Profit maximization

- Question – What is the firm's objective?
  - Usually want to make as much profit as possible
- Interpret the firm as a single economic decision maker whose goal is to maximize the owners profit
- What is profit? – Two definitions
  - Accounting profit
    - Total Revenue – Accounting costs
  - Economic profit
    - Total Revenue – All costs of production
    - = Total revenue – (explicit costs + implicit costs)
- What is the difference between these two?
Profit maximization

- Economic Profit

  ![Spreadsheet showing costs and profit](image)

  - Total Revenue from Selling T-shirts: $300,000
    - Cost of raw materials: $80,000
    - Wages and salaries: $90,000
    - Electricity and phone: $20,000
    - Advertising cost: $40,000
  - Total Explicit Costs: $208,000
  - Investment income forgone: $6,000
  - Rent forgone: $5,000
  - Salary forgone: $40,000
  - Total implicit costs: $50,000
  - Total Costs: $340,000
  - Economic Profit: $40,000

Profit Maximization

- In this class we will be using the concept of economic profit
- The proper measure of profit for understanding and predicting the behavior of firms is economic profit.
- Unlike accounting profit, economic profit recognizes all the opportunity costs of production – both explicit and implicit

Profit Maximization

- One constraint is the demand curve facing the firm
  - This is the demand curve for the product produced by the firm
  - This demand curve is built upon the consumer theory – do not confuse the demand with supply here
  - The demand curve facing the firm tells us, for different prices, the quantity of output that customers will choose to purchase from that firm.

Profit Maximization

- The firms constraints
  - Recall with the LRATC discussion from last day the graph gave us the lowest average cost possible to produce a given level of output
    - However, the PRATC curve could not tell us anything about how much should be produced
    - How much the firm should produce is going to depend on what will maximize their profit levels, the firm will face constraints which will limit the amount they would like to produce

Profit Maximization

- A note on firms
  - Firms need not refer to only those organizations which sell goods and services
  - We could also include non-profit organizations as well (UNICEF, NRA, etc.)
    - We would just need to use a broader definition of total revenue to accomplish this
    - i.e. putting value on helping people, improving living conditions, etc.
  - The principles we use here could be applied to pretty much any organization

Profit Maximization

- The demand curve facing the firm shows us the maximum price the firm can charge to sell any given amount of output.
Profit Maximization

- Total revenue
  - is the total inflow of receipts from selling a given amount of output
  - This is computed as the quantity sold multiplied by the accompanying price on the demand curve

- The cost constraint
  - For each level of production the firm must determine the cheapest method to produce that quantity – i.e. determine the least cost method
  - At any level of output the firm may produce at it must incur the cost associated with “least cost method”
  - This is largely determined by the firms production technology
    - How many inputs are used to produce any given level of output

Profit Maximization

- In summation:
  - Firms face constraints that limit its ability to earn profit
  - The demand curve constrains how much can be changed for a certain level of output
  - The cost of production is constrained by the firms technology which is used to determine the firms “least cost method” of production

The profit-maximizing level of output

- We can use 2 methods to determine what is the profit maximizing level of output
  - 1) the total revenue and total cost approach
  - 2) The marginal revenue and marginal cost approach
- Both methods will give exactly the same result

The profit-maximizing level of output

- The total revenue and total cost approach
  - This method is the easiest to understand
  - Under this approach the firm calculates:
    - Profit = TR – TC for each level of output
    - The firm then selects the level of output with the highest amount of profit
  - This is what is done is the last column of fig#1
### The profit-maximizing level of output

<table>
<thead>
<tr>
<th>Price</th>
<th>Output</th>
<th>Total Revenue</th>
<th>Total Cost</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$650</td>
<td>0</td>
<td>$300</td>
<td>$300</td>
<td></td>
</tr>
<tr>
<td>$650</td>
<td>1</td>
<td>$650</td>
<td>$700</td>
<td>$450</td>
</tr>
<tr>
<td>$650</td>
<td>2</td>
<td>$1,250</td>
<td>$900</td>
<td>$350</td>
</tr>
<tr>
<td>$550</td>
<td>3</td>
<td>$2,250</td>
<td>$1,350</td>
<td>$900</td>
</tr>
<tr>
<td>$500</td>
<td>4</td>
<td>$2,400</td>
<td>$1,600</td>
<td>$800</td>
</tr>
<tr>
<td>$450</td>
<td>5</td>
<td>$2,250</td>
<td>$1,900</td>
<td>$350</td>
</tr>
<tr>
<td>$400</td>
<td>6</td>
<td>$2,000</td>
<td>$2,150</td>
<td>$500</td>
</tr>
<tr>
<td>$350</td>
<td>7</td>
<td>$1,650</td>
<td>$2,400</td>
<td>$650</td>
</tr>
<tr>
<td>$300</td>
<td>8</td>
<td>$1,200</td>
<td>$2,600</td>
<td>$400</td>
</tr>
<tr>
<td>$250</td>
<td>9</td>
<td>$700</td>
<td>$3,000</td>
<td>$300</td>
</tr>
<tr>
<td>$200</td>
<td>10</td>
<td>$2,000</td>
<td>$3,100</td>
<td>$100</td>
</tr>
</tbody>
</table>

#### Marginal Revenue (MR)

Is the change in total revenue (TR) from producing one more unit of output (Q).

\[
MR = \frac{\Delta TR}{\Delta Q}
\]

#### Marginal Cost (MC)

Is the increase in total cost from producing one more unit of output.

\[
MC = \frac{\Delta TC}{\Delta Q}
\]

### The profit-maximizing level of output

- **Note:** Notice that maximizing profit is not the same as maximizing revenue.

### The profit-maximizing level of output

- The marginal revenue and marginal cost approach.
  - This method may seem less intuitive but gives much more insight into the firms and managers decision-making process.
  - In other economics courses this is the primary method used since it is much more insightful in understanding behavior.

### The profit-maximizing level of output

<table>
<thead>
<tr>
<th>Output</th>
<th>Total Revenue</th>
<th>Marginal Revenue</th>
<th>Total Cost</th>
<th>Marginal Cost</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>1</td>
<td>$650</td>
<td>$650</td>
<td>$700</td>
<td>$450</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>$1,250</td>
<td>$500</td>
<td>$900</td>
<td>$350</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>$2,250</td>
<td>$1,000</td>
<td>$1,350</td>
<td>$900</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$2,400</td>
<td>$1,560</td>
<td>$1,600</td>
<td>$800</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>$2,250</td>
<td>$1,150</td>
<td>$1,900</td>
<td>$350</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>$2,000</td>
<td>$1,650</td>
<td>$2,150</td>
<td>$500</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>$1,650</td>
<td>$550</td>
<td>$2,400</td>
<td>$650</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>$1,200</td>
<td>$1,150</td>
<td>$2,600</td>
<td>$400</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>$700</td>
<td>$900</td>
<td>$3,000</td>
<td>$300</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>$2,000</td>
<td>$1,400</td>
<td>$3,100</td>
<td>$100</td>
<td></td>
</tr>
</tbody>
</table>
The profit-maximizing level of output

- When a firm faces a downward sloping demand curve there will be two forces acting on revenue:
  1) revenue gain – from selling additional output at the new price
  2) revenue loss – from selling all the previous units output at a lower price

- Example – going from 2 to 5 bed frames – selling 3 more frames but the instead of getting $600 for the first two, you now only get $450

How to find the profit maximizing level using graphs

- Using the TR and TC approach:
  - To maximize profit the firm should produce the quantity of output where the vertical distance between the TR and TC curves is greatest and the TR curve lies above the TC curve

- Using the MR and MC approach:
  - The firm should produce at a level closest to where MR=MC

The profit-maximizing level of output

- Using MC and MR to maximize profits:
  - An increase in output will always raise profits as long as MR>MC
  - An increase in output will always decrease profit when MR<MC
  - Following from above, profit will be maximized where MR is as close to MC as possible

![Figure 2: Profit Maximization](image-url)