Chapter 9: Perfectly competitive markets

1. Perfectly competitive markets
   A. key characteristics:
      • many buyers and sellers, none of which can affect prices of inputs or outputs
      • all firms produce the same ("undifferentiated") product
      • buyers and sellers have perfect information about prices
      • equal access to resources (no barriers to entry or exit)
   B. implications of these characteristics
      • buyers and sellers are price-takers
      • "law of one price" – all transactions at a given moment occur at the same price
      • "free entry" (no barriers to entry/exit)
   C. we assume that the firm's objective is to maximize economic profit:
      economic profit
      = revenue – economic costs (including all relevant opportunity costs)
      accounting profit
      = revenue – accounting costs
2. Profit-maximizing output choice
(relevant to any producer, perfectly-competitive or otherwise)

A. Profit = revenue – costs
so, to increase profit, take any action \textit{if}
  it raises revenue by more than costs
  or cuts revenue by less than costs

B. mathematically: \( \pi = TR - TC \)
and \( \pi = TR(Q) - TC(Q) \)
so profit maximization requires
(i) \underline{first-order condition}
  ("slope of profit function = zero")
\[
\frac{d\pi}{dQ} = \frac{dTR(Q)}{dQ} - \frac{dTC(Q)}{dQ} = 0
\]
\[
\Rightarrow \text{implies profit-maximizing level}
  \text{of } Q = Q^*
\]
(ii) \underline{second-order condition}
  ("at } Q^*, \text{ the profit maximum, the}
  \text{slope of profit function is decreasing")
\[
\frac{d^2\pi}{dQ^2} = \frac{d(d\pi/dQ)}{dQ} = \frac{d^2TR(Q)}{dQ^2} - \frac{d^2TC(Q)}{dQ^2} < 0
\]
C. application to perfect competition:
in perfect competition, \( TR = PQ \), and \( P \) is fixed by the market (firm is a price-taker)

**first-order condition:**
\[
\frac{d\pi}{dQ} = \frac{dTR(Q)}{dQ} - \frac{dTC(Q)}{dQ} = MR - MC
\]
\[
= P - MC = 0, \text{ or } P = MC
\]

**second-order condition:**
\[
\frac{d^2\pi}{dQ^2} = \frac{d^2TR(Q)}{dQ^2} - \frac{d^2TC(Q)}{dQ^2} = \frac{dMR}{dQ} - \frac{dMC}{dQ}
\]
\[
= \frac{dP}{dQ} - \frac{dMC}{dQ} < 0 \quad \Rightarrow \quad \frac{dMC}{dQ} > 0
\]
\[
\frac{dQ}{dQ} \quad \frac{dQ}{dQ}
\]

"increasing marginal cost"

\[ MC = \frac{dTc}{dQ} \]
\[ MR = \frac{dR}{dQ} = \frac{d(p,q)}{dQ} > P \]
3. Short-run equilibrium (w/fixed plant size)
   A. when all fixed costs are sunk costs: produce up to where \( P = MC \)
      caveat: never produce where \( P < AVC \) (i.e., where \( TR < TVC \)) -- can't even cover variable costs if this is true
      thus, firm's short-run supply curve is the SRMC curve above minimum AVC (= "shut-down price")

   \[ \begin{align*}
   &\text{MC} \\
   &\text{ATC} \\
   &\text{AVC}
   \end{align*} \]

   "Shut-down price"

   \[ \begin{align*}
   &Q_0 \\
   &Q
   \end{align*} \]

   B. if some fixed costs are nonsunk, add them to VC and proceed as above
   C. note that positive economic profit or loss is possible in the short run
   D. short run market supply = horizontal sum of individual firms' short run supply schedules
4. Comparative statics in the short run
A. at **given** market price, changes in MC (via input prices, taxes, etc.) will change firm's short-run profit-maximizing Q; in turn, this changes market supply, market price
B. e.g., higher wage or tax on output shifts MC curve up, reduces firm's Q*, shifts market supply to left, market price rises

5. Long-run equilibrium
A. In long run, firm can adjust its plant size **as well as** its level of output

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**FIGURE 9.13** Long-Run Output and Plant Size Adjustment by a Price-Taking Firm
A rose grower expects that the market price will be $0.40 per rose. At its existing plant size, represented by short-run marginal and average cost curves $SMC_0$ and $SAC_0$, the grower's profit-maximizing output is 18,000 roses per month. To maximize profit over the long run, the grower would increase output to 75,000 roses per month, the quantity at which the price $P$ equals the long-run marginal cost $MC$. To do so, the grower would expand its plant size to the cost-minimizing level represented by curves $SMC_1$ and $SAC_1$. 

B. long-run supply curve: MC curve above minimum AC and "spike" at $P < \text{min. AC}$

C. free entry and long-run equilibrium in perfect competition
- each firm picks plant size and output level to maximize its long-run profit
- each firm's economic profit is zero (new entrants "compete away" all positive or "excess" economic profits)
- market demand equals market supply

D. can't simply add firms' individual supply curves to get a long-run market supply curve, because number of firms changes in long run because of entry/exit of firms
e.g., *if* typical firm is as shown on the left, rise in demand pushes up price, attracts new entrants and drives price back down

6. **Constant-cost, increasing-cost, and decreasing-cost industries**
   A. do changes in industry output affect the prices of its inputs?
   if no: industry is constant-cost industry
   if yes: industry is an increasing-cost industry
       if higher industry Q causes higher industry input prices (e.g., "industry-specific inputs")
       industry is a decreasing-cost industry
       if higher industry Q causes lower industry input prices (e.g., computer chips?)
B. example: increasing-cost industry
increase in demand drives industry costs up for each individual firm, raises profits, attracts new entrants – new equilibrium has higher ATC for each individual firm

![Graph showing typical firm and market in an increasing-cost industry](image)

**FIGURE 9.19** Long-Run Industry Supply Curve in an Increasing-Cost Industry

C. example: decreasing-cost industry
increase in demand drives industry costs down for each individual firm, raises profits, attracts new entrants – new equilibrium has lower ATC for each individual firm

![Graph showing typical firm and market in a decreasing-cost industry](image)

**FIGURE 9.20** Long-Run Industry Supply Curve in a Decreasing-Cost Industry
7. Economic rent and producer surplus
   A. **Economic rent** = economic surplus due to an extraordinarily productive input whose supply is limited
      = maximum am't. the firm would be willing to pay for the input
      - reservation value of the input
         (reservation value = return for the input in its best alternative use, outside the industry)
   B. Economic rent is usually divided between the firm and the owner of the input i.e., economic rent = economic profit
      (captured by firm employing the input)
      + salary premium
         (captured by owner of the input)
      division of the rent depends on how mobile the input is
      e.g., if worker can move, his salary will be driven up and he captures all of the rent (firm's costs rise, its economic profit falls to zero)
   C. **Producer surplus**: difference between amount a firm actually receives from selling a good and the minimum it must receive in order to be willing to produce it
8. Producer surplus in the short run
   A. short run producer surplus for a firm
      = area below P but above MC curve,
      above the shut-down price
      (recall that MC = firm's supply curve!)
   B. when price rises, change in producer's
      surplus = change in economic profit
   C. area between short-run market supply
      curve and market price is the sum of the
      individual firms' producer surpluses

9. Producer surplus in the long run
   A. In long run, price-taker has P = LRATC
      and earns a zero economic profit
      so, long run producer surplus is zero too
   B. In an increasing-cost industry, area
      between P and market supply curve in
      long run measures economic rent to
      owners of scarce industry-specific inputs
      (economic profit is zero)