Outline

1. Response to Taxes II

2. Market Equilibrium in The Long-Run

3. Producer Surplus

4. Consumer Surplus
1 Response to taxes II

• Supply: $Y_i^S(p_i - t, w, r)$, Demand: $X_i^D(p, M)$

$$Y_i^S(p_i - t, w, r) - X_i^D(p, M) = 0$$

• Comparative statics:

$$\frac{\partial p^*}{\partial t} = -\frac{\frac{\partial Y^S}{\partial p}}{\frac{\partial Y^S}{\partial p} - \frac{\partial X^D}{\partial p}} = \frac{-\frac{\partial Y^S}{\partial p} \frac{p}{X}}{\left(\frac{\partial Y^S}{\partial p} - \frac{\partial X^D}{\partial p}\right) \frac{p}{X}} = \frac{\varepsilon_{S,p}}{\varepsilon_{S,p} - \varepsilon_{D,p}}$$

• How about price received by suppliers $p^* - t$?

$$\frac{\partial (p^* - t)}{\partial t} = \frac{\frac{\partial Y^S}{\partial p}}{\frac{\partial Y^S}{\partial p} - \frac{\partial X^D}{\partial p}} - 1 = \frac{\varepsilon_{D,p}}{\varepsilon_{S,p} - \varepsilon_{D,p}}$$
• *Inflexible Supply.* (Capacity is fixed) Supply curve vertical ($\varepsilon_{S,p} = 0$)

• Producers bear burden of tax

• *Flexible Supply.* (Constant Returns to Scale) Supply curve horizontal ($\varepsilon_{S,p} \to \infty$)

• Consumers bear burden of tax
• **Inflexible demand.** Demand curve vertical \((\varepsilon_{D,p} = 0)\)?

• Consumers bear burden

• General lesson: Least elastic side bears larger part of burden

• What happens with a subsidy \((t < 0)\)?

• What happens to quantity sold?

• Use demand curve:

\[
\frac{\partial X^{D*}}{\partial t} = \frac{\partial X^{D*}}{\partial p^*} \frac{\partial p^*}{\partial t}
\]

and use expression for \(\partial p^*/\partial t\) above.
2 Market Equilibrium in the Long-Run

- Nicholson, Ch. 10, pp. 295–306 [OLD: Ch. 14, pp. 382–394]

- 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 $Y^S_S (p, w, r)$ 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:

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

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

for \( p \) above \( AC \)

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

• Also:

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

for \( p \) 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
3 Welfare: Producer Surplus

- Nicholson, Ch. 9, pp. 261–263 [OLD: Ch. 13, pp. 350–351]

- Producer Surplus is easier to define:

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

- Can give two graphical interpretations:

1. Rewrite as

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

   Profit equals rectangle of quantity times \((p - \text{Av. Cost})\)
2. Remember:

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

Rewrite profit as

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

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

- Nicholson, Ch. 5, pp. 145–149 [OLD: Ch. 5, pp. 139–143]

- Evaluate welfare effects of price change from $p_0$ to $p_1$

- Proposed measure:

  \[e(p_0, u) - e(p_1, u)\]

- Can rewrite expression above as

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


• 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 Hicsian compensated demand

• Graphically,
5 Next Lecture

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