

Oligopoly and Imperfect Competition

A few large firms, each watching the others, where supply and demand meet game theory.

What this chapter covers



15.2–15.5 The models

- Measuring concentration (HHI)
- Cournot: quantities
- Bertrand: prices
- Stackelberg: moving first



15.6–15.7 Behavior

- Collusion & why it fails
- Product differentiation
- Monopolistic competition
- Merger control



15.8–15.10 Evidence

- Case: global beer
- Empirical: lysine cartel
- Experiment: oligopoly in the lab

THE BIG IDEA

An oligopoly is dominated by a few large firms whose every decision depends on what their rivals will do, the natural home of game theory.

15.1

Introduction

- Markets ruled by a few giants
- Neither monopoly nor perfect competition
- Supply and demand meets game theory

15.1 INTRODUCTION

A few firms dominate, and each watches the others



Mobile service

Verizon, AT&T, and T-Mobile sell almost all U.S. mobile-phone service.



Beer

AB InBev brews close to one of every three beers drunk worldwide.



Passenger jets

Boeing and Airbus build essentially all of the world's large jets.

WHAT THEY SHARE

These markets are oligopolies: dominated by a few large firms whose every decision depends on what rivals will do. Because each firm's best move depends on its rivals', oligopoly is the natural home of game theory.

15.2

Measuring Market Power: Concentration

- The concentration ratio
- The Herfindahl–Hirschman Index (HHI)
- A worked calculation

Two ways to gauge concentration

■ Concentration ratio

Adds up the market shares of the largest firms, the four-firm ratio, the combined share of the top four, is the most common.

■ Herfindahl–Hirschman Index (HHI)

Sums the squares of all firms' market shares (in percentage points). Squaring gives extra weight to large firms, so the HHI rises as a market becomes more lopsided.

15.2 MEASURING MARKET POWER

What the HHI looks like at the extremes

1,000

ten equal firms

$$10 \times 10^2$$

5,000

two equal firms

$$2 \times 50^2$$

10,000

pure monopoly

$$100^2$$

THE MERGER THRESHOLD

Competition authorities use the HHI to judge mergers. In the United States, a market above about 2,500 is considered highly concentrated, and a merger that raises the HHI sharply invites scrutiny.

15.2.1 A WORKED HHI CALCULATION

Same firms, different shares

Market	Shares (%)	HHI	Verdict
A (even)	25, 25, 25, 25	2,500	4×625
B (lopsided)	70, 10, 10, 10	5,200	4,900 + 300

Both markets have four firms, yet the HHI judges B far more concentrated.

WHY SQUARING MATTERS

Both markets have the same four-firm concentration ratio of 100%. But squaring the shares gives heavy weight to B's dominant firm, that is the HHI's advantage over a simple concentration ratio.

Self-check: compute the HHI

SELF-CHECK

A market has four firms with shares 40, 30, 20, and 10 percent. What is the HHI, and would U.S. regulators call this market concentrated?

$HHI = 40^2 + 30^2 + 20^2 + 10^2 = 1,600 + 900 + 400 + 100 = 3,000$. Because it exceeds 2,500, the U.S. merger guidelines classify the market as highly concentrated.

15.3

Cournot Competition: Choosing Quantities

- Firms choose how much to produce
- Reaction functions and Nash equilibrium
- More firms $\rightarrow$ lower price

Competing by choosing quantities

■ Cournot model

A few firms making an identical product each choose how much to produce, simultaneously, and the combined output determines the market price.

■ Reaction function

Each firm picks its best output given what it expects rivals to make. The market settles at the Nash equilibrium, where each firm's quantity is a best response to the other's.

15.3 COURNOT COMPETITION

More firms mean more output and a lower price

Market	Total output	Price
Monopoly (1 firm)	6	\$6
Duopoly (2 firms)	8	\$4
Three firms	9	\$3
Many firms	→ competition	→ MC

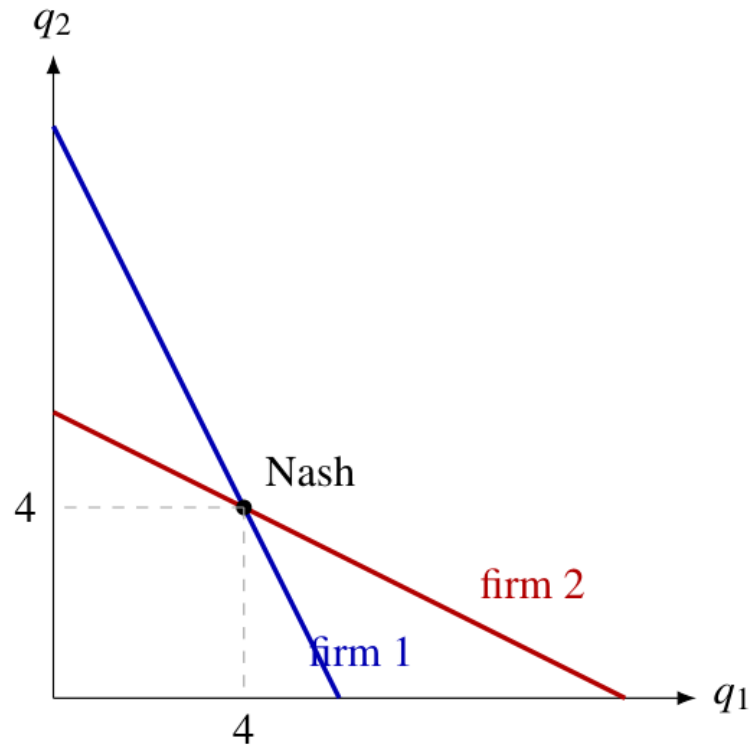
Demand $P = 12 - Q$, with negligible costs. Each duopolist produces 4 units.

THE PATTERN

As the number of firms grows, total output rises and the price falls toward marginal cost, the outcome approaches perfect competition.

15.3 COURNOT COMPETITION

Reaction functions cross at the Nash equilibrium

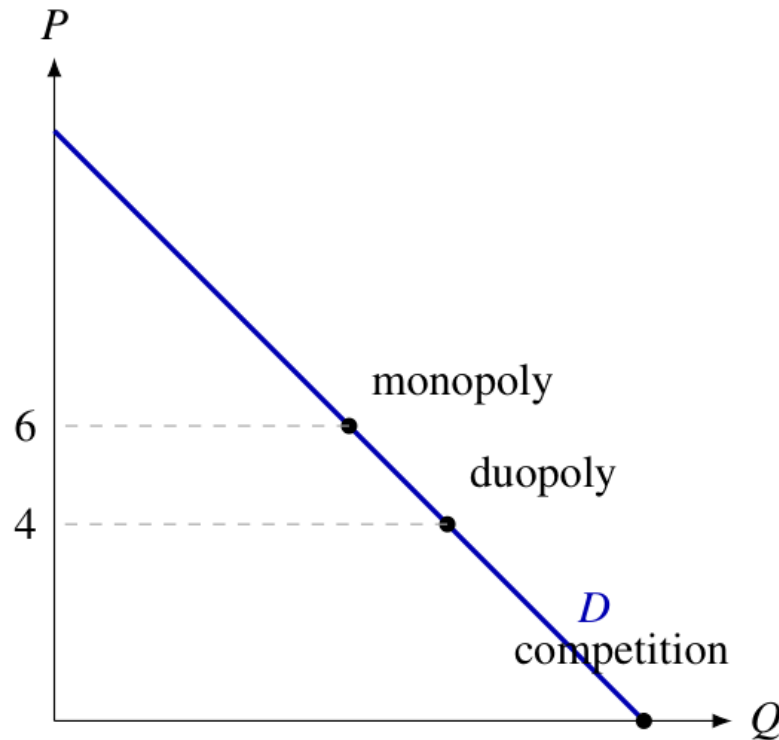


- Each reaction line shows a firm's best output for each level of the rival's output.
- Where the two lines cross, each firm is best-responding, the Cournot–Nash equilibrium.

Figure 15.1 Each firm's reaction function gives its best output for each rival output.

15.3 COURNOT COMPETITION

The duopoly sits between monopoly and competition



- Monopoly produces least and charges most; perfect competition the reverse.
- Cournot duopoly lands in between, and shifts toward competition as firms multiply.

Figure 15.2 More firms mean more output and a lower price.

15.4

Bertrand Competition: Choosing Prices

- Firms set prices, not quantities
- The Bertrand paradox
- Why two firms can be enough

15.4 BERTRAND COMPETITION

Competing in prices: a sharp result

- With an identical product, customers buy from whoever is cheapest.
- Each firm has an incentive to undercut the other by a penny to capture the whole market.
- Undercutting continues until the price is driven all the way down to marginal cost, the competitive outcome, with only two firms.

THE BERTRAND PARADOX

The Bertrand paradox: two price-setting firms can be enough to eliminate market power entirely.

Why two firms rarely compete the price to cost



Differentiation

Products differ, a Coke is not a Pepsi, so the cheapest does not win every buyer.



Capacity limits

A rival cannot instantly serve the whole market, so it cannot grab all demand.



Repetition

Firms meet repeatedly (Chapter 14), giving them ways to avoid ruinous price wars.

COURNOT OR BERTRAND?

Whether oligopoly looks more like Cournot's gentle competition or Bertrand's cutthroat version depends on exactly these features.

15.5

Stackelberg: Moving First

- A leader chooses quantity first
- The follower responds
- The first-mover advantage

Moving first and committing to a large output

■ Stackelberg model

One firm, the leader, chooses its quantity first, and the follower responds after observing it. The leader anticipates the follower's reaction and exploits it by committing to a large output.

6

leader's output

3

follower's output

The first-mover advantage

FIRST-MOVER ADVANTAGE

By committing to a large output, the leader earns more than it would in simultaneous Cournot competition.

- This is a direct application of commitment: by moving first and visibly, the leader forces the follower to accommodate.
- It mirrors the entry-deterring incumbent of Chapter 14, who committed early to shape a rival's response.

15.6

Collusion: Acting Like a Monopoly

- Agreeing to restrict output
- A prisoner's dilemma
- Why collusion is hard to sustain

The temptation to act like a monopoly

THE TEMPTATION

Oligopolists earn less than a monopolist because they compete. So they are tempted to collude: agree to restrict output and split the monopoly profit.

THE NUMBERS

If the two Cournot firms jointly produced the monopoly output of 6 (three each) instead of 8, the price would rise to \$6 and their combined profit would be larger.

15.6 COLLUSION

But collusion is a prisoner's dilemma

- At the collusive output, each firm is tempted to cheat by producing extra at the high price.
- If both cheat, the agreement collapses back to competition.
- Repeated interaction can sustain collusion through the threat of punishment, a price war following any betrayal.

WHY IT IS POLICED

This is why competition authorities watch oligopolies so closely, and why explicit price-fixing agreements are illegal.

Three forces that break a cartel

1

More firms

The more firms there are, the harder it is to detect and punish cheating, and the larger each firm's temptation to defect.

2

Demand shocks

They make it hard to tell a cheater from an unlucky rival whose sales simply fell.

3

No legal enforcement

Explicit price-fixing is illegal, so members cannot enforce the cartel in court.

IN PRACTICE

These pressures explain why cartels like OPEC constantly struggle with quota-busting, and why the lysine conspiracy eventually came apart.

15.7

Product Differentiation and Monopolistic Competition

- Many firms, differentiated products
- A little market power each
- Welfare: variety vs. efficiency
- Merger control

Many firms selling differentiated products

■ Monopolistic competition

Many firms sell differentiated products, restaurants, coffee shops, hair salons, clothing brands. Each has a little market power because its product is different, so it faces a downward-sloping demand curve and prices above marginal cost, like a small monopolist.

Free Entry Drives Profit to Zero

But entry is free: when firms earn profits, new ones enter with their own variety until economic profit is competed away to zero, as under perfect competition.

A trade-off: variety vs. efficiency



The inefficiency

Price stays above marginal cost, and each firm produces below its lowest-cost scale, excess capacity, like a rarely-full restaurant or a salon with idle chairs.



The benefit

Variety. Consumers choose among dozens of restaurants, brands, and coffee shops, each a little different, and that diversity is itself valuable.

THE VERDICT

Monopolistic competition trades a modest inefficiency for abundant choice, whether the trade is worthwhile has no single right answer.

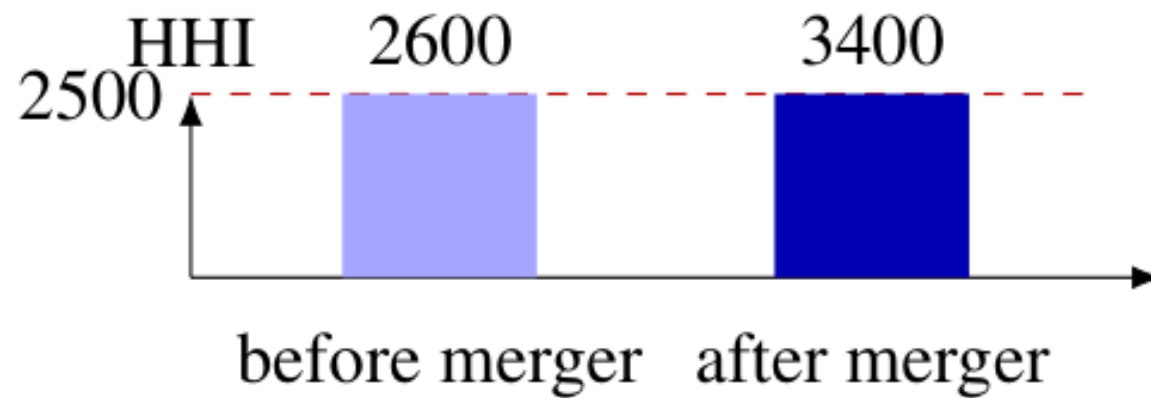
Governments regulate by policing mergers

- Because an oligopoly with fewer firms tends to charge higher prices, the main tool is merger control, blocking or conditioning combinations that would make a market too concentrated.
- The main screen is the HHI of Section 15.2: how much would the merger raise the index, and does the result cross the highly-concentrated threshold?

THE HHI TEST IN ACTION

A merger of two firms each holding 20% of a market raises the HHI from 2,600 to 3,400, an increase of 800 that pushes the market well past the usual threshold.

A merger raises concentration past the threshold



- The HHI jumps from 2,600 to 3,400, a rise of 800.
- Crossing the dashed 2,500 line invites close antitrust scrutiny.

Figure 15.3 A merger raises the HHI; values above 2,500 (dashed line) are highly concentrated.

Two real merger reviews

■ Siemens–Alstom (EU, 2019)

Germany and France backed merging their rail businesses into a “European champion” to rival China's state-owned train maker. The European Commission blocked it, ruling it would harm competition in signalling and high-speed trains and raise prices, competition policy over industrial-policy ambitions.

■ Walmart–Massmart (South Africa, 2010–11)

Little threat to competition, but South African law weighs public-interest factors. The Tribunal approved on conditions: no layoffs for two years, rehire 503 workers, honor labor agreements, and a 100-million-rand supplier fund.

15.8

Case Study: The Global Beer Oligopoly

Oligopoly forming through merger, then competing on brands.

15.8 CASE STUDY

Oligopoly built through mega-merger

THE DEAL

In 2016, Anheuser-Busch InBev, itself the product of earlier mega-mergers, acquired its largest rival, SABMiller, for about \$107 billion.

~30%

of all beer on earth brewed by AB
InBev

~11%

next-largest brewer, Heineken

THE GIANTS

A handful of giants, AB InBev, Heineken, Carlsberg, and Asahi, together account for a large share of the global market.

Beer illustrates several chapter themes at once



Rivals' reactions

Concentrated enough that each giant must weigh rivals' reactions, as in Cournot or Stackelberg competition.



Differentiation

They own hundreds of brands, Budweiser, Stella Artois, Corona, competing on variety, softening Bertrand price pressure.



Merger review

The wave of mergers that built these giants is exactly what HHI-style measures are designed to single out for antitrust review.

15.9

Empirical Evidence: The Lysine Cartel

Collusion is not just theory, it happens, it is illegal, and it gets caught.

15.9 EMPIRICAL EVIDENCE

A textbook cartel acting as a single monopolist

- Lysine is an animal-feed additive, made by only a handful of firms worldwide.
- 1992–1995: Archer Daniels Midland and four rivals secretly agreed to fix the price and divide the world market.
- An informant, an ADM executive, cooperated with the FBI, which secretly recorded the cartel's meetings.

+70%

price rise within the first nine months

\$100M

ADM fine, then the largest in U.S. history

THE COLLAPSE

The cartel collapsed in 1995 and several executives went to prison. The case shows collusion can raise prices substantially, and why the law works so hard to detect and deter it.

15.10

Experimental Evidence: Oligopoly in the Laboratory

Reproducing oligopoly with real payoffs to test the models directly.

Testing the models in the lab

Study	Setting	Theory's prediction	Experimental result
Huck, Normann & Oechssler (2004)	Cournot, 2 to 5 firms	More firms push output toward competition	2 firms partly collude; 3 near Cournot-Nash; 4–5 at or above Cournot
Dufwenberg & Gneezy (2000)	Bertrand (price) competition	Two firms suffice to reach marginal-cost pricing	With 2 firms prices stay above cost; with 3–4 they fall close to it
Many studies	Repeated interaction with communication		Allowing rivals to communicate sharply increases collusion

Table 15.1 Experimental tests of oligopoly models.

What the experiments teach

THE MODELS HOLD UP

The experiments broadly vindicate the chapter's logic: fewer firms and competition in quantities yield higher prices; more firms and competition in prices push markets toward the competitive outcome.

THE WARNING

A practical warning that mirrors antitrust law: the single strongest predictor of collusion is whether firms can talk to one another. That is precisely why communication among rivals about prices is illegal.

Key takeaways

1

Concentration

The HHI sums squared market shares; above ~2,500 a U.S. market is highly concentrated.

2

Cournot

Firms choose quantities; more firms mean more output and a price falling toward marginal cost.

3

Bertrand

Firms choose prices; two firms can drive price to cost, the Bertrand paradox.

4

Stackelberg

Moving first and committing to a large output yields a first-mover advantage.

5

Collusion

Firms are tempted to act like a monopoly, but it is a prisoner's dilemma and hard to sustain.

6

Mon. competition

Many differentiated firms: market power, zero long-run profit, variety vs. excess capacity.

7

Regulation

Governments police mergers using the HHI, Siemens–Alstom, Walmart–Massmart.

8

Evidence

Global beer, the lysine cartel, and lab experiments confirm the models, communication breeds collusion.