

ECN 594: Entry and Market Structure

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Plan

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)

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

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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:

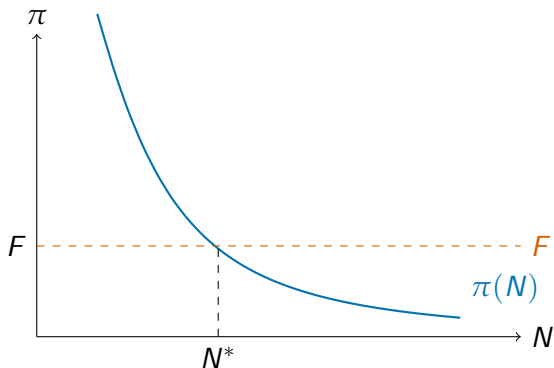
$$\pi(N^*) \geq F > \pi(N^* + 1)$$

- **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 \uparrow : $N^* \uparrow$ (more room for firms)
- Fixed cost $F \uparrow$: $N^* \downarrow$ (harder to cover costs)
- Marginal cost $c \uparrow$: $N^* \downarrow$ (lower profit margins)
- Competition intensity \uparrow : $N^* \downarrow$ (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 $P = MC$.

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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

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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

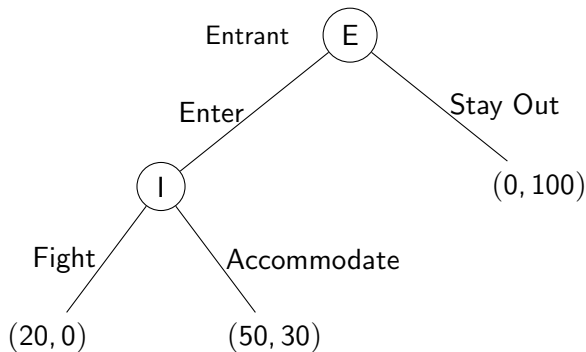
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Entry deterrence: the key question

- 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 → lower post-entry profits
- **Key insight:** Capacity makes “fight” credible
- Building capacity is a commitment device

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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 → 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