

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4. Entry barriers
5. Entry deterrence strategies
6. Sequential game analysis (from ECN 532)

Part 1: Entry and Market Structure

What determines market structure?

- Why do some industries have many firms (restaurants) and others few (aircraft)?
- **Key factors:**
  1. Fixed costs of entry
  2. Market size (demand)
  3. Nature of competition
  4. Entry barriers
- Today: focus on entry decisions and barriers

Free entry condition

- Suppose entry requires fixed cost F
- **Entry decision:** Enter if $\pi(N) > F$
  - $\pi(N) =$ profit when N firms in market
- **Free entry equilibrium:** Number of firms N^* such that:

$$\pi(N^*) \geq F > \pi(N^* + 1)$$

- **Intuition:**
  - Current firms earn enough to cover F
  - One more firm would push profits below F

Entry reduces profits

- As N increases:
  - Competition intensifies
  - Prices fall
  - Each firm's profit falls
- $\pi(N)$ is decreasing in N
- Eventually: $\pi(N) < F$ and entry stops

Entry with Cournot: setup

- Inverse demand: $P = a - bQ$
- N symmetric firms, each with $MC = c$
- Fixed cost of entry: F
- Cournot equilibrium with N firms:

$$q_i^* = \frac{a-c}{b(N+1)}$$
$$P^* = \frac{a+Nc}{N+1}$$
$$\pi_i^* = \frac{(a-c)^2}{b(N+1)^2}$$

Worked example: Entry with Cournot

- **Question:** $P = 100 - Q$, $c = 20$, $F = 100$.
- How many firms will enter in equilibrium?

Take 5 minutes.

Worked example: Entry (solution)

- With $a = 100$, $b = 1$, $c = 20$:

$$\pi(N) = \frac{(100 - 20)^2}{(N+1)^2} = \frac{6400}{(N+1)^2}$$

- Check different values of N:

N	$\pi(N)$	Enter?
1	$6400/4 = 1600$	Yes (> 100)
2	$6400/9 = 711$	Yes
3	$6400/16 = 400$	Yes
5	$6400/36 = 178$	Yes
7	$6400/64 = 100$	Indifferent
8	$6400/81 = 79$	No (< 100)

- **Answer:** $N^* = 7$ firms enter

Fixed costs and natural monopoly

- When F is very high relative to demand:
  - Only one firm can profitably operate
  - **Natural monopoly**
- **Examples:**
  - Utilities (water, electricity distribution)
  - Railroad tracks
  - Cable infrastructure
- Average cost is declining over relevant range
- One firm can serve entire market more cheaply than multiple firms

Excess entry theorem (brief)

- Free entry may produce "too many" firms
- **Why?** Each entrant ignores:
  1. Business-stealing effect: takes customers from incumbents
  2. Consumer surplus: captured by entrant, not new value created
- Private incentive to enter $>$ social incentive
- **Result:** Free entry equilibrium can have more firms than socially optimal
- Caveat: depends on model specifics

Part 2: Entry Deterrence

Entry barriers

- **Structural barriers:** inherent to industry
  - Economies of scale (high F)
  - Capital requirements
  - Patents and intellectual property
  - Network effects
- **Strategic barriers:** created by incumbents
  - Limit pricing
  - Capacity commitment
  - Product proliferation
  - Long-term contracts with customers

Entry deterrence: the key question

- Can an incumbent prevent entry?
- **The credibility problem:**
  - Incumbent threatens to "fight" if entry occurs
  - But is this threat credible?
  - Once entry happens, fighting may hurt the incumbent too
- **From ECN 532:** Need subgame perfect equilibrium (SPE)
  - Check what incumbent would actually do if entry occurs
  - Non-credible threats are ignored

Limit pricing

- Incumbent sets price low enough that entry is unprofitable
- **Idea:** If P is low, post-entry profits are low
- **Problem:** Why would incumbent maintain low P after entry?
  - If entrant enters anyway, incumbent may prefer to accommodate
  - Threat to keep P low may not be credible
- Works better if low P is a commitment device
- Or if low P signals low costs

Capacity commitment

- Incumbent builds excess capacity before entry decision
- **Why it works:**
  - Capacity is a sunk cost
  - With excess capacity, incumbent's marginal cost is low
  - Post-entry, incumbent will produce more (use the capacity)
  - Entrant anticipates this $\rightarrow$ lower post-entry profits
- **Key insight:** Capacity makes "fight" credible
- Building capacity is a commitment device

Entry deterrence game: structure

- **Stage 1:** Incumbent chooses capacity K
- **Stage 2:** Entrant observes K and decides: Enter or Stay Out
- **Stage 3:** If entry, firms compete (Cournot or Bertrand)
- Solve by **backward induction** (from ECN 532):
  1. Find post-entry equilibrium profits given K
  2. Determine when entrant enters
  3. Find incumbent's optimal K

Worked example: Entry deterrence

- **Setup:**
- Inverse demand: $P = 100 - Q$
- Incumbent has capacity K (sunk), $MC = 0$ up to K
- Entrant has $MC = 20$, fixed cost $F = 200$
- If entry: Cournot competition
- **Question:** What K deters entry?

Take 5 minutes to set up the backward induction.

Worked example: Entry deterrence (solution 1)

- **Step 1: Post-entry equilibrium**
- Incumbent produces $q_I \leq K$ at $MC = 0$
- Entrant FOC: $100 - 2q_E - q_I - 20 = 0 \Rightarrow q_E = 40 - q_I/2$
- If K is large, incumbent produces $q_I = K$
- Entrant produces: $q_E = 40 - K/2$
- Price: $P = 100 - K - (40 - K/2) = 60 - K/2$
- Entrant profit: $\pi_E = (60 - K/2 - 20)(40 - K/2) = (40 - K/2)^2$

Worked example: Entry deterrence (solution 2)

- **Step 2: Entry decision**
- Entrant enters if: $\pi_E - F > 0$

$$(40 - K/2)^2 > 200$$

- Entry occurs if: $40 - K/2 > \sqrt{200} \approx 14.1$
- Entry is deterred if: $K \geq 2(40 - 14.1) = 51.8$
- **Step 3: Incumbent's choice**
- If deterrence is profitable: Set $K \geq 52$
- Compare: monopoly profits with $K = 52$ vs accommodation

When is deterrence profitable?

- Incumbent compares:
  1. **Deter:** Monopoly profits minus cost of excess capacity
  2. **Accommodate:** Duopoly profits
- Deterrence is profitable when:
  - Cost of deterrence (excess capacity) is low
  - Post-entry competition is intense
  - Monopoly profits are high
- Sometimes: accommodation is better ("puppy dog" strategy)

Predatory pricing (brief)

- **Predatory pricing:** Price below cost to drive out competitor
- **Requirements:**
  - "Deep pockets" - survive losses longer than rival
  - Recoupment - raise prices after rival exits
- **Antitrust concern:**
  - Hard to distinguish from aggressive competition
  - Low prices benefit consumers (in short run)
- **Legal standard:** Price below appropriate cost measure + recoupment likely

Summary: barriers and deterrence

	Structural	**Strategic**
Examples	Economies of scale, patents, network effects	Capacity, limit pricing, product proliferation
Created by	Industry characteristics	Incumbent behavior
Key issue	–	Credibility of threat

Key Points

1. **Free entry:** Enter until $\pi(N^*) \geq F > \pi(N^* + 1)$
2. As N increases, profits decrease
3. High fixed costs $\rightarrow$ few firms (natural monopoly at extreme)
4. Free entry may lead to **excess entry** (business stealing)
5. **Barriers:** Structural (inherent) vs Strategic (created)
6. Entry deterrence requires **credible** commitment
7. **Capacity commitment:** Makes "fight" credible (sunk cost)
8. Solve deterrence games by **backward induction** (SPE)

Next time

- **Lecture 10:** Mergers and Merger Policy
  - Merger effects on prices
  - Merger simulation (connects demand estimation to policy)
  - Antitrust review and HHI
- **HW2 released:** Merger simulation exercise