ECON 100A - Section Notes
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Partial Equilibirum under Perfect Competition

1. Market Equilibrium. In a perfectly competitive market, equilibrium occurs where quantity demanded equals quantity supplied:

$$Q_D(P) = Q_S(P).$$

Solving for P^* gives the equilibrium price; plug into either function to find Q^*. Consumer surplus (CS) and producer surplus (PS) are the areas between price and their respective curves:

$$CS = \int_{P^*}^{P_{\max}} Q_D(P)\,dP, \qquad PS = \int_{P_{\min}}^{P^*} Q_S(P)\,dP.$$

A *price ceiling* ($P_C < P^*$) creates excess demand and may cause deadweight loss. A per-unit tax t shifts the supply: $Q_S = f(P_S - t)$.

2. Firm Behavior in Perfect Competition. Each firm takes price p as given and chooses output y to maximize profit:

$$\pi(y) = py - c(y), \quad \text{with first-order condition } p = MC(y) = c'(y).$$

Average cost and average variable cost are

$$AC(y) = \frac{c(y)}{y}, \qquad AVC(y) = \frac{c(y) - \text{FC}}{y}.$$

The firm produces only if $p \geq AVC(y)$ (*shutdown condition*). In the long run, free entry drives $\pi = 0$, so

$$p = AC(y^*) = MC(y^*).$$

3. Returns to Scale and Cost Structure. Fixed cost (FC) is independent of output; variable cost (VC) depends on y. Marginal cost is the derivative of total cost, and the minimum of AC occurs where $MC = AC$.

Quick Reference.

$$MC(y) = c'(y), \qquad AC(y) = \frac{c(y)}{y},$$
$$\pi(y) = py - c(y), \qquad \text{Long run: } p = AC_{\min}.$$

Section Exercises

Take $\sim$ 15 minutes to work on these exercises individually, then turn to your neighbors and discuss your responses in small groups for a few minutes. We will then come together to work through them as a class, with groups sharing their progress/responses.

1. The demand curve for a product is given by $Q = 150 - 2P$. Starting from some original price, the price of the product goes up by 1%, and the quantity demanded falls by more than 2%. In what range must the original price have fallen? Show any calculations and explain your answer.

2. Consider a perfectly competitive market in which demand is given by

$$Q_D = 65 - P_D$$

and supply is given by

$$Q_S = 2P_S - 10.$$

   (a) What is the equilibrium price and quantity traded in this market?

   (b) Say that a price ceiling of \$20 is imposed (that is, this good cannot be traded at a price above \$20). How many units are traded? Sketch a diagram of this situation. Your diagram should show the demand and supply curves, including their intercepts, the equilibrium, and consumer surplus, producer surplus, and, if applicable, deadweight loss. (You don't have to calculate these; just show them on the diagram.)

   (c) How big of a per-unit tax would have to be placed on this good to have the same effect on quantity traded as the price ceiling from part (b)? Thinking in terms of surpluses, are consumers as a whole better off, worse off, or just as well off under the tax as they would be under the price ceiling? What about the same question for producers? Explain your answers.

   (d) Say that a price ceiling of \$30 is imposed. How many units are traded and why?

3. A firm in a perfectly competitive industry produces an output y that sells for $p = 35$ per unit. Its cost function is given by

$$c(y) = 25 + 5y + y^2.$$

   (a) What are the firm's fixed costs, and what are the firm's variable costs?

   (b) Find expressions for marginal cost and average cost.

   (c) Write the firm's profit function. Find the firm's optimal output y^*. What profit does the firm make?

   (d) Find the price in this industry in the long run.

   (e) Find the firm's optimal output if the price is at the long-run value you found in (d). What profit does the firm make?

4. A profit-maximizing firm in a perfectly competitive industry has a cost function

$$c(y) = 450 + 10y + \tfrac{1}{2}y^2.$$

The firm's average cost reaches a minimum at $y = 30$. The firm currently makes positive profit.

(a) Find expressions for the firm's average cost and marginal cost. Sketch their general shapes on the usual axes (the right general shape is enough for average cost, but make sure the curves are in the correct position relative to each other).

(b) What do we know about the price in this industry at the moment? What will be the price in this perfectly competitive industry in the long run? Explain your answers with reference to any assumptions of the perfectly competitive model that are important here.