Long Run Cost

Making Long-Run Production Decisions
• To make their long-run decisions:
  – Firms look at costs of various inputs and the technologies available for combining these inputs.
  – Then decide which combination offers the lowest cost.

Making Long-Run Production Decisions
• The firm makes long-run decisions on the basis of the expected costs and expected usefulness of inputs.

Technical Efficiency and Economic Efficiency
• **Technical efficiency** – as few inputs as possible are used to produce a given output.
• Technical efficiency is efficiency that does not consider cost of inputs.

Technical Efficiency and Economic Efficiency
• **Economically efficient** – the method that produces a given level of output at the lowest possible cost.

Economies of Scale and Long-Run Cost Curves
• In the long run, a firm has many sizes to choose from.
• The short run requires that scale be fixed—only one or a few resources can be changed.
Determinants of the Shape of the Long-Run Cost Curve

• The law of diminishing marginal productivity does not hold in the long run.
• All inputs are variable in the long run.

Determinants of the Shape of the Long-Run Cost Curve

• The shape of the long-run cost curve is due to the existence of economies and diseconomies of scale.

Economics of Scale

• Scale means size.
• Economies of scale: the decrease in per unit costs as the quantity of production increases and all resources are variable
• Diseconomies of scale: the increase in per unit costs as the quantity of production increases and all resources are variable
• Constant returns to scale: unit costs remain constant as the quantity of production is increased and all resources are variable

A Typical Long-Run Average Total Cost Table

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Total Costs of Labor</th>
<th>Total Cost of Machines</th>
<th>Total Costs = TCL + TCM</th>
<th>Average Total Costs = TC/Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>$381</td>
<td>$254</td>
<td>$635</td>
<td>$58</td>
</tr>
<tr>
<td>12</td>
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<td>54</td>
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<td>670</td>
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<td>400</td>
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<td>53</td>
</tr>
<tr>
<td>20</td>
<td>666</td>
<td>444</td>
<td>1,110</td>
<td>56</td>
</tr>
</tbody>
</table>

Economies of Scale

• Economies of scale – long run average total costs decrease as output increases.
• In real-world production processes, economies of scale are extremely important at low levels of production.
Economies of Scale

• An *indivisible setup cost* is the cost of an indivisible input for which a certain minimum amount of production must be undertaken before the input becomes economically feasible to use.

Economies of Scale

• Indivisible setup costs create many real-world economies of scale.
  - The cost of a blast furnace or an oil refinery is an example of an indivisible setup cost.

Economies of Scale

• In the longer run all inputs are variable, so only economies of scale can influence the shape of the long-run cost curve.

Economies of Scale

• Because of the importance of economies of scale, business people often talk of a minimum efficient level of production.

Economies of Scale

• The *minimum efficient level of production* is the amount of production that spreads setup costs out sufficiently for firms to undertake production profitably.

Economies of Scale

• The minimum efficient level of production is reached once the size of the market expands to a size large enough so that firms can take advantage of all economies of scale.
Minimum Efficient Scale

- Most industries experience both economies and diseconomies of scale.
- The **minimum efficient scale (MES)** is the minimum point of the long-run average-cost curve; the output level at which the cost per unit of output is the lowest.
- The MES varies considerably across industries.

Diseconomies of Scale

- **Diminishing marginal productivity** refers to the decline in productivity caused by increasing units of a variable input being added to a fixed input.

Pay attention!

Diminishing marginal productivity only applies in the Short-run!

- Diminishing marginal productivity only applies in the Short-run!

Diseconomies of Scale

- Diseconomies of scale refer to decreases in productivity which occur when there are equal increases of all inputs (no input is fixed).
  - Diseconomies of scale occur on the right side of the long-run average cost curve where it is upward sloping, meaning that average cost is increasing.

Diseconomies of Scale

- As the size of the firm increases, team spirit or morale generally decreases.
- **Team spirit** is the feelings of friendship and being part of a team that brings out peoples’ best effort.

Diseconomies of Scale

- As the size of the firm increases, monitoring costs generally increase.
- **Monitoring costs** are those incurred by the organizer of production in seeing to it that the employees do what they are supposed to do.

Constant Returns to Scale

- **Constant returns to scale** is where long-run average total costs do not change as output increases.
- It is shown by the flat portion of the LRATC curve.
Long-Run and Short-Run Cost Curves (1)

### A Typical Long-Run Average Total Cost Curve

- ATC falls because of economies of scale.
- ATC is constant because of constant returns to scale.
- ATC rises because of diseconomies of scale.

**Long-run average total cost (LRATC)**

Importance of Economies and Diseconomies of Scale

- Economies and diseconomies of scale play important roles in real-world long-run production decisions.

Importance of Economies and Diseconomies of Scale

- The long-run and the short-run average cost curves have the same U-shape, but the underlying causes of these shapes differ.
Importance of Economies and Diseconomies of Scale

- Economies and diseconomies of scale account for the shape of the long-run total cost curve.

The Envelope Relationship

- Long-run costs are always less than or equal to short-run costs because:
  - In the long run, all inputs are flexible
  - In the short run, some inputs are fixed

- There is an envelope relationship between long-run and short-run average total costs. Each short-run cost curve touches the long-run cost curve at only one point.

- In the short run all expansion must proceed by increasing only the variable input
  - This constraint increases cost

The Envelope of Short-Run Average Total Cost Curves

The long-run average total cost curve (LRATC) is an envelope of the short-run average total cost curves (SRATC1-4).

Costs per unit

The Envelope Relationship

- In the short run all expansion must proceed by increasing only the variable input
  - This constraint increases cost

Short-Run and Long-Run Average-Cost Curves

Long-Run Average Total Cost

- **Long-run average total cost (LRATC):** the lowest-cost combination of resources with which each level of output is produced when all resources are variable.

- The long-run average total cost curve gets its shape from economies and diseconomies of scale.

Shape of LRATC

- If producing each unit of output becomes **less costly** there are **economies of scale**.
- If producing each unit of output becomes **more costly** there are **diseconomies of scale**.
- If unit costs remain **constant** as output rises there are **constant returns to scale**.
Long-Run and Short-Run Cost Curves (2)