Economics 101A
(Lecture 25)

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Outline

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

1 Oligopoly: Stackelberg

- Cost: $c(y) = cy$, with $c > 0$

- Demand: $p(Y) = a - bY$, with $a > c > 0$ and $b > 0$

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

- Total production:

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

- Price equals

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

- 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$\uparrow \Longrightarrow$ wage of experienced workers?
  - minimum wage$\uparrow \Longrightarrow$ effect on higher earners?
  - steel tariff$\uparrow \Longrightarrow$ 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: ω_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), (ω_1, ω_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 $\left((x_1^{1*}, x_2^{1*}), (x_1^{2*}, x_2^{2*})\right)$ 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 $\left((\hat{x}_1^1, \hat{x}_2^1), (\hat{x}_1^2, \hat{x}_2^2)\right)$ 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 (ω_1, ω_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 Walrasian Equilibrium

- Prices p_1, p_2

- Consumer 1 faces a budget set:

$$p_1 x_1^1 + p_2 x_2^1 \leq p_1 \omega_1^1 + p_2 \omega_2^1$$

- How about consumer 2?

- Budget set of consumer 2:

$$p_1 x_1^2 + p_2 x_2^2 \leq p_1 \omega_1^2 + p_2 \omega_2^2$$

or (assuming $x_i^1 + x_i^2 = \omega_i$)

$$p_1(\omega_1 - x_1^1) + p_2 \left(\omega_1 - x_2^1\right) \leq p_1 \left(\omega_1 - \omega_1^1\right) + p_2 \left(\omega_2 - \omega_2^1\right)$$

or

$$p_1 x_1^1 + p_2 x_2^1 \geq p_1 \omega_1^1 + p_2 \omega_2^1$$

- **Walrasian Equilibrium.** $\Big((x_1^{1*}, x_2^{1*}), (x_1^{2*}, x_2^{2*}), p_1^*, p_2^*\Big)$ is a Walrasian Equilibrium if:

  – Each consumer maximizes utility subject to budget constraint:

$$\begin{aligned} (x_1^{i*}, x_2^{i*}) &= \arg\max_{x_1^i, x_2^i} u_i\Big((x_1^i, x_2^i\Big) \\ s.t.\ p_1^* x_1^i + p_2^* x_2^i &\leq p_1^* \omega_1^i + p_2^* \omega_2^i \end{aligned}$$

  – All markets clear:

$$x_j^{1*} + x_j^{2*} \leq \omega_j^1 + \omega_j^2 \text{ for all } j.$$

- Compare with partial (Marshallian) equilibrium:
  - each consumer maximizes utility
  - market for good i clears.
  - (no requirement that all markets clear)

- How do we find the Walrasian Equilibria?

6 Next lecture

- Example of General equilibrium

- General Equilibrium with Prices