Producer Theory and Supply

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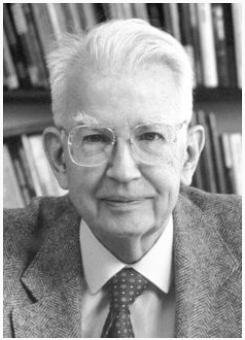
What is a Firm?



Ronald Coase

Outside the firm, price movements direct production, which is coordinated through a series of exchange transactions on the market. Within a firm, these markets transactions are eliminated and in place of the complicated market structure with exchange transactions is substituted the entrepreneur-coordinator, who directs production.

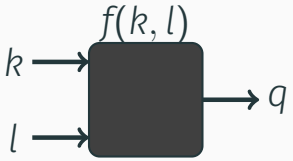
This co-ordination of the various factors of production is, however, normally carried out without the intervention of the price mechanism. [...] It can, I think, be assumed that the distinguishing mark of the firm is the supersession of the price mechanism[a].

[a] From The Nature of the Firm (1937).

Production Function

Production Function

$$q = f(k, l, \dots)$$



- Inputs: Factors of Production: Capital (k), Labor (l), Land, ...
- Output: # of units of the good produced (q).

Marginal Product

$$\text{MP}_l = \frac{\Delta q}{\Delta l} \qquad \text{MP}_k = \frac{\Delta q}{\Delta k}$$

- The increase in output that arises from an additional unit of input.
- The marginal product of labor measures the contribution of hiring an extra worker.

Diminishing Marginal Product

Diminishing Marginal Product. Marginal product declines as the quantity of the input increases.

David Ricardo

- David Ricardo applied the concept of diminishing (marginal) returns to land rent. Due to lower quality inputs.
- The modern view attributes the diminishing (marginal) returns to adding successive units of labor to a fixed quantity of capital.

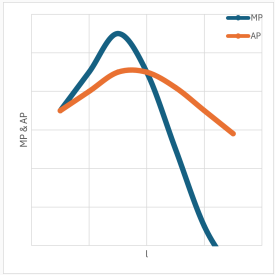
Example

l	q
0	0
1	50
2	110
3	180
4	240
5	280
6	300
7	308

- Assume capital (and other inputs) is fixed.
- Find and plot the marginal product of labor.
- Marginal product may increase when labor is low because there are efficiency gains.
- Eventually the law of diminishing returns kicks in.

Average Product

$$\text{AP} = \frac{q}{l}$$



- Measures the average units produced per worker.
- Simplest measure of productivity.
- Curves cross each other at the maximum value of the average product.

Cost Function

Cost Function

$$\mathrm{TC}(q) = \mathrm{VC}(q) + \mathrm{F}$$

- Input: # of units produced.
- Output: Total cost of producing them.
- Encodes the information about the production function. We can study the productive process through it.
- Total cost already includes the opportunity cost.
- Decompose into variable and fixed cost.

Marginal Cost

$$\text{MC} = \frac{\Delta \text{TC}}{\Delta q}$$

- The increase in total cost that arises from producing an extra unit.
- Marginal cost increases due to diminishing marginal product.

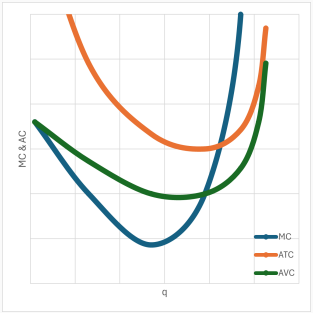
Example

l	q
0	0
1	50
2	110
3	180
4	240
5	280
6	300
7	308

- Assume hiring each worker costs $240.
- And there's a fixed cost of $120.
- Find total cost (variable and fixed) and marginal cost.
- Plot the marginal cost.
- Careful: Now q in horizontal axis.

Average Cost

$$\text{ATC} = \frac{\text{TC}(q)}{q} \qquad \text{AVC} = \frac{\text{VC}(q)}{q}$$



- Measures what's the average cost of each unit.
- Marginal cost crosses the other two at their minimum values.
- **Efficient Scale**. The quantity where the ATC is minimum.

Profit Maximization

Competitive Firm

- Price taker. Small firm with no influence on prices. $(p, w, r, \dots)$ are given.
- Short vs Long run.
  - Short run. Capital is sunk. The firm can freely adjust labor, but it is already invested in capital.
  - Long run. The firm can freely adjust all factors of production. It may decide to exit or stay in the market.

Profits

$$\text{Profits} = pq - \text{TC}(q)$$

- Profits are the difference between total revenue and total cost.
- Recall that total cost includes the opportunity cost.

Example

$$\text{TC}(q) = q^2 + 100 \qquad \text{MC}(q) = 2q$$

- Find ATC.
- Plot MC and ATC for $q = 5, 10, 15, 20, 25$.
- Assume $p = 25$, find the quantity that maximizes profits.
- Show profits in the graph.
- Find the supply of the firm.

Profit Maximization

$$\text{MR} = \text{MC}$$

- How many units should I produce? Supply of the good.
- Defines the optimal quantity the firm should produce to maximize profits:
  - Producing more would decrease profits.
  - Producing less would leave potential profit on the table.
- Condition is valid even for non-competitive firms. For a competitive firm it happens to be the case that $\text{MR} = p$.

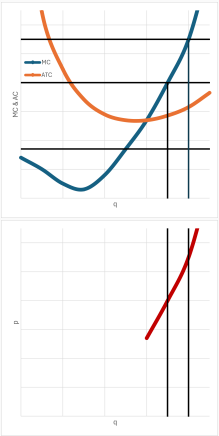
Profit Maximization II

$$p\text{MP} = w$$

- How many workers should I hire? Demand for labor.
- Left hand side: marginal revenue of hiring an extra worker.
- Right hand side: marginal cost of hiring an extra worker.
- A competitive firm pays workers their marginal product.

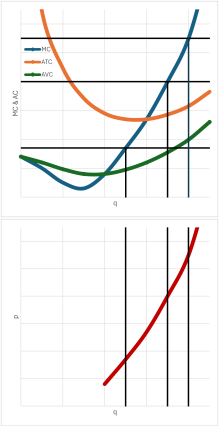
Supply

Supply - Long Run



- The supply is the marginal cost curve past the efficient scale.
  - If price is lower than minimum ATC, supply 0 units.
  - If price is higher than minimum ATC, supply # units such that $p = \text{MC}$.
  - If price is equal to the minimum ATC, the firm is indifferent between any quantity. Zero profits no matter what.

Supply - Short Run



- The supply is the marginal cost curve past the minimum AVC.
  - If price is lower than minimum AVC, supply 0 units.
  - If price is higher than minimum AVC, supply # units such that $p = \text{MC}$.
- There's a range of prices in which the firm makes negative profits.

Supply & Input demand

- Supply:
  - Changes in p → Movement along the supply curve.
  - Changes in costs or technology → Shift the supply curve.
- Input Demand:
  - Producing units requires labor (and capital).
  - The amount of labor I need to produce.
  - Profit maximization defines also a labor demand curve depending on the real wage w/p.
  - Because MP of labor decreases, labor demand slopes down.

Summary

Production Function

Cost Function

Profit Maximization

Supply