Chapter 7: Firm's Costs

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Outline

Implicit and Explicit Costs

Economists measure all relevant costs.

- ***Explicit costs:*** direct, out-of-pocket payments for inputs to its production process within a given time period
- ***Implicit costs:*** reflect only a forgone opportunity rather than an explicit, current expenditure.
- Accountants measure costs in ways that are more consistent with tax laws and other laws.

Opportunity Costs

- ***Economic cost or opportunity cost:*** the value of the best alternative use of a resource, includes both explicit and implicit costs.
- ***Accounting profit*** = Total Revenue - Explicit Costs
- ***Economic Profit*** = Total Revenue - (Explicit and Implict Costs)
- ***Sunk Cost***: Cost already incurred or committed that cannot be recovered
- Not relevant in decision making such as cost on fixed input

Short-run Costs

- Recall that in the S-R we have at least one fixed input and one variable input
- ***Fixed cost (F)***: a production expense that does not vary with output.
- ***Variable cost (VC)***: a production expense that changes with the quantity of output produced.
- ***Total cost (C or TC)***: the sum of a firm's variable cost and fixed cost:

$$C = VC + F$$

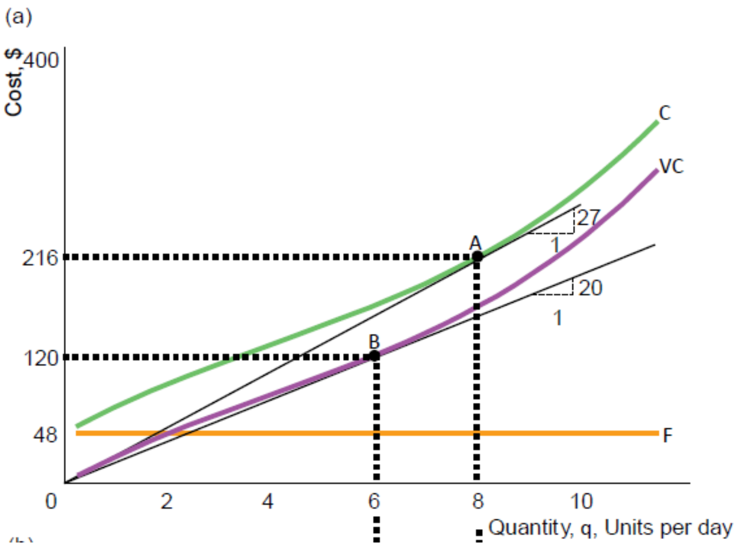
From production to Costs

Given $q = \sqrt{LK}$ $\quad w = 2, \quad r = 3 \quad$ and K fixed at $\quad \bar{K} = 4,$

Show that the S-R cost function is given by $C = 12 + \frac{1}{2}q^2$

Typical Costs

But the typical cost functions are . . .



Marginal cost (MC)

- the amount by which a firm's cost changes if the firm produces one more unit of output.

$$MC = \frac{\Delta C}{\Delta q} = \frac{\Delta VC}{\Delta q}$$

Average Costs

- ***Average fixed cost (AFC)***: the fixed cost divided by the units of output produced:

$$AFC = \frac{FC}{q}$$

- ***Average variable cost (AVC)***: the variable cost divided by the units of output produced:

$$AVC = \frac{VC}{q}$$

- ***Average cost (AC)***: the total cost divided by the units of output produced:

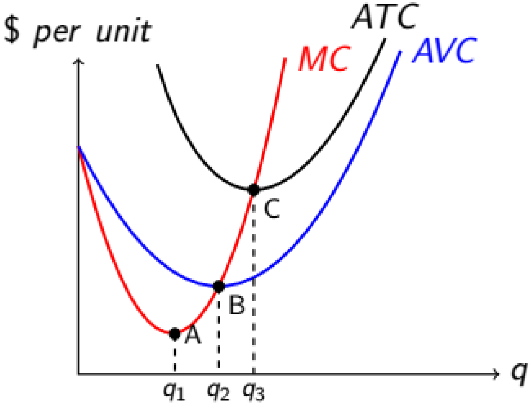
$$AC = \frac{TC}{q} = \frac{FC + VC}{q} = AFC + AVC$$

Example:

Apply the above formula for total cost function, $C = q^3 - 8q^2 + 26q + 50$, to find the functions for:

1. FC, VC
2. AFC, AVC, AC and MC
3. Find the y intercepts and the minimum values of the functions in (2)

The per unit Cost Curves



Now You Try

Repeat the same for the cost function $C = \frac{1}{2}q^2 + 10q + 18$

Facts about cost curves

It can be shown using some math that:

- The area below MC curve = variable cost
- MC and AVC curves start at the same point because these costs don't include fixed cost
- AC is decreasing (increasing) when MC is below (above) AC (this is true also for MC and AVC)

As a result we have . . .

Relationship Cost Curves to Product curves

$$MC = \frac{\Delta VC}{\Delta q} = \frac{w \cdot \Delta L}{\Delta q} = w \cdot (\frac{\Delta q}{\Delta L})^{-1} = \frac{w}{MP_L}$$

Similarly,

$$AVC = \frac{VC}{q} = \frac{w \cdot L}{q} = w \cdot (\frac{q}{L})^{-1} = \frac{w}{AP_L}$$

- Lesson: MC is a mirror image of AP_L reflect on x-axis and AVC is the mirror image of AP_L

Effect of taxes on Costs

- per unit tax of t shift all the per unit costs (ATC, AVC, MC) up by t at each q; AFC is unaffected
- a lump sum tax changes only the FC so changes only AFC and ATC

Long run Costs

Isocost line: all the combinations of inputs that require the same (iso) total expenditure (cost).

- The firm's total cost equation is:

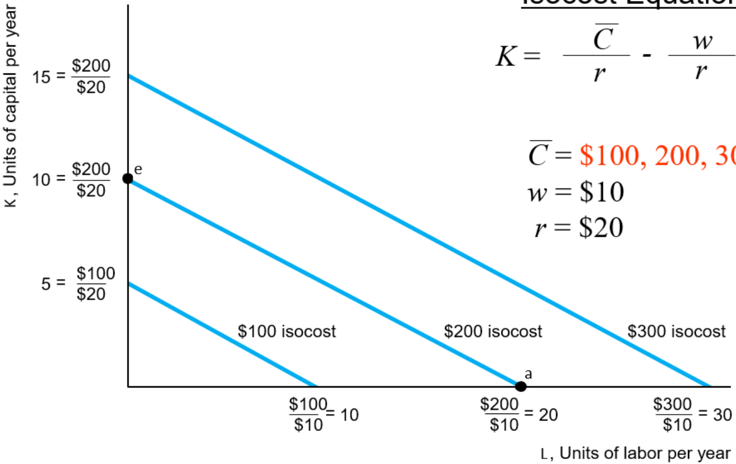
$$C = wL + rK$$

where w is wage and r is interest or cost of capital

- Hence for a given cost $\bar{C}$ the Isocost line functions is

$$K = \frac{\bar{C}}{r} - \frac{\bar{w}}{r}L$$

Family of Isocost



Isocost Equation

$$K = \frac{\overline{C}}{r} - \frac{w}{r} L$$

$$\overline{C} = \$100, 200, 300$$
$$w = \$10$$
$$r = \$20$$

Long run Cost Minimization

- For a given output, the firm selects the least cost given by the lowest isocost line:

$$\text{minimize C subject to } \bar{q}$$

- This is given by the tangency of isocost line and the isoquant
- Which implies that at the optimal:

$$MRTS_{L,K} = -\frac{w}{r} \Rightarrow \frac{MP_L}{MP_K} = \frac{w}{r} \Rightarrow \frac{MP_L}{w} = \frac{MP_K}{r}$$

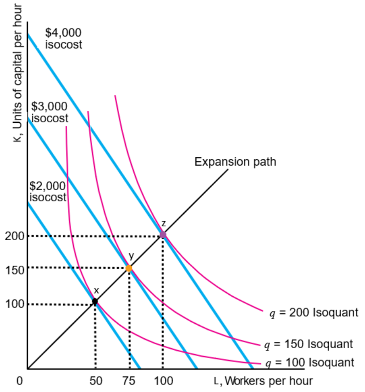
Example

For the cobb-douglas production function $q = L^{.6}K^{.4}$, w = 24, r=8,

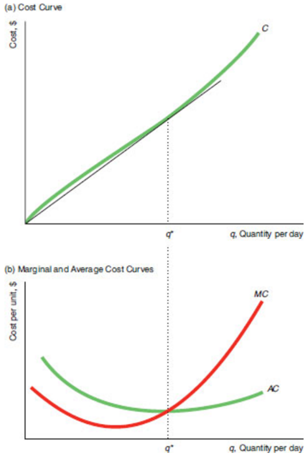
1. find the minimum cost to produce 100 units of output.
2. repeat 1 at q = 200
3. repeat 1 at $q = \bar{q}$

The Long-Run Expansion Path and the Long-Run Cost Function

- ***Expansion path***: the cost-minimizing combination of labor and capital for each output level.



Expansion Path, Total Cost Curve and Per Unit Costs



Economies of scale

- ***Economies of scale***: property of a cost function whereby the average cost of production falls as output increases.
- ***Diseconomies of scale***: property of a cost function whereby the average cost of production rises when output increases.

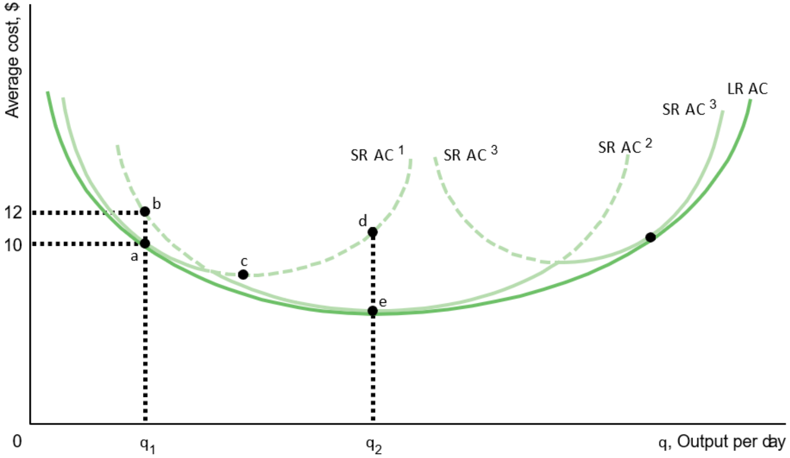
Average cost and returns to scale

It can be shown that the ATC is the mirror image of AP reflected on a horizontal axis. Thus

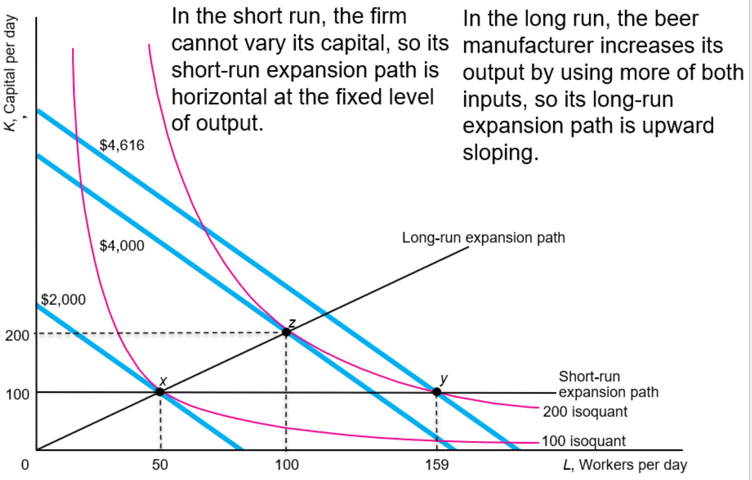
$$\text{If f(L,K) is: } \begin{pmatrix} \text{IRS} \\ \text{CRS} \\ \text{DRS} \end{pmatrix} \text{ then } \begin{pmatrix} \text{AC(q) is decreasing} \\ \text{AC(q) is constant} \\ \text{AC(q) is increasing} \end{pmatrix}$$

- Note that $TC = ATC * q$

Long-Run Average Cost as the Envelope of Short-Run Average Cost Curves



Long-Run and Short-Run Expansion Paths



Cost of Producing Multiple Goods

- ***Economies of scope***: situation in which it is less expensive to produce goods jointly than separately.

$$SC = \frac{C(q_1, 0) + C(0, q_2) - C(q_1, q_2)}{C(q_1, q_2)}$$

- ***Production possibility frontier***: the maximum amounts of two goods that can be produced from a given amount of input.
- In terms of PPF, if there is economies of scope, the PPF is concave to the origin, if there isn't, then the PPF is linear.