ECN 453: Market Structure

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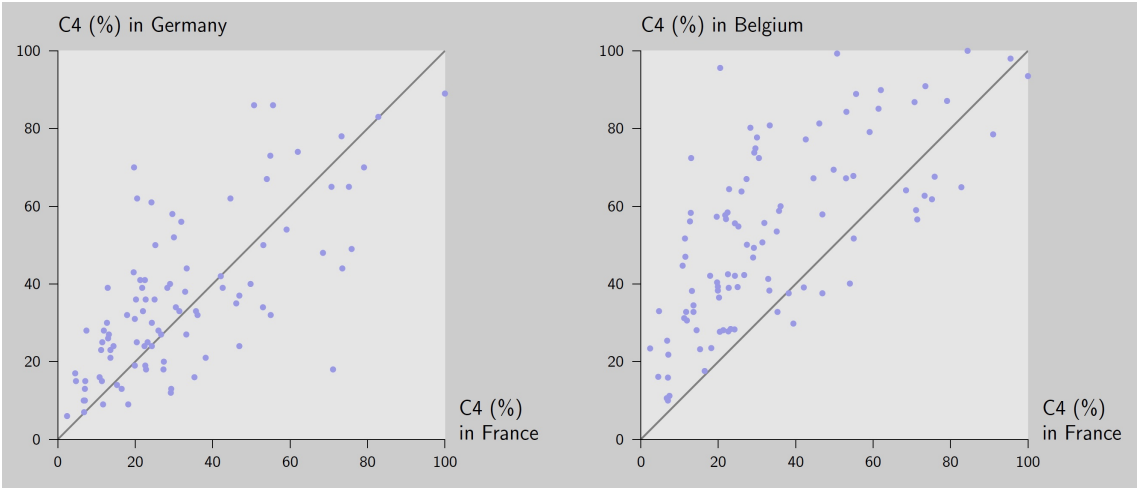
Market Structure

- So far we have studied markets and competition *given* the number of firms.
- Taking a step back:
- How many firms would you expect to find in a given market?
- How large would you expect these firms to be?

Market share of the four largest firms



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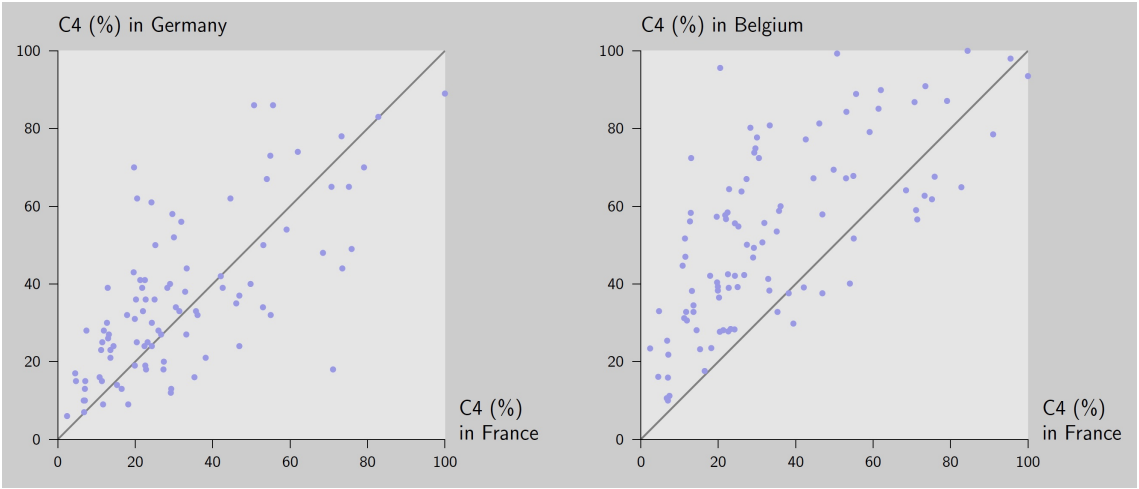

- Suggests industry-specific factors determine each firm's size

Plan

1. Measuring market concentration and market power
2. Entry costs and market structure
3. Model assumptions vs reality

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Measuring market concentration and market power

- **Market concentration**: the extent to which a small number of firms account for a large percentage of the market

- **Market power**: ability of firms to raise price above marginal cost

Measuring market concentration and market power: different methods

- Count the number of firms (why is this not a good measure?)
- Largest four firms:

$$C_4 = \sum_{i=1}^{4} s_i = s_1 + s_2 + s_3 + s_4$$

- Herfindahl index:

$$HHI = 10000 \sum_{i=1}^{n} s_i^2 = 10000 * (s_1^2 + ... + s_n^2)$$

- Lerner index:

$$L = \sum_{i=1}^{n} s_i \frac{p - MC_i}{p}$$

- Note: if all firms have same MC then this is just the (common) margin set by all firms

Measuring market concentration and market power: different methods

- Suppose that there are three firms. Firm 1 and Firm 2 each produce $q = 100$. Firm 3 produces $q = 200$. The market price is $p = 5$. Firm 1 and Firm 2 have a marginal cost of 4, and Firm 3 has a marginal cost of 3.

- **Question:**

- What is the largest four firm concentration ratio?

- What is the HHI?

- What is the Lerner index?

Measuring market concentration and market power: different methods

- Suppose that there are three firms. Firm 1 and Firm 2 each produce $q = 100$. Firm 3 produces $q = 200$. The market price is $p = 5$. Firm 1 and Firm 2 have a marginal cost of 4, and Firm 3 has a marginal cost of 3.

- **Question:**

- What is the largest four firm concentration ratio? 1.0

- What is the HHI? 3750

- What is the Lerner index? 0.3

Measuring market concentration and market power: different methods

- Suppose that there is one firm. The market price is $p = 5$ and the firm has a marginal cost of 3.
- **Question:**
- What is the largest four firm concentration ratio? 1.0
- What is the HHI? 10000
- What is the Lerner index? 0.4

Plan

1. Measuring market concentration and market power
2. **Entry costs and market structure**
3. Model assumptions vs reality

Entry costs and market structure

- What is the relationship between technology, market size, and industry concentration?
- Start by considering a model with n identical firms. Assume cournot competition.
- Cost function: $C = F + cq_i$
- Demand: $Q = (a - P)S$ where S is a number that refers to 'market size'.
- **Question:**
- 1. What is the profit of each firm? $\Pi(n)$
- 2. What is the free entry equilibrium? (I.e. what is the number of active firms so that (i) no active firm wishes to leave the market (ii) no inactive firm wants to enter the market)

Entry costs and market structure

- 1. What is the profit of each firm? $\Pi(n)$

- From n-firm cournot example in a previous lecture, we found that for n firms and demand $P = a - bQ$:

$$q = \frac{a-c}{(n+1)b}$$
$$p = \frac{a+nc}{n+1}$$

- Note that if $Q = (a-P)S$ then $b = 1/S$. Therefore:

$$\Pi(n) = S\left(\frac{a-c}{n+1}\right)^2 - F$$

Entry costs and market structure

- 2. What is the free entry equilibrium? (I.e. what is the number of active firms so that (i) no active firm wishes to leave the market (ii) no inactive firm wants to enter the market)

- Find $\hat{n}$ where $\Pi(\hat{n}) \geq 0 \geq \Pi(\hat{n}+1)$

- Set $\Pi(n) = 0$ and rearrange:

$$n = (a-c)\sqrt{\frac{S}{F}} - 1$$

- So:

$$\hat{n} = \left[(a-c)\sqrt{\frac{S}{F}} - 1\right]$$

- Where $[x]$ denotes highest integer lower than x. E.g. if $n = 32.4$ than $\hat{n} = [32.4] = 32$.

Entry costs and market structure: observations

$$\hat{n} = \left[(a - c)\sqrt{\frac{S}{F}} - 1 \right]$$

- Equilibrium number of firms:
  - An increasing function of market size S (and a)
  - Decreasing in F and c
  - Relation between S and n is not proportional: actually in order to 2x the number of firms, market size S must increase around 4x
  - Why?

Entry costs and market structure: observations

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- Equilibrium number of firms:
  - An increasing function of market size S (and a)
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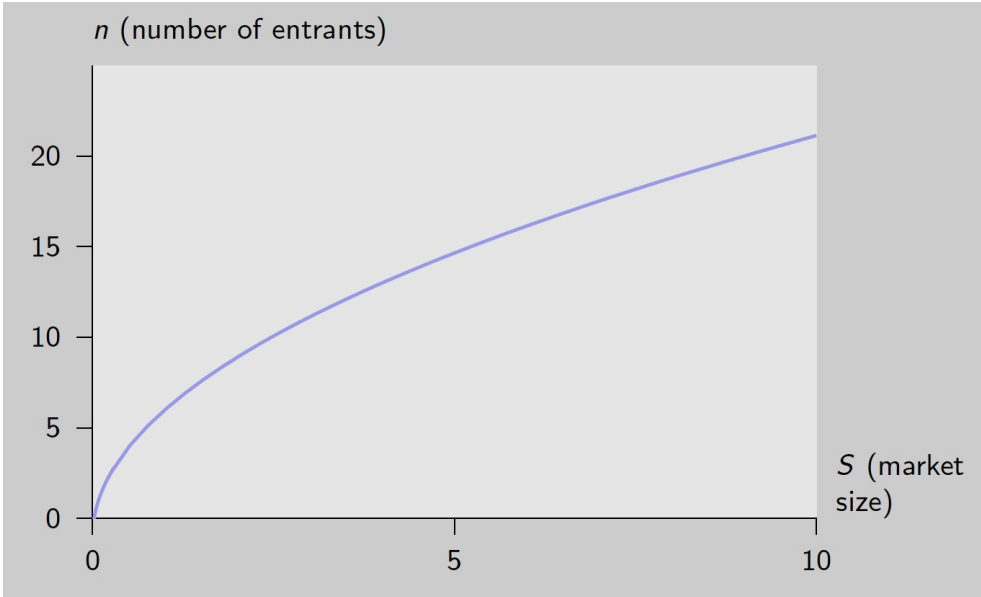
  - Relation between S and n is not proportional: actually in order to 2x the number of firms, market size S must increase around 4x
  - Why? Price changes as firms enter: High S $\rightarrow$ higher n $\rightarrow$ lower $p - c$, which limits the increase in n
- **Due to increased price competition, the equilibrium number of active firms varies less than proportionally with respect to market size.**

Entry costs and market structure: observations



Minimum efficient scale and concentration

- The cost structure of firms is a key determinant of market structure.
- The particular cost structure we have used in this class $C(q) = F + cq$ has **increasing returns to scale**. (increasing returns to scale means that the average cost is decreasing.)
- A common way of measuring the degree of returns to scale in an industry is through **minimum efficient scale**.
  - This is defined as when a firms average cost is 'close' to the minimum average cost (c).
- $AC = F/q + c$. Let MES be the scale where average cost is equal to c'. Solving for q:

$$MES = \frac{F}{c - c'}$$

Minimum efficient scale and concentration

$$MES = \frac{F}{c - c'}$$

- Interpret changes in MES as coming from changes in F.
- If F doubles then MES doubles.
- If MES doubles (due to F doubling) then the number of firms decreases by around $\sqrt{2} < 2$
  - Intuition?

Minimum efficient scale and concentration

$$MES = \frac{F}{c - c'}$$

- Interpret changes in MES as coming from changes in F.
- If F doubles then MES doubles.
- If MES doubles (due to F doubling) then the number of firms decreases by around $\sqrt{2} < 2$
  - Intuition? for why it decreases less than 2 is due to the price effects previously discussed when talking about changes in S.
- **Concentration is generally greater the greater the minimum efficient scale.**

Plan

1. Measuring market concentration and market power
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3. **Model assumptions vs reality**

Model assumptions vs reality

- Model before made a few implicit assumptions:
- 1. All firms have access to the same technology (corresponding to cost $C = F + cq$)
- 2. Firms have perfect information about the demand (i.e. they know demand)
- 3. Entry process is well-coordinated
  - Firms are choosing their entry decision sequentially knowing the previous decisions entrants have made.

Model assumptions vs reality: history matters

- If these assumptions hold then for a given set of parameter values (a, c, F, etc) then we can predict exactly the number of firms in the market, and all these firms should be the same size.

- Do these predictions hold in reality? Usually not...

- Example: prepared soups industry in the US and the UK.
  - Markets differ in size but similar in most other dimensions (e.g. canned vs dried)
  - Campbell was the first entrant in the US; Heinz established an early lead in the UK
  - Despite attempts to expand market share, Heinz still dominates UK (41% share) and Campbell dominates US market (63%).

- Example: industries include firms of different sizes
  - e.g. US car market

Model assumptions vs reality: history matters

- How can we relax these assumptions?
- Perhaps firms don't have access to the same technology.

Model assumptions vs reality: history matters

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- Perhaps firms don't have access to the same technology.
  - Example: Dupont
  - For a period of time, Dupont had exclusive rights over a new production process for titanium dioxide
  - Even after the patents expired, Dupont maintained a cost advantage due to the fact that it had moved down the *learning curve*.

Model assumptions vs reality: history matters

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Model assumptions vs reality: history matters

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- Imperfect information about market conditions
- **Forecasting mistakes**:
  - several oil companies built large refineries in early 1970s
  - 1973: oil shock, demand cuts, excess capacity, n too large

Model assumptions vs reality: history matters

- How can we relax these assumptions?
- Imperfect information about market conditions
- **Coordination mistakes**:
  - Commercial aircraft in 1960s. Lockheed and McDonnell Douglas were considering whether to enter the market for large commercial aircraft.
  - Boeing had entered with B747 and there was room for only one more firm $\hat{n} = 2$. Both ended up entering the market and made huge losses.
  - A different example in the same industry: Boeing and Airbus in the 'super-jumbo' segment.
  - In 1990, firms agreed there wasn't room for two firms. Initially thought about a joint design, but then Airbus decided to go it alone.
  - Both firms delayed their entry decision until late 2000, A380 developed a decade later due to the coordination 'mistake'