Economics 326: Long and Short Run Equilibria and Welfare

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Outline

1. Short and Long Run Equilibria
2. Consumer and Producer Surplus
3. Government Price Setting
4. Government Quantity Setting: Quotas
5. Maximizing Surplus

1 Short and Long Run Equilibria

- What is the difference?

1. In the short run, some factors may be fixed for the firm - thus the individual firm supply function may look different

2. In the short run, the number of firms who have entered may earn profits. In the long run, this will lead to entry (given the free entry assumption) which will lead profits to go to zero.

- For the most part, we will not focus on (1.). With (2.), the main difference is that

  1. In the short run, the number of firms (J), is a fixed exogenous parameter

  2. In the long run, the number of firms (J), is an endogenous variable

- Lets consider a specific problem. Lets try to solve for a price and quantity determined in a competitive

market. In theory, we could start from a production function, factor prices, a utility function, income and prices of goods other than the one in consideration. We also start with a set of consumers: N and firms: J (in the long run J will be an endogenous variable, in the short run, it will be an exogenous parameter).

- We could then derive Marshallian Demand:

$$X_D^* \left(p_X, p_Y, I \right)$$

- We could then derive Supply Functions:

$$X_S^*(p_X, w, r)$$

1. First we would derive input demand functions:

$$K^* \left(p, w, r \right), L^* \left(p, w, r \right)$$

2. Then we could form supply:

$$Y^* \left(K^* \left(p, w, r \right), L^* \left(p, w, r \right) \right)$$

when profits are positive or price is above average cost: $p > AC$.

Alternatively, we could:

1. Minimize costs subject to an output constraint to find minimized cost functions:

$$C^*(q, w, r)$$

2. Derive supply as the marginal cost curve above average cost: $\frac{\partial C^*}{\partial q}$ for $p > AC$

– We then construct industry supply and market demand functions

– We then impose market clearing and set supply equal to demand so that we can solve for price:

$$NX^*_{D,M}(p_X, p_Y, I) = JX^*_S(p_X, w, r)$$

– We then can plug price into either supply or demand to get quantity:

$$X^*_D(p^{eq}_x, p_y, I)$$

– For short run analysis, we are done. For long run analysis, we need to figure out the number of firms that enter. We do this by solving for a number of firms: J such that profits are zero: $p = AC$:

$$p^*(J) = \frac{2q^{*2}(J) + 20}{q^*(J)}$$

- To make things easy, we will start with individual firm cost functions and market demand functions (if we started with individual demand functions, we would have to aggregate to market demand):

$$\begin{aligned} X_D^* &= 100 - 2p_X \\ C(q) &= 2q^2 + 32 \end{aligned}$$

also we assume that the number of firms in the short run is $J = 8$.

- First we derive the short run supply curve. This is the same as the marginal cost curve where price is

above average cost:

$$\begin{aligned} \frac{\partial C}{\partial q} &= 4q = p_X \\ q &= \frac{p_X}{4} \end{aligned} \tag{1}$$

- Now we generate industry supply:

$$q = \sum_{j=1}^{J} \frac{p_X}{4} = \frac{Jp_X}{4} = \frac{8p_X}{4} = 2p_X$$

- Finally, we equate industry supply with market demand and solve first for the price:

$$\begin{aligned} q_S \quad = \quad & 2p_X = 100 - 2p_X = q_D \\ \Longrightarrow \quad & 4p_x = 100 \\ \Longrightarrow \quad & p_X = 25 \end{aligned}$$

and then for quantity by plugging the equilibrium price, p_X, into either supply or demand:

$$\begin{aligned} q_S \quad &= \quad 2p_X = 2 * 25 = 50 \\ \text{note} \quad &: \quad q_D = 100 - 2p_X = 100 - 2 * 25 = 50 \end{aligned}$$

why do we get the same answer for q_S and q_D?

- We should also check that profits are greater than zero (or price is above average cost):

$$\begin{aligned} pq - C(q) &> 0 \\ \text{or } p &> \frac{C(q)}{q} \end{aligned}$$

To check this, we first have to solve for individual firm supply. Since market supply is 50 and there are 8 firms, individual supply is $\frac{50}{8} = 6\frac{1}{4}$. Since price must be greater than average cost in order to cover fixed cost and since the firm will equate price with marginal cost, in this case we get from equation (1) :

$p_X = 4q$. So $4q$ must be greater than average cost:

$$\begin{aligned} 4q &> \frac{2q^2 + 32}{q} \\ \implies & \quad 4q > 2q + \frac{32}{q} \\ \implies & \quad 2q > \frac{32}{q} \\ \implies & \quad q^2 > 16 \\ \implies & \quad q > 4 \end{aligned}$$

so 4 is the minimum profitable scale of production for an optimizing firm. When individual firms optimally choose to produce 4 units of production, they will get a price to just cover their costs.

- In the long run, then, firms enter until the price drops so that each firm is producing 4 units. So the price drops so that quantity per firm is 4. We can solve for this price by using the our expression for optimal quantity given price (supply) - i.e. we can figure

out the price that would make individual firm supply equal to 4 :

$$q_S = \frac{p_X}{4} = 4 \implies p_X = 16$$

- Finally, we can use the supply equation to determine how many firms will enter in order for the price to reach 16 :

$$\begin{array}{rcl} q_S & = & 100 - 2p_X \\ 4J & = & 100 - 32 = 68 \\ & \implies & J = 17 \end{array}$$

2 Producer and Consumer Surplus

2.1 Producer Surplus

- Producer Surplus is easier to define:

$$\pi\left(p, y_0\right) = py_0 - c\left(y_0\right).$$

- 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 - Av. Cost)

2. Remember:

$$f(x) = f(0) + \int_0^x f'_x(s)\, ds.$$

Rewrite profit as

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

$$= \int_0^{y_0} \left(p - c'_y(y)\right) dy - c(0).$$

Producer surplus is area between price and marginal cost (minus fixed cost)

3 Welfare: Consumer Surplus

- 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

$$\begin{aligned} E(p_0, u) - E(p_1, u) &= \left(E(0, u) + \int_0^{p_0} \frac{\partial E(p, u)}{\partial p} dp \right) - \\ &\quad \left(E(0, u) + \int_0^{p_1} \frac{\partial E(p, u)}{\partial p} dp \right) \\ &= \int_{p_1}^{p_0} \frac{\partial E(p, u)}{\partial p} dp \end{aligned}$$

- What is $\frac{\partial E(p,u)}{\partial p}$?

- Remember the envelope theorem:

$$\frac{\partial E^*}{\partial p_X} = \frac{\partial \left[p_X X_H^* + p_Y Y_H^* \right]}{\partial p_X} = X_H^*$$

- Result:

$$\frac{\partial e(p,u)}{\partial p} = X_H^*(p,u)$$

- Welfare mesure is integral of area to the side of Hicksian compensated demand
  - Note that this is a problem to estimate empirically because we don't observe Hicksian Demand.

- Show graph.

4 Government Price Setting

- What happens when the government sets a price floor (minimum wage)?
  - Not Binding - Nothing
  - Binding - quantity transacted in the market is equal to the minimum of supply and demand at the price floor

- What happens when the government sets a price ceiling (rent cap)?
  - Not Binding - Nothing
  - Binding - quantity transacted in the market is equal to the minimum of supply and demand at the price ceiling

- Show graphs

5 Government Quantity Setting

- What happens when the government sets a quantity restriction (i.e. on imports or on production)
  - Not Binding - Nothing
  - Binding - Quantity is produced at that level and price is Demand-determined

6 Puzzle

- Minimum Wage:
  - Empirical estimates of the impact of a rise in the minimum wage on employment are small.
  - Since with a binding minimum wage, there should be an excess supply of labor, employment should be demand-determined.

  - Thus the small response of employment to the wage tells us that labor demand is relatively inelastic for low-wage workers.

- Immigration:
  - Empirical estimates of an increase in immigration is like a shifting out of the labor supply curve.
  - The reaction of the wage should depend upon the elasticitity of labor demand.
  - Empirical estimates suggest that immigration has a small impact even on wages of non-high school graduates.
  - This suggests that labor demand elasticities are high!
  - Contradiction!!

- What's the resolution of this paradox?

- Economists aren't sure. A couple of possibilities lie in two areas of economics

  1. Search theory (where firms and workers - or firms and consumers) have to find eachother by searching - in these models, supply doesn't equal demand.

  2. Behavioral theory (where wages are determined by beliefs and these beliefs shift when prices change)

7 Maximizing Surplus

- The sum of consumer plus producer surplus is maximized at the market clearing price.

- We can see this graphically.

- Consumer and producer surplus are used standardly in policy analysis but:

    1. Weighs rich people more than poor people (greater willingness to pay)

    2. Weighs producers more than most consumers

    3. Uses the area under the Marshallian instead of the Hicksian as a measure of Consumer Surplus

- Question: what happens with rent control? Show graph.