ECN 594: Entry and Market Structure

Nicholas Vreugdenhil

January 4, 2026

Plan

1. **What determines market structure?**

2. Free entry condition

3. Entry with Cournot: worked example

4. Entry barriers

5. Entry deterrence strategies

6. Sequential game analysis (from ECN 532)

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

Plan

1. What determines market structure?

2. **Free entry condition**

3. Entry with Cournot: worked example

4. Entry barriers

5. Entry deterrence strategies

6. Sequential game analysis (from ECN 532)

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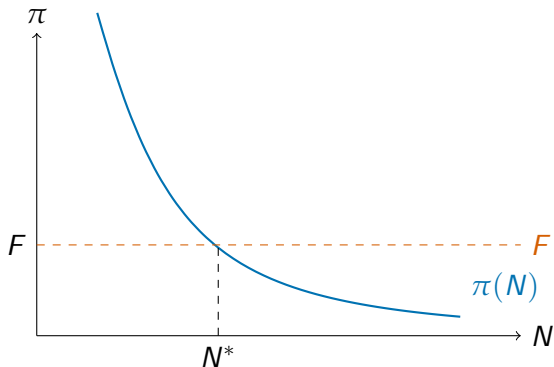
$$\pi(N^*) \geq F > \pi(N^* + 1)$$

- **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 reduces profits: graphical

- Entry continues until $\pi(N) = F$

- N^* = equilibrium number of firms

Comparative statics of entry

- **How does N^* change when:**

- Market size ↑: N^* ↑ (more room for firms)

- Fixed cost F ↑: N^* ↓ (harder to cover costs)

- Marginal cost c ↑: N^* ↓ (lower profit margins)

- Competition intensity ↑: N^* ↓ (profits lower for any N)

- **Prediction:** Large markets with low entry costs have many small firms

Practice: Free entry

- **True, False, or NEI:**

- (a) In a free entry equilibrium, all firms earn zero profit.

- (b) Higher fixed costs lead to more concentrated industries.

- (c) Under Bertrand competition with homogeneous products, free entry leads to the same number of firms as Cournot.

Take 2 minutes.

Practice: Free entry (solution)

Answers

- **(a) FALSE.** Firms earn $\pi(N^*) \geq F$. Integer constraint means they may earn more than F.

- **(b) TRUE.** Higher F means fewer firms can cover their fixed costs. Industries are more concentrated.

- **(c) FALSE.** Under Bertrand with homogeneous products, $P = MC$ even with 2 firms. More entry doesn't change profits—1 firm would be monopoly, 2+ gives $P = MC$.

Plan

1. What determines market structure?

2. Free entry condition

3. **Entry with Cournot: worked example**

4. Entry barriers

5. Entry deterrence strategies

6. Sequential game analysis (from ECN 532)

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)

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

Practice: Market structure

- **Question:** Two industries with same demand $P = 100 - Q$.

- Industry A: $F_A = 200$, $c_A = 10$ (Cournot)

- Industry B: $F_B = 50$, $c_B = 30$ (Cournot)

- Which industry will have more firms in equilibrium?

Take 3 minutes.

Practice: Market structure (solution)

Solution

- Industry A: $\pi_A(N) = \frac{(100-10)^2}{(N+1)^2} = \frac{8100}{(N+1)^2}$

    - $N = 5$: $\pi = 225 > 200$ (Enter)

    - $N = 6$: $\pi = 165 < 200$ (No)

    - $\Rightarrow N_A^* = 5$

- Industry B: $\pi_B(N) = \frac{(100-30)^2}{(N+1)^2} = \frac{4900}{(N+1)^2}$

    - $N = 8$: $\pi = 60 > 50$ (Enter)

    - $N = 9$: $\pi = 49 < 50$ (No)

    - $\Rightarrow N_B^* = 8$

- Industry B has more firms despite higher MC (lower F dominates)

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

Plan

1. What determines market structure?

2. Free entry condition

3. Entry with Cournot: worked example

4. **Entry barriers**

5. Entry deterrence strategies

6. Sequential game analysis (from ECN 532)

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

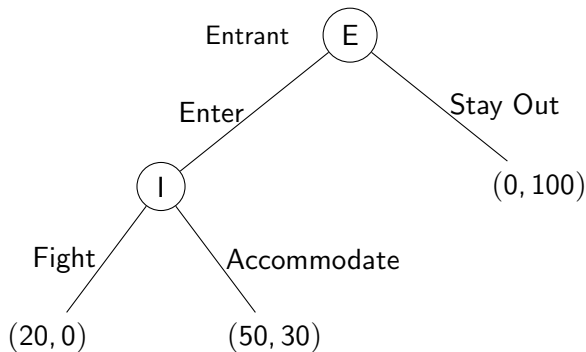   - Long-term contracts with customers

Plan

1. What determines market structure?

2. Free entry condition

3. Entry with Cournot: worked example

4. Entry barriers

5. **Entry deterrence strategies**

6. Sequential game analysis (from ECN 532)

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

Entry game: basic structure

- Payoffs: (Entrant, Incumbent)

- If I would Accommodate, threat to Fight is not credible

Finding the SPE

- **Step 1: Incumbent's decision (if entry occurs)**

    - Fight: $\pi_I = 0$

    - Accommodate: $\pi_I = 30$

    - $\Rightarrow$ Incumbent accommodates

- **Step 2: Entrant's decision (knowing I will accommodate)**

    - Enter: $\pi_E = 50$

    - Stay Out: $\pi_E = 0$

    - $\Rightarrow$ Entrant enters

- **SPE:** (Enter, Accommodate) with payoffs $(50, 30)$

- Entry not deterred because threat wasn't credible

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

Plan

1. What determines market structure?

2. Free entry condition

3. Entry with Cournot: worked example

4. Entry barriers

5. Entry deterrence strategies

6. **Sequential game analysis (from ECN 532)**

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)

Solution

- **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)

Solution

- **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)

Fudenberg-Tirole taxonomy

	Deter	**Accommodate**
Tough	Top Dog (Overinvest)	Lean & Hungry (Underinvest)
Soft	Puppy Dog (Underinvest)	Fat Cat (Overinvest)

- "Tough" = investment makes incumbent more aggressive

- "Soft" = investment makes incumbent less aggressive

- Optimal strategy depends on competition type!

Practice: Entry deterrence

- **True, False, or NEI:**

- (a) An incumbent should always try to deter entry.

- (b) Building excess capacity is always a credible deterrent.

- (c) Limit pricing works better when entrant believes incumbent has low costs.

Take 2 minutes.

Practice: Entry deterrence (solution)

Answers

- **(a) FALSE.** Sometimes accommodation is more profitable. Deterrence has costs (excess capacity, low prices).

- **(b) FALSE.** Capacity must actually be usable. If capacity depreciates, or if using it is costly, it may not be credible.

- **(c) TRUE.** Limit pricing as signaling: low price $\rightarrow$ entrant infers low MC $\rightarrow$ post-entry profits low $\rightarrow$ don't enter.

Product proliferation

- Fill product space to leave no room for entrants

- **Example:** Ready-to-eat cereals (FTC case, 1970s)

    - Kellogg's, General Mills, General Foods, Quaker

    - Launched many brand variants

    - Claimed: deterred entry into cereal market

- **Logic:** In product space (Hotelling), each niche is smaller

- Entrant can't find profitable niche if all are occupied

- **Commitment:** Products are sunk; can't remove them post-entry

Real-world examples of entry deterrence

- **Airlines:** Frequent flyer programs, gate slots
    - Switching costs for consumers
    - Scarce airport capacity

- **Tech platforms:** Network effects $+$ exclusive contracts
    - Facebook: acquire potential competitors
    - Google: default search engine contracts

- **Retail:** Long-term leases in prime locations

- **Pharma:** Patent thickets, authorized generics

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

Entry and antitrust policy

- **Key question for regulators:**

  - Is lack of entry due to structural barriers (efficient)?

  - Or strategic barriers (potentially anticompetitive)?

- **Tricky cases:**

  - Low prices can be competitive OR predatory

  - Large capacity can be efficient OR exclusionary

  - Product variety can be consumer-friendly OR entry-deterring

- Intent is hard to prove; focus on market effects

Empirical entry models

- **Bresnahan & Reiss (1991):** Entry thresholds

    - How much market size needed to support N firms?

    - If threshold for 2nd firm $> 2\times$ threshold for 1st $\rightarrow$ competition

- **Berry (1992):** Entry in airline markets

    - Which routes do airlines serve?

    - How do hub presence and distance affect entry?

- These papers estimate the entry model we studied today

Connection to merger analysis

- **Why entry matters for mergers:**
    - Merger raises prices $\rightarrow$ creates entry opportunity
    - If entry is easy, price increase is temporary
    - Antitrust agencies consider "entry conditions"

- **Horizontal Merger Guidelines:**
    - Entry must be timely (2 years)
    - Entry must be likely
    - Entry must be sufficient to restore competition

- Next lecture: mergers in detail

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