

# 1 Supply in a competitive industry

- In a competitive industry, a competitive firm does not expect its output decision to affect the price of output in the industry,  $p$ .
- Let  $q$  be the output of a competitive firm. The long run cost curve of the firm is  $LC(q)$ :

$$\begin{aligned} LC(q) &= \min_{K,L} rK + wL \quad \text{s.t.} \quad f(K, L) \geq q \\ &= rK^{LR}(q, r, w) + wL^{LR}(q, r, w) \\ &= LVC(q) \end{aligned}$$

- The short run cost curve is  $SC(q, K_0)$ :

$$\begin{aligned} SC(q, K_0) &= \min_L rK_0 + wL \quad \text{s.t.} \quad f(K_0, L) \geq q \\ &= rK_0 + wL^{SR}(q, K_0, w) \\ &= FC + SVC(q) \end{aligned}$$

Sometimes we write  $SC(q)$  because  $K_0$  is fixed.

- In this lecture, we will hold input prices fixed. So we are only interested in the relationship between  $p$  and  $q$ , in the long run and in the short run.
- With cost curve  $C(q)$ , the firm chooses  $q$  to maximize output:

$$\begin{aligned}\max_q \pi(q) &= pq - C(q) \\ &= R(q) - C(q)\end{aligned}$$

In the long run,  $C(q) = LC(q)$ . In the short run,  $C(q) = SC(q)$ .

- For a competitive firm,  $R(q)$  is linear in  $q$ . So marginal revenue,  $MR(q) = p$ .
- Let  $MC(q)$  be the marginal cost curve for the firm. We expect  $MC(q)$  to be increasing in  $q$ . Why?
- A necessary condition for profit maximization is:

$$MR(q) = p = MC(q)$$

- Explain why  $p = MC(q)$  is necessary. Consider an initial level of output  $q_0$ . The firm wants to know if it should increase output by  $\Delta$  marginal units.

- The increase in cost is

$$MC(q_0)\Delta$$

- The increase in revenue is

$$p\Delta$$

- The increase in profits is

$$p\Delta - MC(q_0)\Delta = (p - MC(q_0))\Delta$$

- Firm is at a local maximum if

$$p - MC(q_0) = 0$$

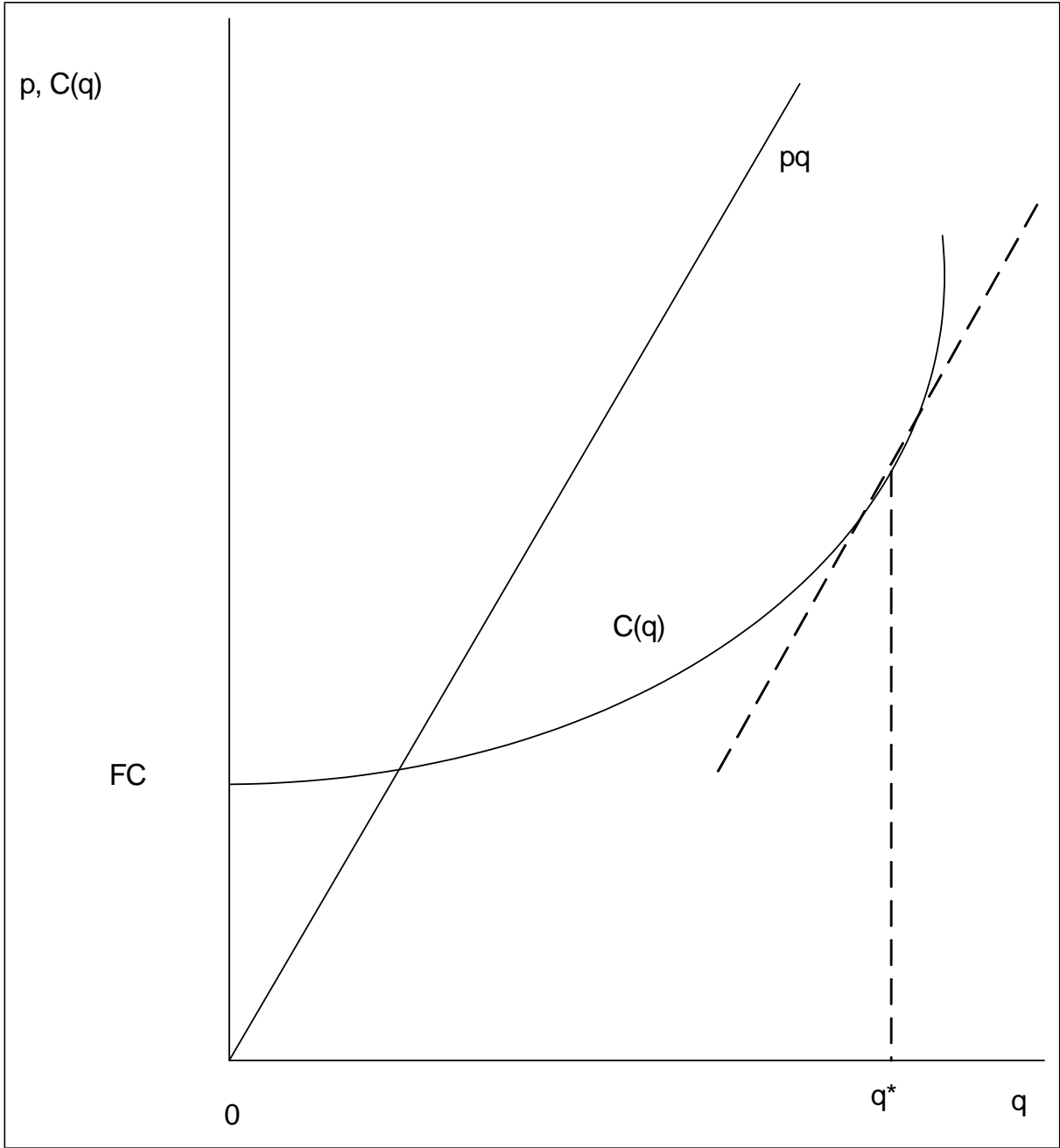
- But what if

$$\pi(q_0) = \pi_0 < 0$$

In this case, it must also evaluate

$$\pi(0)$$

- There are two cases, the long run,  $LR$ , and the short run,  $SR$ . The difference between them is whether there is a fixed cost or not.



- In the long run,

$$\pi^{LR}(0) = 0$$

So if  $\pi_0^{LR} < 0$ , the firm should produce nothing in the long run. That is, it leaves the industry.

- In the short run,

$$\pi^{SR}(0) = -FC$$

Then the firm should produce  $q_0$  in the short run if

$$\pi^{SR}(q_0) > \pi^{SR}(0) = -FC$$

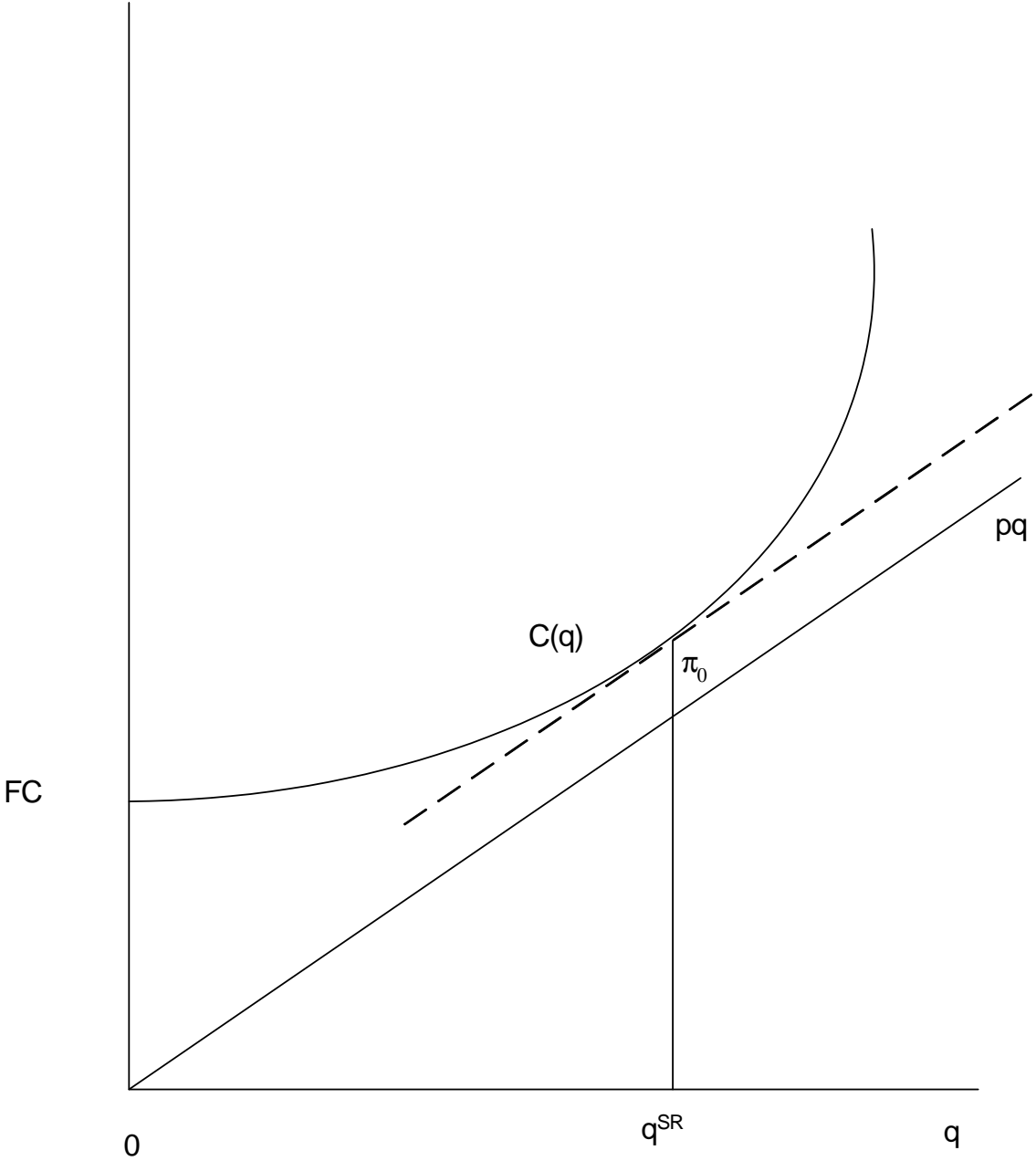
So if the firm can cover some portion of fixed cost, it should produce and lose  $\pi_0$  per period in the short run. In other words, if the firm covers variable cost, it should produce.

- But if

$$\pi^{SR}(q_0) \leq -FC$$

it should produce nothing. It will lose  $FC$  per period in the short run. In this case, it cannot cover variable cost even in the short run.

$p, C(q)$



- In the long run, it should leave the industry if  $\pi^{SR}(q_0) < 0$  and the choice of capital,  $K_0$ , is optimal even in the long run.

- Summarizing:
- At a high price, the firm will choose output to equate marginal cost to price.
- As the price falls, the firm's optimal output will fall, continuing to equate marginal cost to price. So the supply curve of the firm is the marginal cost curve.
- The firm will produce positive output in the short run even if short run profits is negative as long as it covers some portion of fixed cost.
- The firm will not produce positive output in the long run if long run profits is negative.

- When the price falls sufficiently in the short run, when the firm is unable to cover any portion of fixed cost, output will jump to zero.

$$AC(q) = \frac{C(q)}{q}$$
$$AVC(q) = \frac{VC(q)}{q}$$
$$AFC(q) = \frac{FC}{q}$$

- $AC(q)$  decreases and then increases in  $q$  due to fixed cost and rising marginal cost when  $q$  increases.
- $AC(q) > AVC(q)$  if fixed cost is positive.
- $MC(q)$  intersects  $AC(q)$  and  $AVC(q)$  at the bottoms of the average cost curve and average variable cost.

- Area below marginal cost is equal to  $VC(q) = AVC(q) * q$ .
- $MR(q) = p$  is independent of  $q$ .
- In terms of average cost, in the short run, the firm will produce positive output and choose  $q$  to equate  $p = MC(q)$  if  $p > AVC(q)$ . It will produce nothing if output level which equates  $p = MC(q)$  results in  $p < AC(q)$ .

Producer surplus: Revenue minus variable cost

$$PS(q) = pq - VC(q)$$

In other words, producer surplus is profits ignoring fixed cost.

It is the area between the marginal cost curve and price.

$PS(q)$  is a useful concept for measuring industry profits as we will see.

## 2 Industry supply

- A competitive industry supply is the horizontal sum of all the firms supply curves (marginal cost curves for firms that produce positive output).
- Some firms may supply zero and other firms may supply positive output.
- Industry profit is area between the industry supply curve and price of output which is producer surplus.
- In the long run, firms may enter or leave the industry.
- In the long run, no firm makes negative profit. Negative profit firms leave the industry.
- In the short run, some firms may make negative profits.

- Are there positive profits in the long run? Will free entry drive profits per firm to zero?
- We define positive profit for a competitive firm in the long run as economic rent. E.g. you are a farmer with good land. So you make economic rent on your land. Alberta can produce oil cheaply. So she makes economic rents on oil.
- The marginal long run competitive firm is indifferent between entering, staying in, or leaving the industry. It makes zero profit in the long run. Newfoundland is the marginal oil producer.
- If you don't know what to assume, assume that the long run industry supply curve is perfectly elastic around the marginal firm.

### 3 The organization of the firm

- Which factor of production should own the firm? Who should be the residual claimant (i.e. own the profits positive or negative)?
- Who should make the decisions within a firm?
- Will all the shareholders agree?
- Shareholders will agree if the decisions of the firm only affect profits and not also directly the utilities of the shareholders.
- (1) You are an author. You write a book. Do you sell the book to a publisher or do you set up a publishing company and publish it yourself?

- (2) You are a programmer. You write a utility program. Do you sell the program to a software publisher or do you set up a company and sell it yourself?
- (2) You are a cook. Do you work in a restaurant as an employee or do you want to be owner/chef of a restaurant?
- Although the wage bill is the largest portion of the cost of a firm, workers often do not own the firm.
- Workers/owners can borrow from the bank to rent capital and other inputs.
- Being a residual claimant is risky. Workers/owners will have substantial non-diversifiable risk.
- Easier for shareholders to diversify in well functioning stock market. So a worker/owner may want to take a private company public to reduce risk. Then public shareholders become owners of the firm.