Lecture 1

Jakob Sverre Alexandersen
GRA4156 Accounting, Valuation and Financial Economics

September 3, 2025

Contents

1 Bundling

- Different goods are sold in **one** package at one bundle price P_B
- One example is the office365 package, now THAT'S a bundle
- P.B.: Pure Bundling – only the bundle is sold (ex: netflix)
- M.B.: Mixed bundling – consumers can choose between a bundle or each good separately (ex: a McD's meal)
- Note: $\Pi^{MB} \geq \Pi^{PB}$ because MB can always replicate PB by setting high prices for the separate goods
- Why it works:
  - Reduces variation in willingness to pay $\rightarrow$ setting "only one price" is less problematic!
  - If negative correlatiuon in willingness to pay, then bundle!!!

2 Game Theory

In the majority of markets, firms interact with few competitors (oligopoly)

- Need to consider rival's actions!
- Strategic interaction in prices, outputs, R&D, advertising...

Example of game from politics:

You have 10 staff members to distribute to:

- City A (10 votes)
- City B (6 votes)
- City C (4 votes)

Where would you spend your 10 staff given the following payoffs:

$$\text{Opponent's staff} = \begin{cases} \text{more than you} & \text{you lose} \\ \text{same as you} & \text{split the votes} \\ \text{less than you} & \text{you win} \end{cases}$$

2.1 Overview

Key ideas and concepts in game theory

Oligopoly models:

- Cournot (firms choose quantities simultaneously)
- Bertrand (firms choose prices simultaneously)
- Stackelberg (firms choose prices or quantities sequentially)

They are distinguished by:

- Decision variable that firms choose (e.g. prices or quantities)
- Timing of the underlying game (i.e. simultaneous or sequential, finite or infinite)

Use game theory to analyze situations with strategic interaction!

- All players choose strategies (one for each player), which determine the action a player will take at any stage of the game
- the combination of strategies determines the outcome

Hence, we have to define:

1. the set of players: $i \in I$
2. the strategies: $s_i \in S$
3. the payoffs (utility): $u_i : S \to \mathbb{R}$

Common knowledge / full rationality assumption:

- Each player is "fully rational" and each agent knows this
- Each player knows that each player knows the payoffs and strategies available to the players, and so on

Since players are rational:

- No player will choose a *dominated* strategy: A strategy is dominated when it gives lower return than other strategies, irrespective of what other players do

A strategy $s_i \in S$ is dominant for player i if:

$$u_i(s_i, s_{-i}) \geq u_i(s'_i, s_{-i}) \quad \forall s'_i \in S_i \ \wedge \ \forall s_{-i} \in S_{-i}$$

In plain text: "if an action always gives a higher (lower) payoff compared to another action, whatever the other player does, we assume a player will (not) pick it"

NOTE: all players know this, and we can rule out such strategies

Definition (dominant strategy equilibrium)

A strategy profile s^* is the dominant strategy equilibrium if for each player i, s^*_i is a dominant strategy

2.2 Static vs. dynamic games and strategies

- Static: players choose actions simultaneously and play once (e.g., Cournot/Bertrand)
- Dynamic: players move sequentially or repeatedly (e.g., Stackelberg)

Pure strategies

A pure strategy is the choice by a player of a given action with certainty

Ex: play left or right with certainty

Mixed strategies

Mixed strategy is when a player might randomize between his actions

Ex: a goalkeeper who plays left with $p = 0.3$ and right with $p = 0.7$

Solution to firms' strategic interactions requires concept of equilibrium, first formalized by John F. Nash

- The market will be in equilibrium when no player wants to change its current strategy, given that no other players change their current strategy
- in this stable situation, players are best responding to each other: "a strategy is a best response if it maximizes payoffs given the other player's strategy"

A Nash equilibrium is a strategy profile $s^* \in S$ such that $\forall$ players $i \in I$

$$u_i(s_i^*) \geq u_i(s_i', s_{-i}^*) \quad \forall s_i' \in S_i$$

(i.e., no player can profitably deviate given the strategies of the other players)

Example 1

Two airlines compete in departure times (prices are set)

Imagine that

- 70% if consumers prefer evening departure, 30% prefer morning departure
- if airlines choose same departure times, they share the market equally
- pay-offs to the airlines as determined by market shares

what if there are no dominated or dominant strategies?

Example: a pricing game between the two airlines

- 60 potential passengers with a reservation price of 500
- 120 additional passengers with a reservation price of 220
- assumption: price discrimination is not possible

- costs are 200 per passenger no matter who is on the plane

- airlines must choose between a price of 500 and a price of 220
  - equal prices → passengers are evenly shared
  - different prices → cheapes airline gets *all* the passengers

3 Oligopoly

3.1 Oligopoly models

- Three main classes of oligopoly competition:
  - Cournot
  - Bertrand
  - Stackelberg and dynamic Hotelling
- They are distinguished by
  - The decision variable that firms can choose
  - the timing of the underlying game
- Concentrate on the Cournot first

3.1.1 Cournot competition

Assume: two firms making an identical product with demand for this product equal to:

$$P = A - BQ = A - B(q_1 + q_2) \quad (q_x \text{ is output firm } x)$$

For each firm, $MC = c$ (i.e. constant marginal cost c per unit)

What is the demand curve dacing each firm?

- Treat the output of the other firm as constant
- For firm 2, demand is $P = (A - Bq_1) - Bq_2$

$$\begin{aligned} MR_2 = (A - Bq_1) - 2Bq_2 \\ MR = MC \\ A - Bq_1 - 2Bq_2 = c \\ \rightarrow q_2^* = \frac{(A-c)}{2B} - \frac{q_1}{2} \end{aligned}$$

$q_2^* = \frac{(A-c)}{2B} - \frac{q_1}{2}$ this is the reaction function for firm 2

- firm 2's profit-maximizing output for any output choice by firm 1

By exactly the same argument, the reaction function for firm 1 is:

$$q_1^* = \frac{(A-c)}{2B} - \frac{q_2}{2}$$

Cournot-Nash equilibrium requires that both firms be on their reaction functions!!!

In terms of P, note that they are the same product, customers don't really care about who sells the product: $p_1 = p_2 = p$

Firm 1's problem:

- $\max \Pi = p \times q_1 - c \times q_1 = [A - B \times (q_1 + q_2)] \times q_1 - c \times q_1$

$$\begin{aligned} FOC_{q_1} : p'_{q_1} \times q_1 + p - c = 0 \\ -Bq_1 + A - B(q_1 + q_2) - c = 0 \\ \text{Solve for } q_1 \\ q_1 = \frac{A-c}{2B} - \frac{q_2}{2} = q_1(q_2) \end{aligned}$$

q_1 is thus the reaction function (best response function)