Firms

Three economic supply decisions:

1) Whether to produce?
2) How much to produce?
3) How to produce?

Assume profit maximization . . .

\[ \pi = P \times Q - TC \]

Inputs = factors of production
Outputs = products

Costs

• (a) purchased and rented factors
• (b) imputed costs (opportunity costs)
  – using own time
  – firms’ own equity
  – durable assets

Consider an unskilled worker who can earn $20,000 per year in any of many plentiful jobs: working in a factory, being a construction laborer, doing childcare, etc. She is thinking of operating an ice cream cart on The Mall in Washington DC. She has done some investigating, and knows the following.

• A used cart costs $8000.
• The cart will sell one year later for about $7000.
• She has $4000 in the bank, earning 5% interest, which she can invest in the cart.
• If she borrows the rest of the money for the cart, the bank will charge her 10%.
• One year’s worth of ice cream will cost her $30,000. She does not need to borrow the money for this because Häagen-Dazs will give her the ice cream weekly in advance of her sales.
• She can sell that ice cream for $52,000.

What is her total net profit of operating the ice cream cart for one year (taking into account all opportunity costs)?
Production and costs in the short run

- **DN:** Short run = time period in which some factors are **fixed**
  - fixed factors hard to change
  - fixed factors do not depend on output \( Q \)
- \( TC = TFC + TVC \)
  \[ AC = \frac{TC}{Q} \]
  \[ AFC = \frac{TFC}{Q} \]
  \[ AVC = \frac{TVC}{Q} \]
  \[ MC = \frac{\Delta TC}{\Delta Q} = \frac{\Delta TVC}{\Delta Q} \]
  \[ MR = \frac{\Delta TR}{\Delta Q} = P \times \frac{\Delta Q}{\Delta Q} = P \]
  (for now)

Costs

Two parts of the short-run production decision

- (1) produce at all?
  - \( TR > TVC \)
  - implies \( \pi \) can be negative in the SR
- (2) how much?

Example: A pizza business

- rent = $100/day (fixed costs)
- \( P = $10 \) each
- \( AVC = $5 \) per pizza
- Sundays slow -- only sell 10 pizzas

Sunday production decision

- \( TR = 10 \times $10 = $100 \)
- \( TVC = 10 \times $5 = $50 \)
- \( TC = $100 + $50 = $150 \)
- \( \pi = TR - TC = $100 - $150 = -$50 \)

<table>
<thead>
<tr>
<th>Profits if open:</th>
<th>Profits if closed:</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \pi = -$50 )</td>
<td>( \pi = -$100 )</td>
</tr>
</tbody>
</table>

Shutdown price (rule #1)

- Stay open if \( TR > TVC \)
  - \( P \times Q > TVC \)
- \( P > TVC/Q = AVC \)
- \( P > AVC \)
Costs

- AC = TC/Q
- AFC = TFC/Q
- AVC = TVC/Q
- MC = ΔTC/ΔQ = ΔTVC/ΔQ
- MR = ΔTR/ΔQ = P × ΔQ/ΔQ

(for now)

Example: A sweater factory (wage = $25/day)

<table>
<thead>
<tr>
<th>TFC</th>
<th>L</th>
<th>Q</th>
<th>TVC</th>
<th>TC</th>
<th>AFC</th>
<th>AVC</th>
<th>ATC</th>
<th>MC</th>
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<td>50</td>
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<td>12.5</td>
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<td>125</td>
<td>150</td>
<td>1.56</td>
<td>7.81</td>
<td>9.38</td>
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</table>

Example: A sweater factory (wage = $25/day)

Relationship Between Total Product and Total Cost

Short-Run Cost

- Redraw the graph with cost on the y-axis and output on the x-axis, and you've got the TVC curve drawn the usual way.
- Put the TFC curve back in the figure,
- and add TFC to TVC, and you've got the TC curve.
Short-Run Cost

- Marginal Cost
  - **Marginal cost** \((MC)\) is the increase in total cost that results from a one-unit increase in total product.
  - Over the output range with *increasing marginal returns*, marginal cost falls as output increases.
  - Over the output range with *diminishing marginal returns*, marginal cost rises as output increases.

- Average Cost
  - Average cost measures can be derived from each of the total cost measures:
    - **Average fixed cost** \((AFC)\) is total fixed cost per unit of output.
    - **Average variable cost** \((AVC)\) is total variable cost per unit of output.
    - **Average total cost** \((ATC)\) is total cost per unit of output.
    
      \[ ATC = AFC + AVC. \]

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**Part 2 of the production decision**

- Marginal analysis
- Cost of additional sweater = \(MC = \Delta TC / \Delta Q\)
- Benefit of additional sweater = \(P = MR\)
- ......  
  - if \(MR > MC\) produce another sweater  
  - if \(MR < MC\) produce fewer sweaters

**Rule #2:** Increase production until \(MR = MC\)
The Effect of a Change in Input Prices

Another view of Production Costs ….

<table>
<thead>
<tr>
<th>Units of labor</th>
<th>Sweaters per day</th>
<th>Total Product</th>
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</thead>
<tbody>
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<tr>
<td>B</td>
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<tr>
<td>C</td>
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<th>Marginal Product</th>
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<thead>
<tr>
<th>Units of labor</th>
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<th>Total Product</th>
<th>Marginal Product</th>
<th>Average Product</th>
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<tbody>
<tr>
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Total Product (Q)

Marginal Product
Marginal and Average Product

Marginal Product vs Labor per day

Average Product vs Labor per day