Chapter 8: Firms in Competitive Markets

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Learning Objectives

- Perfect Competition.
- Profit Maximization.
- Competition in the Short Run .
- Competition in the Long Run.

Market Structure

- Previous chapter we saw the cost side of profit; now we look at revenue ($P \cdot q$) part of the firm
- The price the firm charges depends on ***Market Structure***, the number of firms in the market, existence of free entry and exit from the market and the degree of product differentiation of these firms.
- ***Competitive market structure***: many firms produce identical products and firms can easily enter and exit the market.

Price Taking

- A market is competitive if each firm in the market is a price taker.
- While the market demand is downward slopping, the price taker firm faces a demand curve that is horizontal at the market price.
- While perfect competition doesn't exist in reality it is a benchmark from which other deviations can originate or are compared to

TR, AR, MR

- The following are true for a firm in any market structure:

$$TR \equiv P \cdot q$$

$$AR \equiv TR/q \equiv P \cdot q/q \equiv p$$

$$MR \equiv \frac{\Delta TR}{\Delta q}$$

- For a competitive firm

$$MR = P$$

Deviations from Perfect Competition ??

- ***Residual demand curve*** the market demand that is not met by other sellers at any given price.

$$D^r(p) = D(p) - s^i(p)$$

  - where $D^r(p)$= the firm's residual demand, $D(p)$ = market demand and $s^0(p)$= the other firms' supply.

- If the market has n identical firms, the elasticity of demand,ε_i , facing the Firm i is

$$\varepsilon_i = n\varepsilon - (n-1)\eta_0$$

- where ε is the market elasticity of demand (a negative number); η_0 is the elasticity of supply of each of the other firms (typically a positive number); and $n-1$ is the number of other firms.

Example: ??

- The Canadian metal chair manufacturing market has $n = 78$ firms. The estimated elasticity of supply is $\eta = 3.1$, and the estimated elasticity of demand is $\varepsilon = -1.1$. Assuming that the firms are identical, calculate the elasticity of demand facing a single firm. Is its residual demand curve highly elastic?

Two decisions of the firm:

1. Should the firm produce (shut down decision)
2. If it decide to produce, how much? (Output decision- marginal analysis)

Regarding the first, in the short run, the firm should produce (not shut down) if the revenue from producing that level of output at least covers its variable cost i.e.,
$TR \geq VC \Rightarrow P \geq AVC$

Supply decision of a competitive firm: Firm's Supply

- Given cost function, $c(q)$, a firm maximizes its profit

$$\min_{q} \quad \pi = pq - c(q)$$

$$\underrightarrow{F.O.C} : MR(q) = MC(q)$$

- But since $MR = P$ for competitive firm,

$$p = MC(q)$$

which yields the supply function, $q = S(p)$.

Two caveats

1. The solution must be at the upward-sloping part of MC curve (2nd order condition)
2. If $P \leq$ min AVC, then $q^* = 0$ is optimal– "Shutdown" situation in the SR (corner/boundery solution)

More about Shutdown

- Shutdown means that the fixed cost has to be incurred anyway

(i) SR: Shutdown is optimal if $p < min \quad AVC(q)$, which in this case the firm minimizes loss at $-FC$

(ii) LR: Exit is optimal if $p < min \quad AC(q)$

Numerical Example with typical cost curves (Optional)

Given a total cost of

$$C = q^3 - 8q^2 + 26q + 50,$$

which implies

$$MC = dC/dq = 3q^2 - 16q + 26;$$

$$AVC = VC/q = q^2 - 8q + 26;$$

$$AC = C/q = q^2 - 8q + 26 + 50/q$$

1. The minimum ATC occurs at $q = 5$, find the coordinates of minimum ATC, AVC curves
2. Find the optimal quantity, q^* and profit, π^* , at each of the following prices:

a.\$35 b. \$15 c. \$8

Numerical Example with linear MC, AVC curves

Given a total cost of

$$C = 2q^2 + 10q + 128,$$

which implies

$$MC = 4q + 10;$$

$$AVC = VC/q = 2q + 10;$$

$$AC = C/q = 2q + 10 + 128/q$$

1. Find the coordinates of Min AVC, ATC and MC curves and sketch their graphs
2. Find the optimal quantity, q^* and profit, π^* , at each of the following prices:

a.\$45 b. \$15 c. \$8 d. P (in general)

Short-Run Firm Supply Curve

- The competitive firm's short-run supply curve is its marginal cost curve above its minimum average variable cost.
- For the previous example, the SR firms supply curve in the indirect form is:

$$P = 4q + 10$$

  and in the 'direct form':

$$q = 0.25P - 2.5$$

- The market supply is the horizontal summation of all firms' supply curve

Short-Run Market (Industry) Supply Curve

- In the short run, the number of firms, N, is fixed because no firm can liquidate its fixed cost and enter or exit the market
- If all the firms in a competitive market are identical, each firm's supply curve is identical, then the market quantity supplied at each price is N times the quantity supplied by each firm. (horizontal summation- sum q at each price, not the other way around)
- Example: if each firm's MC is given by $MC = 4q + 10$, find the market supply function if there are $N = 1000$ firms in the industry

Quantity tax and short-run equilibrium

- A specific tax of t per unit shifts all per unit costs (ATC, MC and AVC) vertically by t and reduces output and raises prices in the market
- How would the incidence of the tax be distributed on buyers and sellers?

Long-Run Competitive Profit Maximization

- $P = MC$ is still the condition for profit maximization
- but in the LR no loss is tolerated (firms would exit) and a profit triggers entry of firms until profit is eliminated. So, the only profit possible in the LR is 0 (but why would firms stay in the industry for zero profit?)
- Thus, the profit maximization and zero profit implies:

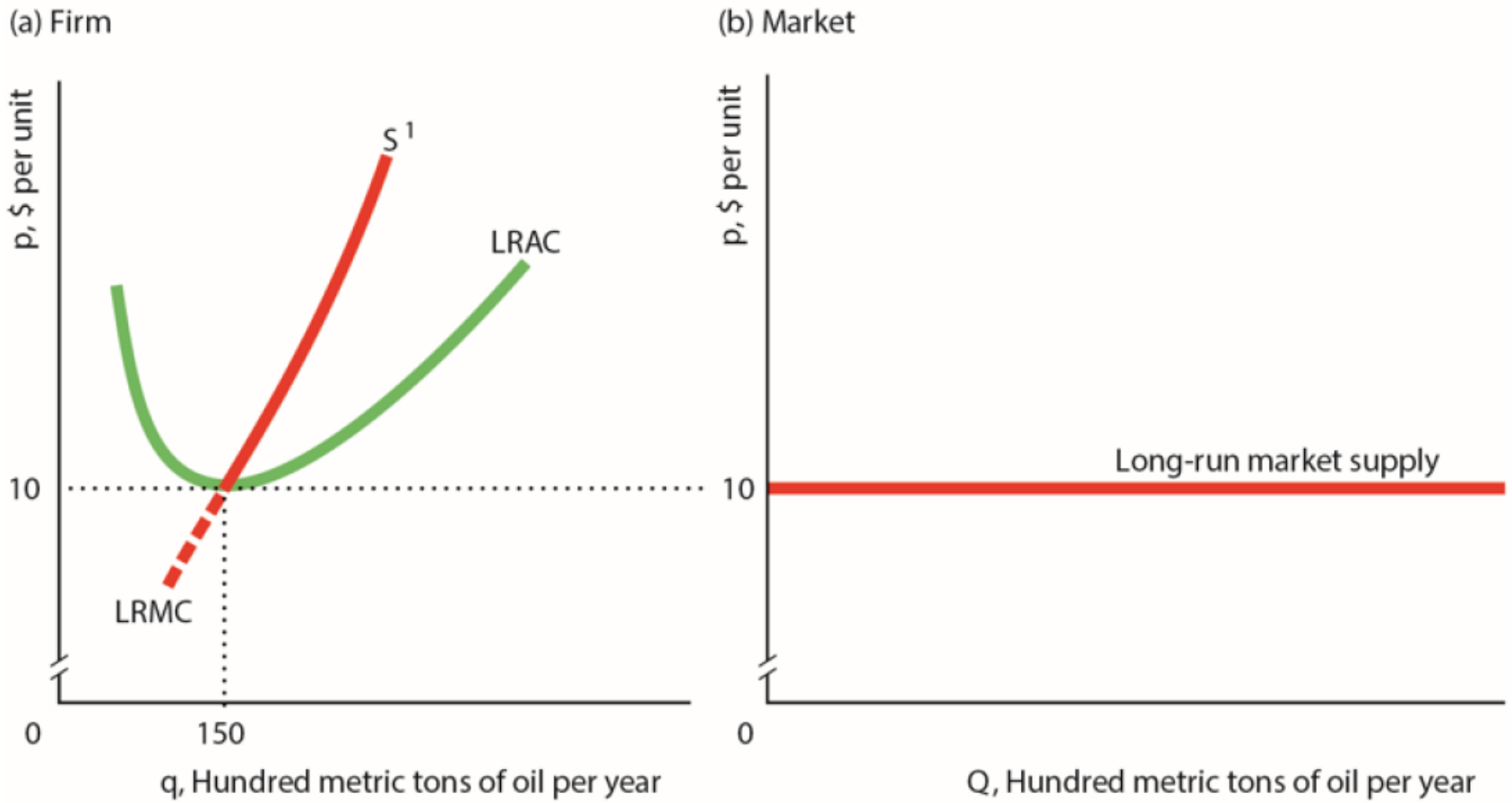
$$P = LRMC = LATC$$

- We know that this occurs at the minimum of LATC (LRMC = LATC only at the min of the latter)

Long-Run Market Supply Curve

- The competitive market supply curve is the horizontal sum of the supply curves of the individual firms in both the short run and the long run.
- In the long run, firms can enter or leave the market.
- Thus, before we can obtain the long-run market supply curve, we need to determine how many firms are in the market at each possible market price.

Long-Run Firm and Market Supply with Identical firms in Constant Cost Industry Industry



Numerical Example:

- For previous cost function, assuming that the industry is constant cost industry and the firms are identical

a. Find the LR eqm (find P, q, Q, N, π) if

$$Q_D = 488 - 4P$$

- Solution:

$$P = \text{ min ATC} = \$42$$

Since LR supply is horizontal at P.LR:

$$Q^* = 488 - 4(42) = 320$$

Since min AC occurs at q = 8 for each firm, $q^* = 8$ in the LR and hence

$$N_1 = Q^*/q^* = 320/8 = 40$$

and each firm's profit is $\pi = (P - ATC)q^* = (42 - 42) * 8 = 0$

Numerical Examples: Cont'd

Suppose now the govt imposes a \$5 per unit tax on each firm,

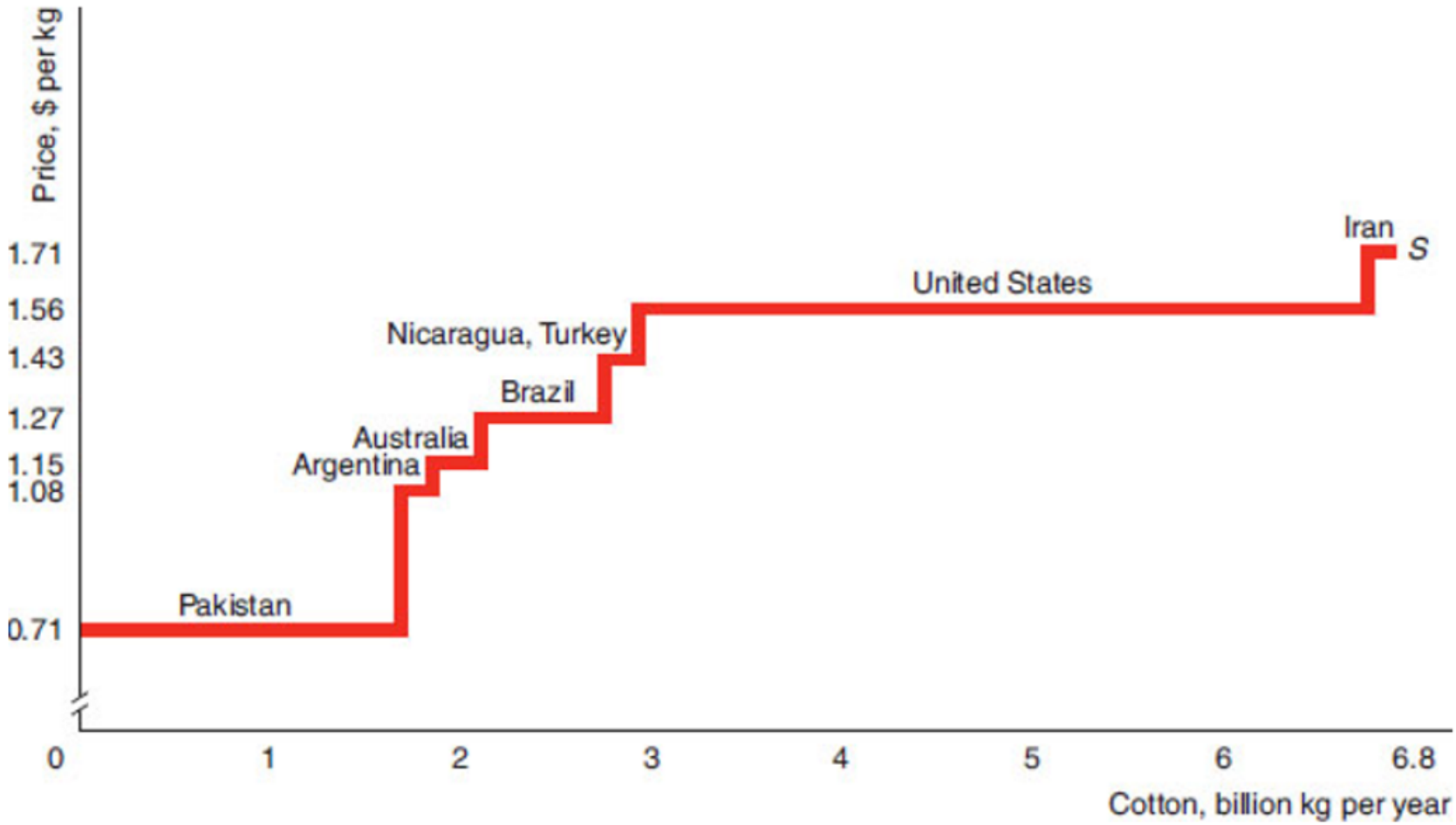
b. Find the SR eqm after tax is imposed (P, q, Q, N, π).

c. Find the LR eqm after the tax is imposed (P, q, Q, N, π).

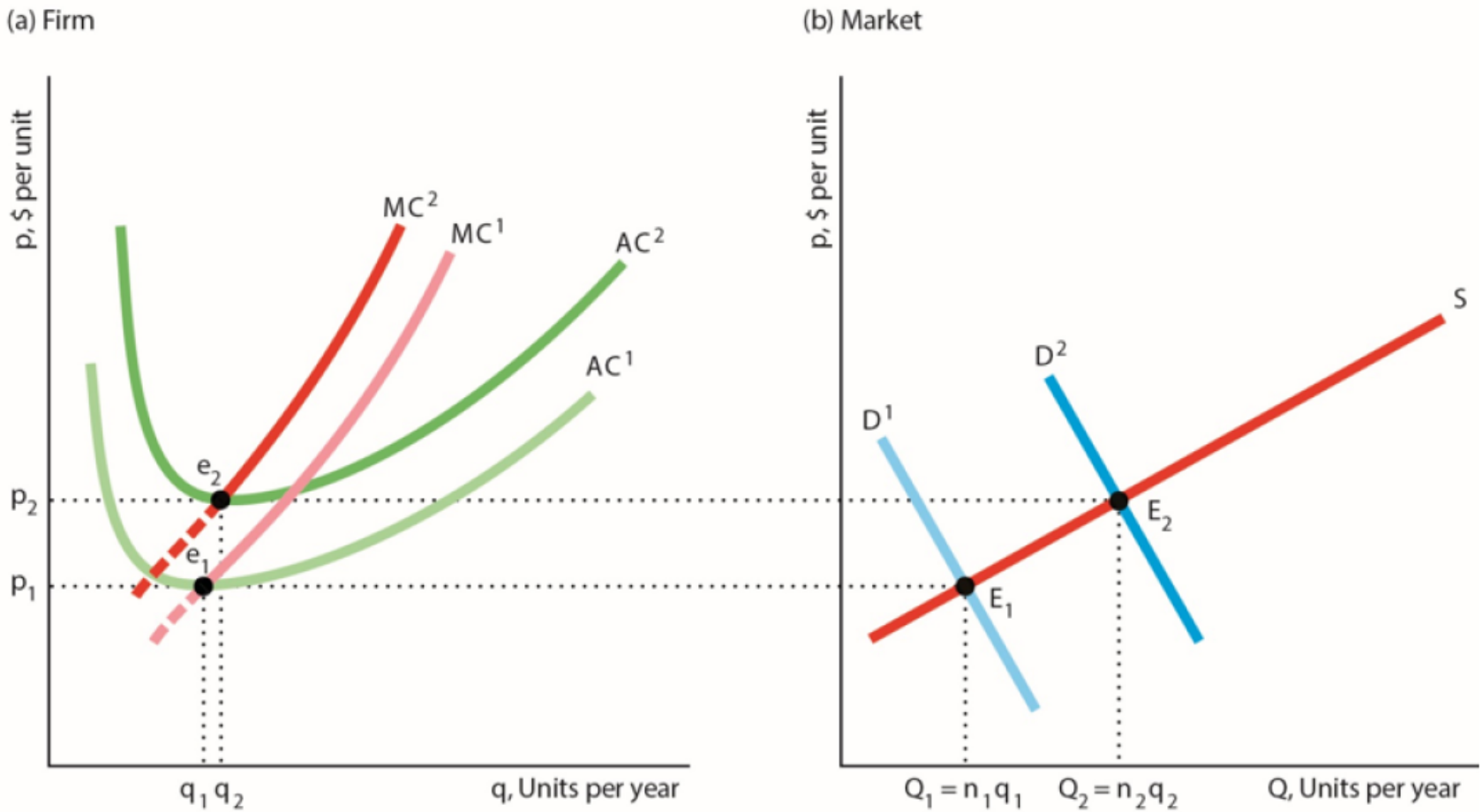
Why Long-Run Market Supply may be Upward Slopping

1. ***Limited Entry***: due to government restrictions, few firms owning a scarce resource, or entry if costly.
2. ***Not Identical Firms***: firms differ in their cost. (see the graph in the next slide)

Application: Upward-Sloping Long-Run Supply Curve for Cotton in the world



3. ***Increasing Cost Industry:*** input prices rise with entry of firms



4. Long-Run Market Supply Curve with a Large Buyer (*Optional*)

- Another reason why a market supply curve may slope upward is that a buyer, such as a country, demands a large share of a good sold in the market.
- Residual supply curve is the quantity that the market supplies that is not consumed by other buyers at any given price:

$$S^r(p) = S(p) - D^0(p)$$

- For Japan, for example, the residual supply of cotton it faces is the difference between the World's supply of cotton and the demand of the rest of the world- meaning that it can import as much as it can buy.

4. Long-Run Market Supply Curve with a Large Buyer (*Optional*)

- In terms of elasticity, this means

$$\eta_r = \frac{\eta}{\theta} - \frac{1-\theta}{\theta}\varepsilon_0$$

where θ is the importing country's share of the worlds output

Example:

- Suppose that the market supply elasticity, $\eta = 0.5$, the demand elasticity in other countries, $\varepsilon = -0.7$ (Green et al, 2005), which is virtually equal to ε_0.. The U.S. imports about $\theta = 0.1\% = .001$ of the world's cotton, so its residual supply elasticity is 1,199.3 (show using the above formula)

Downward Slopping LR Supply Curve?

- Possible if input prices decline with entry of firms (decreasing cost industry (DCI))
- DCI is possible if the production of inputs exhibit economies of scale such as the production of computer chips

SUMMARY

- Profit maximization for any market structure: $MR = MC$
- Perfect competition: $P \equiv MR$ hence $P = MC$
- Recall, MC is cost of producing the marginal unit; P is value to buyers of the marginal unit.
- So, the Competitive eq'm is efficient (maximizes total surplus)