

# Economics 101A

## (Lecture 25)

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## Outline

1. Oligopoly: Stackelberg
2. General Equilibrium: Introduction
3. Edgeworth Box: Pure Exchange
4. Barter

# 1 Oligopoly: Stackelberg

- Setting as in problem set.
- 2 Firms
- Cost:  $c(y) = cy$ , with  $c > 0$
- Demand:  $p(Y) = a - bY$ , with  $a > c > 0$  and  $b > 0$
- Difference: Firm 1 makes the quantity decision first
- Use subgame perfect equilibrium

- Solution:
- Solve first for Firm 2 decision as function of Firm 1 decision:

$$\max_{y_2} (a - by_2 - by_1^*) y_2 - cy_2$$

- F.o.c.:  $a - 2by_2^* - by_1^* - c = 0$
- Firm 2 best response function:

$$y_2^* = \frac{a - c}{2b} - \frac{y_1^*}{2}.$$

- Firm 1 takes this response into account in the maximization:

$$\max_{y_1} (a - by_1 - by_2^*(y_1)) y_1 - cy_1$$

or

$$\max_{y_1} \left( a - by_1 - b \left( \frac{a - c}{2b} - \frac{y_1}{2} \right) \right) y_1 - cy_1$$

- F.o.c.:

$$a - 2by_1 - \frac{(a - c)}{2} + by_1 - c = 0$$

or

$$y_1^* = \frac{a - c}{2b}$$

and

$$y_2^* = \frac{a - c}{2b} - \frac{y_1^*}{2} = \frac{a - c}{2b} - \frac{a - c}{4b} = \frac{a - c}{4b}.$$

- Total production:

$$Y_D^* = y_1^* + y_2^* = 3 \frac{a - c}{4b}$$

- Price equals

$$p^* = a - b \left( \frac{3a - c}{4b} \right) = \frac{1}{4}a + \frac{3}{4}c$$

- Compare to monopoly:

$$y_M^* = \frac{a - c}{2b}$$

and

$$p_M^* = \frac{a + c}{2}.$$

- Compare to Cournot:

$$Y_D^* = y_1^* + y_2^* = 2 \frac{a - c}{3b}$$

and

$$p_D^* = \frac{1}{3}a + \frac{2}{3}c.$$

- Compare with Cournot outcome

- Firm 2 best response function:

$$y_2^* = \frac{a - c}{2b} - \frac{y_1^*}{2}$$

- Firm 1 best response function:

$$y_1^* = \frac{a - c}{2b} - \frac{y_2^*}{2}$$

- Intersection gives Cournot

- Stackelberg: Equilibrium is point on Best Response of Firm 2 that maximizes profits of Firm 1
- Plot iso-profit curve of Firm 1:

$$\bar{\pi}_1 = (a - c) y_1 - b y_1 y_2 - b y_1^2$$

- Solve for  $y_2$  along iso-profit:

$$y_2 = \frac{a - c}{b} - y_1 - \frac{\bar{\pi}_1}{b y_1}$$

- Iso-profit curve is flat for

$$\frac{dy_2}{dy_1} = -1 + \frac{\bar{\pi}}{b (y_1)^2} = 0$$

or

$$y_1 =$$



Figure

## 2 General Equilibrium: Introduction

- So far, we looked at consumers
  - Demand for goods
  - Choice of leisure and work
  - Choice of risky activities
  
- We also looked at producers:
  - Production in perfectly competitive firm
  - Production in monopoly
  - Production in oligopoly

- We also combined consumers and producers:
  - Supply
  - Demand
  - Market equilibrium
- Partial equilibrium: one good at a time
- General equilibrium: Demand and supply for all goods!
  - supply of young worker $\uparrow$   $\implies$  wage of experienced workers?
  - minimum wage $\uparrow$   $\implies$  effect on higher earners?
  - steel tariff $\uparrow$   $\implies$  effect on car price

### 3 Edgeworth Box: Pure Exchange

- Nicholson, Ch. 12, pp. 335–338, 369–370 [OLD: Ch. 16, pp. 422-425]
- 2 consumers in economy:  $i = 1, 2$
- 2 goods,  $x_1, x_2$
- Endowment of consumer  $i$ , good  $j$ :  $\omega_j^i$
- Total endowment:  $(\omega_1, \omega_2) = (\omega_1^1 + \omega_1^2, \omega_2^1 + \omega_2^2)$
- No production here. With production (as in book),  $(\omega_1, \omega_2)$  are optimally produced

- Edgeworth box
- Draw preferences of agent 1
- Draw preferences of agent 2

- Consumption of consumer  $i$ , good  $j$ :  $x_j^i$

- Feasible consumption:

$$x_i^1 + x_i^2 \leq \omega_i \text{ for all } i$$

- If preferences monotonic,  $x_i^1 + x_i^2 = \omega_i$  for all  $i$
- Can map consumption levels into box

## 4 Barter

- Consumers can trade goods 1 and 2
- Allocation  $((x_1^{1*}, x_2^{1*}), (x_1^{2*}, x_2^{2*}))$  can be outcome of barter if:

- **Individual rationality.**

$$u_i(x_1^{i*}, x_2^{i*}) \geq u_i(\omega_1^i, \omega_2^i) \text{ for all } i$$

- **Pareto Efficiency.** There is no allocation  $((\hat{x}_1^1, \hat{x}_2^1), (\hat{x}_1^2, \hat{x}_2^2))$  such that

$$u_i(\hat{x}_1^i, \hat{x}_2^i) \geq u_i(x_1^{i*}, x_2^{i*}) \text{ for all } i$$

with strict inequality for at least one agent.

- Barter outcomes in Edgeworth box
- Endowments  $(\omega_1, \omega_2)$
- Area that satisfies individual rationality condition
- Points that satisfy pareto efficiency
- **Pareto set.** Set of points where indifference curves are tangent



- **Contract curve.** Subset of Pareto set inside the individually rational area.
- Contract curve = Set of barter equilibria
- Multiple equilibria. Depends on bargaining power.
- Bargaining is time- and information-intensive procedure
- What if there are prices instead?

## 5 Next lecture

- Example of General equilibrium
- General Equilibrium with Prices