Outline

1. Producer Surplus

2. Consumer Surplus

3. Market Equilibrium in The Long-Run
1 Welfare: Producer Surplus

- Nicholson, Ch. 11, pp. 371-374 (Ch. 9, pp. 261–263, 9th)

- Producer Surplus is easier to define:

\[ \pi(p, y_0) = py_0 - c(y_0). \]

- Can give two graphical interpretations:

  - Interpretation 1. Rewrite as

    \[ \pi(p, y_0) = y_0 \left( p - \frac{c(y_0)}{y_0} \right). \]

    - Profit equals rectangle of quantity times (p - Av. Cost)
• **Interpretation 2.** Remember:

\[ f(x) = f(0) + \int_0^x f'(s) \, ds. \]

• Rewrite profit as

\[
\left[ p \ast 0 + p \int_0^{y_0} 1 \, dy \right] - \left[ c(0) + \int_0^{y_0} c'_y(y) \, dy \right] = \\
= \int_0^{y_0} \left( p - c'_y(y) \right) \, dy - c(0).
\]

• Producer surplus is area between price and marginal cost (minus fixed cost)
2 Welfare: Consumer Surplus

- Nicholson, Ch. 5, pp. 165-169 (Ch. 5, pp. 145–149, 9th)

- Welfare effect of price change from $p_0$ to $p_1$

- Proposed measure:

$$e(p_0, u) - e(p_1, u)$$

- Can rewrite expression above as

$$e(p_0, u) - e(p_1, u) = \left( e(0, u) + \int_0^{p_0} \frac{\partial e(p, u)}{\partial p} dp \right) - \left( e(0, u) + \int_0^{p_1} \frac{\partial e(p, u)}{\partial p} dp \right)$$

$$= \int_{p_0}^{p_1} \frac{\partial e(p, u)}{\partial p} dp$$

- What is $\frac{\partial e(p, u)}{\partial p}$?
• Remember envelope theorem...

\[ \frac{\partial e(p, u)}{\partial p} = h(p, u) \]

• Welfare measure is integral of area to the side of Hessian compensated demand

• Graphically,
• Example of welfare effects: Imposition of Tax

• Welfare before tax

• Welfare after tax
3 Market Equilibrium in the Long-Run

- Nicholson, Ch. 12, pp. 406-417 (Ch. 10, pp. 295–306, 9th)

- So far, short-run analysis: no. of firms fixed to $J$

- How about firm entry?

- Long-run: free entry of firms

- When do firms enter? When positive profits!

- This drives profits to zero.
• Entry of one firm on industry supply function $Y^S_t (p, w, r)$ from period $t - 1$ to period $t$:

$$Y^S_t (p, w, r) = Y^S_{t-1} (p, w, r) + y (p, w, r)$$

• Supply function shifts to right and flattens:

$$Y^S_t (p, w, r) = Y^S_{t-1} (p, w, r) + y (p, w, r) > Y^S_{t-1} (p, w, r)$$

for $p$ above $AC$ since $y (p, w, r) > 0$ on the increasing part of the supply function.

• Also:

$$Y^S_t (p, w, r) = Y^S_{t-1} (p, w, r)$$

for $p$ below $AC$ since for $p$ below $AC$ the firm does not produce ($y (p, w, r) = 0$).
• Flattening:

\[
\frac{\partial Y_t^S (p, w, r)}{\partial p} = \frac{\partial Y_{t-1}^S (p, w, r)}{\partial p} + \frac{\partial y (p, w, r)}{\partial p}
\]

\[
> \frac{\partial Y_{t-1}^S (p, w, r)}{\partial p} \quad \text{for } p \text{ above } AC
\]

since \( \frac{\partial y (p, w, r)}{\partial p} > 0 \).

• Also:

\[
\frac{\partial Y_t^S (p, w, r)}{\partial p} = \frac{\partial Y_{t-1}^S (p, w, r)}{\partial p} \quad \text{for } p \text{ below } AC
\]

• Profits go down since demand curve downward-sloping
• In the long-run, price equals minimum of average cost

• Why? Entry of new firms as long as $\pi > 0$

• $(\pi > 0$ as long as $p > AC)$

• Entry of new firm until $\pi = 0 \implies$ entry until $p = AC$

• Also:

$$\text{If } C''(y) = \frac{C(y)}{y}, \text{ then } \frac{\partial C(y)}{\partial y} = 0$$
• Graphically,
• Special cases:

• **Constant cost industry**

• Cost function of each company does not depend on number of firms
• **Increasing cost industry**

• Cost function of each company increasing in no. of firms

• Ex.: congestion in labor markets
• Decreasing cost industry

• Cost function of each company decreasing in no. of firms

• Ex.: set up office to promote exports
4 Next Lecture

- Market Power
- Monopoly
- Price Discrimination
- Then... Game Theory