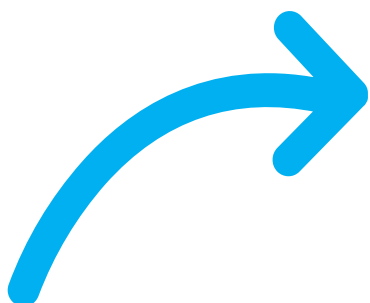


Industrial Organization

The Cournot Model

Week 5

The Cournot Model

	Perfect competition	Monopolistic competition	 Oligopoly	Monopoly
Characteristics	Homogeneous product Many firms Many consumers Free entry and exit	Many firms Many consumers Differentiated product Free entry and exit ($\pi^{LR} = 0$)	Some producers but not many Depending on the characteristic of the oligopoly we will use different models. <u>Examples:</u>	Only one firm Unique product Entry barriers
Behaviour	Takes market determined price as given and chooses quantity to maximizes profits (" <u>Price-takers</u> ")	Sets price and quantity to maximize profits (" <u>Price-maker</u> ")	→ Cournot; → Bertrand; → Stackelberg. → ...	Sets price and quantity to maximize profits (" <u>Price-maker</u> ")
Optimal decision	$P = MC$	$MR = MC$		$MR = MC$

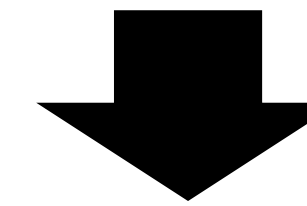
EXAMPLES: telecommunications,
automobile industry, tech industry, etc.

The Cournot Model

Main assumptions:

- Oligopolistic model (more than one firm)
- Firms choose **simultaneously** (let's apply game theory!)
- ... of a **homogenous product**
- ... the **quantity they will produce** (in the profit-maximization problem, q_i will be the decision variable)

The demand faced by each firm will depend on the quantity produced by all other firms



If the market demand is $P = a - bQ$ and we have 2 firms, the demand faced by firm 1 is:

$$P_1 = a - b(q_1 + q_2)$$

**Residual demand
of firm 1**

The higher q_2 is the lower the quantity firm 1 can sell

The Cournot Model

THE CASE OF TWO SYMMETRIC FIRMS

General case $\rightarrow P = a - bQ \wedge MC_1 = MC_2 = c$

Goal of all firms \rightarrow Maximize profits

$$\max_{q_1} \pi_1 = P(q_1 + q_2)q_1 - cq_1$$

Residual demand
of firm 1

$$\frac{d\pi}{dq_1} = 0 \Leftrightarrow (\dots) \Leftrightarrow q_1 = \frac{a - bq_2 - c}{2b}$$

The Cournot Model

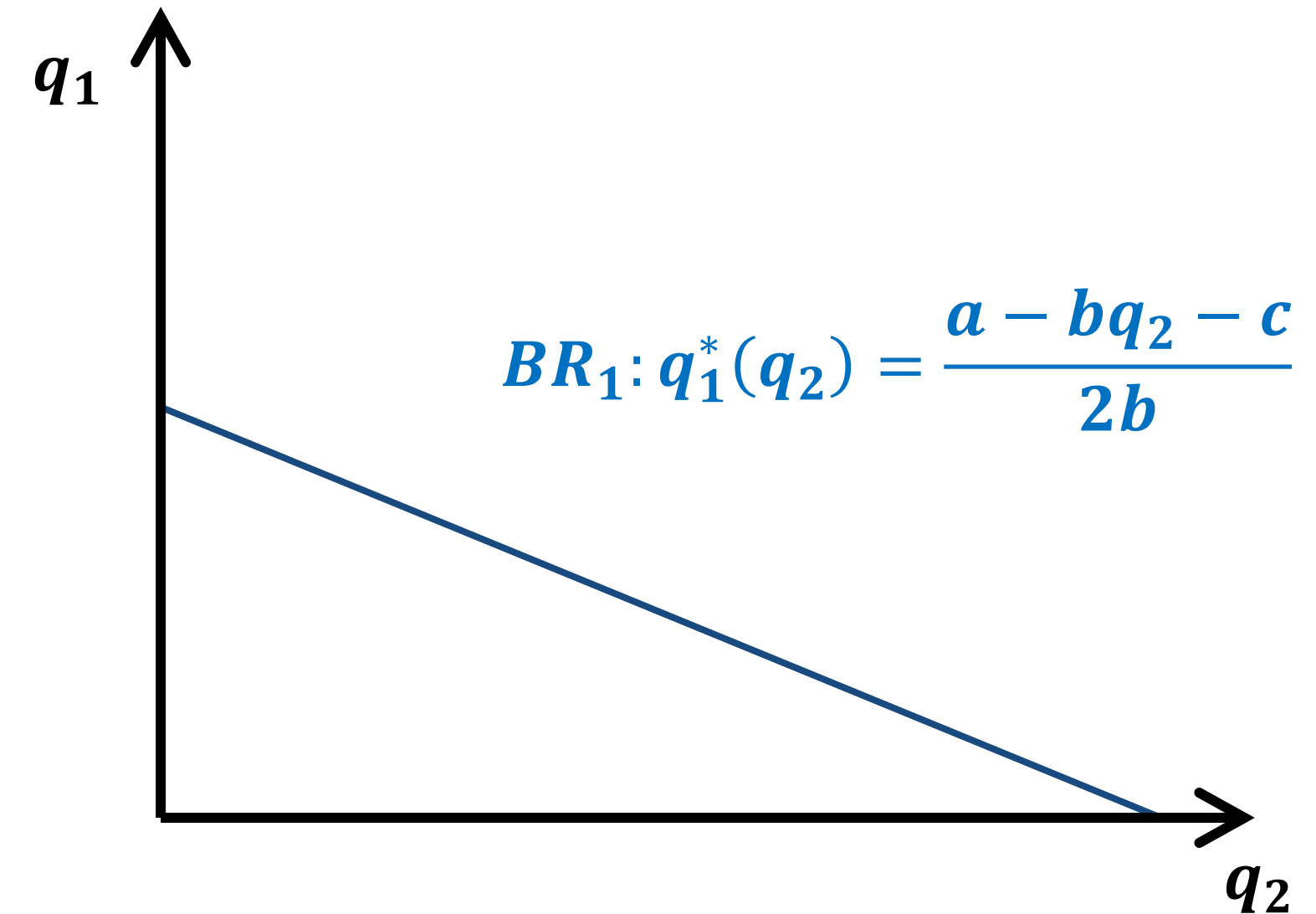
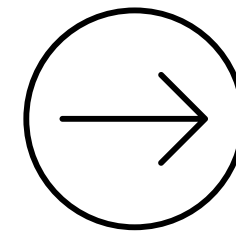
THE CASE OF TWO SYMMETRIC FIRMS

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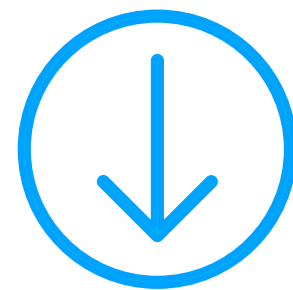
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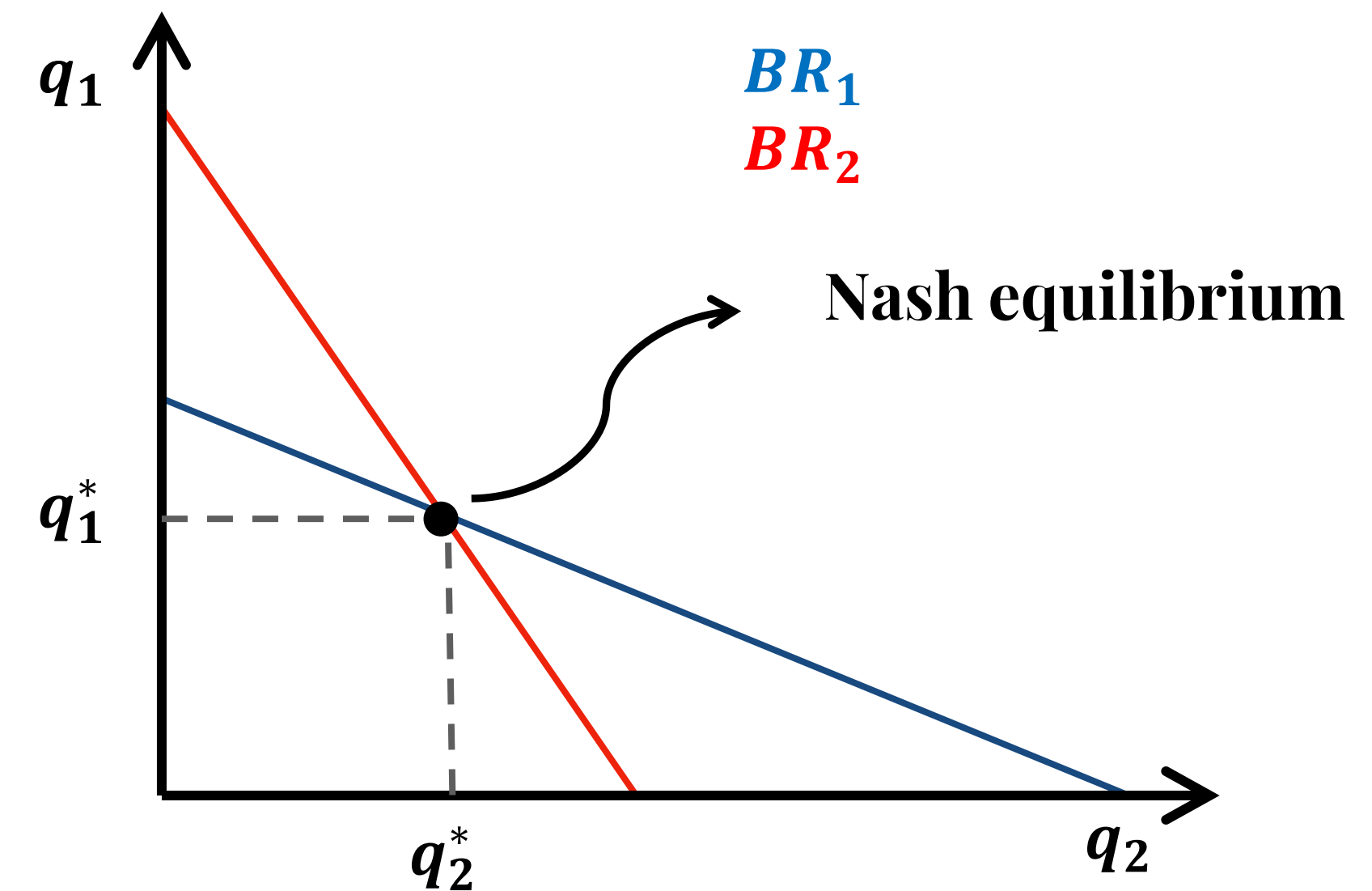
The Cournot Model

THE CASE OF TWO SYMMETRIC FIRMS

The **equilibrium** of the Cournot model is when both players are best responding to each other



Intersection of the best response function of both players



The Cournot Model

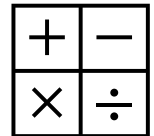
Most exercises you will see generally assume (to simplify your calculations) at least one of the following (and, quite frequently, both):

- There are only **two firms** in the market (**Cournot duopoly**)
- Equal marginal costs (or **identical cost structures**), which lead to **symmetric** Best Response functions

Suppose you are given a linear demand function and the cost structures of two firms. What would you do to solve the model?

- **First step:** compute the Best Response of firm 1 (by solving $\max \pi_1$)
 - **Second step:** compute the Best Response of firm 2 (by solving $\max \pi_2$)
 - **Third step:** find the intersection of the Best Response of both firms
- } *if $c_1 = c_2 \rightarrow q_1 = q_2 \rightarrow$ No need to compute BR_2*

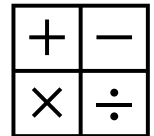
The Cournot Model



EXERCISE

1. Consider the market of a homogeneous product with demand given by $P = 100 - 2Q$. There are two firms, both with constant marginal cost equal to 10.
 - (a) Compute the **Cournot-Nash equilibrium**.
 - (b) Calculate the efficiency loss as a percentage of the efficiency loss in the monopoly situation.
 - (c) Repeat the exercise assuming now that there are **8 firms** instead of 2 firms.

The Cournot Model

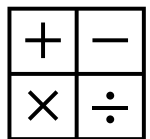


EXERCISE

6. The US has been pressuring Japan to open the automobile market to models made in the US. **Consider that the automobile market in Japan presents a demand curve given by $Q = 10 - p$ and is served by three Japanese firms with total costs given by $TC(q) = q$. The US producers are willing to export automobiles to the Japanese market in function of the price existing there, that is, acting like price-takers, following the function $S = p$, where S represents the number of US cars sold in Japan if the price in that market was p . The Japanese firms act like Cournot competitors.**

(a) Suppose Japan is forced to open its automobile market to US firms. What are the price, the quantity produced domestically, and the quantity imported in equilibrium?

The Cournot Model



EXERCISE

4. Consider a duopoly with demand given by $Q = 500 - 50P$. The first firm has a constant marginal cost equal to 8. The second firm has a marginal cost equal to 6 and a limited production capacity of 25 units.


Calculate the equilibrium values assuming Cournot competition. Compute the Cournot-Nash equilibrium.

Imperfect Competition

Concentration
↓

Market Type	Characteristics
Perfect Competition	Homogeneous product Many consumers and firms Free entry and exit
Monopolistic Competition	Differentiated product Many consumers and firms Free entry and exit
Dominant Firm	A single large firm and a competitive fringe
Oligopoly	Some producers but not many
Monopoly	Only one firm Entry barriers

}

 **FOCUS OF IO:**

IMPERFECT COMPETITION

“Competition among the few”

Recommended readings

CABRAL, LUIS MB. INTRODUCTION TO INDUSTRIAL ORGANIZATION. MIT PRESS, 2017.

- ✓ Chapter 7.3: The Cournot Model

