SPRING 2025 | PRACTICAL SESSIONS

Industrial Organization

Stackelberg Model

Cournot Model

Week 6

The	e 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> : → Cournot;	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> ")		Sets price and quantity to maximize profits (" <u>Price-maker</u> ")
	Optimal decision	P = MC	MR = MC	→ Bertrand; → …	MR = MC





The Stackelberg Model

Main assumptions:

- Oligopolistic model (more than one firm)
- Firms choose **sequentially**
- ... the **quantity they will produce** (in the profit-maximization problem, q_i will be the decision variable)
- ... of a **homogenous product**
- Stackelberg exercise? Where should we start?
- taking into account the Best Response function of the **FOLLOWER**.



Two firms: the firm that moves first will be called the **LEADER**, while the other will be the **FOLLOWER** \Rightarrow now, how can we solve a

We can use <u>backward induction</u> (the same strategy we used to solve sequential games) \Rightarrow the **LEADER** will decide how much to produce

The Stackelberg Model **SEQUENTIAL GAMES – REVISION**

Extensive-form games or sequential games:

- Game game in which players do not choose their strategies at the \checkmark same time, and players that choose later can see the strategies already chosen by other players.
- ✓ Representation: game tree
- Solution concept: Subgame Perfect Nash Equilibrium (SPNE) \checkmark
- ✓ How to get to the SPNE? Backward Induction







The Stackelberg Model

General case $\rightarrow P = a - bQ \land MC_L = MC_F = c$

Goal of all firms → Maximize profits

Rationale \rightarrow The leader will choose q_L that given the BR_F maximizes π_L (*backward induction*)

Determine Follower's BR function

 $\max_{q_F} \pi_F = F$

$$\frac{d\pi}{dq_F} = \mathbf{0} \leftrightarrow (\dots) \leftrightarrow q_F = \frac{a - bq_L - c}{2b}$$



$$P(q_F + q_L)q_F - cq_F$$

The Stackelberg Model

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Determine Leader's optimal choice







- 1. Consider a duopoly in which two firms offer a homogeneous product and compete in q with no cost to produce. There is a leader firm, say L, and a follower firm, say F. Market demand is p = 10 - q.
- (a) Derive firm F's best response and the equilibrium quantities, price and profits.
- (b) Assume now that both firms choose q simultaneously. Compare your results and explain the differences.



EXERCISE

Back to the Cournot Model

8. Consider a market with two firms (1 and 2) simultaneously deciding on the technology (A or B) that they wish to adopt. After this decision they will compete à la Cournot. Note that the competitors observe first the decision before they decide on the quantities. The two available technologies are characterized by the following total cost curves: $TC_A = 10q_A + 120$ and $TC_B = 25q_B + 5$. The demand

function is given by P = 40 - Q.

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



Revision

A side-by-side comparison of the Cournot and Stackelberg models:

Cournot Model

- ✓ Firms **choose quantities** (decision variable: q_i)
- Simultaneous choice
- Homogeneous product



Stackelberg Model

- ✓ Firms **choose quantities** (decision variable: q_i)
- ✓ **Sequential** choice (first the *Leader*, then the *Follower*)
- Homogeneous product

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EXERCISE

True or False?

1 "A dominant firm can induce all the firms in the competitive fringe to produce nothing whatsoever. Yet, it might *not* want to do so."

2 "In a given market, the Herfindahl-Hirschman index may equal its minimum theoretical value and yet all the firms in that market may earn an economic profit."





Recommended readings

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

✓ Chapter 7.3: The Cournot Model





