Lecture 16: Profit Maximization and Long-Run Competition

Clicker Question
Cost, Revenue and Profits

- **Total Cost (TC):**
  \[ TC = FC + VC \]

- **Average Cost (AC):**
  \[ AC = TC / Q \]
  - Sometimes called Average Total Cost (ATC)

- **Profits:**
  \[ \pi = \text{Total Revenue} - \text{Total Cost} = (P \times Q) - TC = (P \times Q) - AC \times Q = (P - AC) Q \]

- Producer surplus is the same as profits before fixed costs are deducted.
  \[ \pi = (P \times Q) - VC - FC = PS - FC \]

A Small Firm in a Competitive Market

- The equilibrium price \( P^* \) is determined by the entire market.

- If all of the other firms charge \( P^* \) and produce total output \( Q_0 \), then …

  ![Diagram of a competitive market with a small firm](image)

  - for the last small firm, the remaining demand near the market price seems very large and very elastic.
  - The last firm’s supply determines its own equilibrium quantity: it will also charge the market price (and be a price-taker).
Suppose Farmer Jones discovers that hip-hop music increases his hens’ output of eggs.

Then his supply curve would shift to the right.

But his price wouldn’t change.

How does the shift of his supply curve affect Farmer Jones?

Farmer Jones’ supply shifts to the right, but his equilibrium price remains the same.

Doesn’t the market supply shift?

Would Farmer Jones sell more or less?
NOW suppose that all farmers find out that hip-hop music increases their hens’ output of eggs.

All the farmers blast hip-hop at their chickens.

And the chicken’s start laying eggs like crazy.

Hip-hop causes the supply curves of Farmer Jones and the other farmers to shift to the right,…

…which causes market supply to shift.

The new market-equilibrium price would fall to \( P' \), so Farmer Jones’ demand shifts down.

Farmer Jones’ supply has shifted to the right, but he must sell at a lower price.

Would he sell more? or less?
Marginal and Average Costs

- **MC** is the cost of producing a given unit.
- **AC** is the average cost of producing all the units up to the given unit.
- **MC** rises eventually – Why?
  - If **FC > 0**, **AC** starts high,…
    - but it falls as fixed cost is divided over more output,…
    - and rises again as **MC** becomes more important.
  - If **MC** crosses **AC**, it must cross at the bottom of the **AC** curve.
    - If **MC** is under **AC**, then **MC** is pulling the average down.
    - But if **MC** is above **AC**, then **MC** is pulling the average up.
Using AC to Measure Profits

- If $P = 120$ then, if the firm produces, profits are maximized when the firm produces 8 units. Why?

- If 8 units are produced, $AC = 90$, …

- so average profits per unit are 30.

- Total profits are $8 \times 30 = 240$.

Using AC to Measure Losses

- If $P = 70$ then, if the firm produces, profits are maximized when the firm produces 4 units. Why?

- If 4 units are produced, $AC = 80$, …

- so on average the firm loses 10 per unit (even though profits are maximized).

- Total losses are $4 \times 10 = 40$.

- The firm cannot be profitable at this price, and it should shut down.
The Shut-Down Condition

- If a firm is producing at the profit-maximizing level of output,
- yet still cannot earn a positive profit,…
- then it should be shut down.
- This happens when price is less than the lowest possible average cost. Why?
- So, if \( P < \text{min AC} \), the firm should stop producing.

But \textit{in the short run}, fixed costs \textit{that are already paid} should \textit{not} be treated as a costs in making the shut-down decision.

- Why not?
- Because they are \textit{sunk costs} (not avoidable).
- So maybe the firm can stay open for a while.
- \textit{In the short run}, only variable costs are avoidable, so we should use \textit{AVC (average variable cost)} as the value of \textit{AC}.
- In the long run, all costs are avoidable, so we should use \textit{ATC (average total cost)} as the value of \textit{AC}.
This firm should not be in business if the market price is below _____.

Price $P$ is above the minimum $AC$, so the firm can produce profitably.

But if the firm produces at a price $P'$ less than the minimum $AC$, it would have to produce at a loss.

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In the long run $AC$ is $ATC$.

Can you tell how much the firm will sell if the price is
- $120 per unit?
- $81?
- $60?
- $40?

If $P < min ATC$, then net profits must be negative at any output level, and the firm will shut down.

In the short run, $AC$ is $AVC$ instead of $ATC$. 
Do real-world firms maximize profits?

- In the competitive model, *maximizing profits* also maximizes *social surplus*.

- But firms have some of the same problems maximizing profits that consumers have maximizing utility.
  - The maximization problem is very difficult.
    - Firms may not know their own marginal costs.
    - They may not be acquainted with all feasible production methods.
  - The psychology of entrepreneurs may create problems.
    - Entrepreneurs tend to be biased by optimism.
    - Or they may suffer from hubris (overconfidence).
The owners of firms face problems that individuals do not.

- **Controlling their employees**
  - How to get workers to work hard?
  - How to get managers to pursue the interests of the owner (instead of their own)?

- **Fear of risk**
  - Maximizing profits may be risky,…
  - so managers may choose very safe bets that are less profitable .
  - Very safe business ventures are often not in the social interest, because new technologies and economic growth require a reasonable amount of risk.

Is profit maximization is a good approximation of what real firms do in a free market?  
*Maybe not!*

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**The Search for Profits**

- In the competitive model, firms maximize profits.
- Moreover, a large number of (greedy) entrepreneurs are searching for profitable business opportunities.

- If the market price of a good and its production costs can generate economic profits,…
- these entrepreneurs will start new firms and enter the industry.

- But if the market price is too low, firms will face losses…
- and some will close down.
Entry and Exit in the Long Run

- When an entrepreneur considers starting a firm, she has **no sunk costs**. [Why not?]
  - (Therefore, *ATC* should be used as *AC*.)

- So she enters only if long-run economic profits can be found.

- Firms will continue to enter as long as these profits are available.

- But as they enter,
  - the market supply shifts out,
  - the market price falls,
  - and further entry becomes less profitable.

- Entry stops when new firms would no longer be able to obtain economic profits.

- At that point, the **economic profits** of existing firms are zero.

- To illustrate this process, we use a fictional example of the market for corn.
Economic Profit in the Corn Market

The Market

At $P = $2.00$, $Q = 130$ and $AC = $1.20$, which is greater than the minimum $AC$.

The Effect of Entry on Price and Economic Profit

However, economic profits will attract new firms, and entry will reduce both prices and profits.
Entry of firms continues until all firms earn zero long-run economic profits.

At this point, there are more firms, and each firm is producing at lower cost.

In the long run, $AC$ is $ATC$ and $ATC = AVC + FC/Q$

$FC/Q$ is large when firms are small (low output), but $AVC$ is small.

$AVC$ is large when firms are large, but $FC/Q$ is small.

At either extreme, $AC$ will be large.

Entry leads to a result between these two extremes and *minimizes $AC = AVC + FC/Q$*...

meaning that competition trades off the *number of firms* and the *size of each firm* in a *perfectly efficient* way.
Economic Losses in the Corn Market

A market price below the minimum AC will result in economic losses.

**The Market**

- Price ($/bushel)
- Quantity (millions of bushels/year)

**One Firm**

- Price ($/bushel)
- Quantity (1000s of bushels/year)

**Economic Losses in the Corn Market**

An economic loss of $21,000/year occurs at a price of $0.75/bushel, where the marginal cost (MC) intersects the average cost (AC) curve. At this price, the quantity supplied (Qs) is 70 million bushels, while the quantity demanded (Qd) is 90 million bushels.

**Equilibrium when Exit Stops**

- In the presence of long-run losses, firms will exit from the industry, and the market price will increase.
- Exit will stop when losses disappear, and economic profits reach zero.

- Again production will occur at minimum AC.
Imperfect Competition

- In the long run, perfect competition balance the number and size of firms perfectly.
- But imperfect competition does not.
- Later in the course, we show that some kinds of imperfect competition yield too many small firms.
- But perfect competition cannot create the iPod.

Clicker Question
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