Agricultural Markets

Lecture 3: Costs and Supply

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Firms maximize profit

- Much like consumers are utility-maximizers, firms are profit-maximizers.
- For a firm producing a product, q, using a set of inputs, $\mathbf{z} = (z_1, \ldots, z_k)'$, the short-run profit is defined as:

$$\pi = pq - w'z,$$

where p is a unit price of q, and $\mathbf{w} = (w_1, \ldots, w_k)$ is a vector of input costs.

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Production function

- A firm's output is related to inputs via a production function:

$$q = q(\mathbf{z})$$

- We can, thus, rewrite he profit function as:

$$\pi = pq(\mathbf{z}) - \mathbf{w}'\mathbf{z}.$$

- We can use this equation to derive a producer's supply function of output and demand functions for inputs.

Marginal product of input

- A producer maximizes profits by using each input up to the point where the last unit just pays for itself.
- Optimal use of inputs is determined with respect to the (known) production function.
- The functional form of production is such that output is increasing with input, but at a decreasing rate.
- The rate at which output increases is referred to as the *marginal product* of input:

$$MP_i = \frac{\partial q}{\partial z_i}$$

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The optimal amount of input

- The optimum level of factor use is at the point where the MP_i multiplied by price of output, p, just equals to the unit cost of input, w_i, which yields the following relationship:

$$\frac{\partial q}{\partial z_i} = \frac{w_i}{p}$$

- This relationship implies that an increase of the input cost, will lead to reduced use of that input and lower output, *ceteris paribus*.
- Moreover, optimal factor use will change only with an increase or decrease in relative prices.

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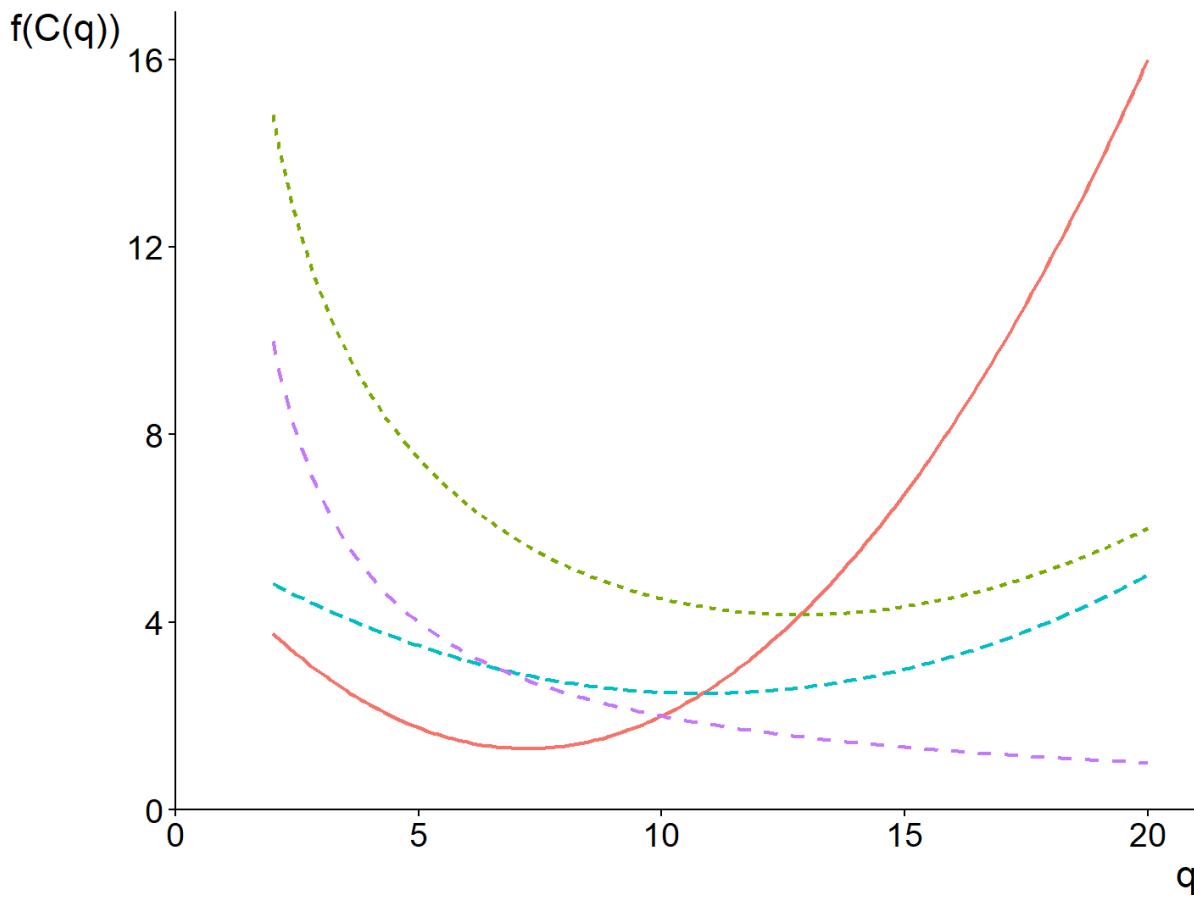
Firm's costs and supply

A firm's costs, $C(q)$, consist of fixed costs, F, that don't change in the short run, and variable costs, $V(q)$, that change with output.

Average costs:
$$\frac{C(q)}{q} = \frac{F}{q} + \frac{V(q)}{q}$$

Marginal cost: $MC = \dfrac{\partial C(q)}{\partial q}$

Economies of scale

- *Economies of scale* happen when average total cost decreases as output increases, i.e. when the marginal cost curve is below the average total cost curve.
- *Diseconomies of scale* happen when average total cost increases as output increases, i.e. when marginal cost is above the average total cost curve.

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A measure of economies of scale

- A measure of economies of scale, s, is the average total cost to marginal cost ratio, which is equivalent to the total cost elasticity of output:

$$s = \frac{AC(q)}{MC(q)} \equiv \frac{\partial q}{\partial C(q)} \frac{C(q)}{q}$$

- We have increasing returns to scale (i.e., economies of scale) when $s > 1$, decreasing returns to scale (i.e., diseconomies of scale) when $s < 1$, and constant returns to scale when $s = 1$.

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Market supply

- Market supply is a (horizontal) sum of firm's supply curves.
- Assuming n identical firms, each producing q units of optimal output, the aggregate market supply is $Q = nq$. The supply curve, generally, is upward sloping, which is inferred in the *law of supply.*

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The supply mover and shifters

- Own price of a good is a sole factor affecting the quantity supplied resulting in the movement along the supply curve.
- All other factors *shift the supply curve.* Such factors can be:
  - prices of inputs;
  - prices of related goods (e.g., palm oil and soybean oil);
  - goods competing for the same factors of production (e.g., the land used to produce corn and soybeans);
  - joint production of goods (e.g., soybean meal and soybean oil);
  - factors affecting production costs and output quantities;
  - production risks (e.g., weather-related);
  - taxes and subsidies.

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Supply elasticity

- The responsiveness of the supply to price changes is known as *price elasticity of supply* (supply elasticity).
- Mathematically, supply elasticity is given by:

$$\eta = \frac{\partial Q}{Q} \Big/ \frac{\partial P}{P} \equiv \frac{\partial Q}{\partial P}\frac{P}{Q}$$
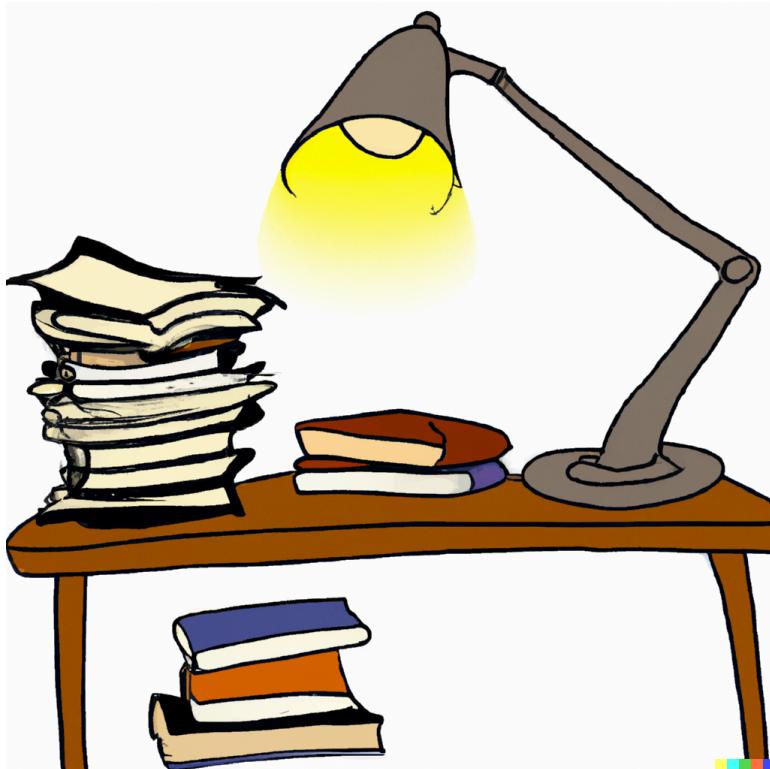
Supply elasticity

- Supply elasticities can be categorized as:
  - Perfectly inelastic (vertical line): the elasticity measure of zero.
  - Inelastic: the elasticity measures between 0 and 1.
  - Elastic: the elasticity measures greater than 1.
  - Perfectly elastic (horizontal line): the elasticity measure of ∞.
- In the very short run, agricultural supply elasticity is nearly zero; as the time-frame increases, producers are able to react to price changes and, thus, the supply elasticity increases.

Supply elasticity

- Assuming a linear supply curve, as quantity and price increase (i.e., as we move upwards along the supply curve) the price elasticity of supply converges to 1.
- Moreover, if a linear supply curve intersects with the origin, the elasticity of supply is always 1.

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Readings

Tomek & Kaiser, Chapter 4

Masters & Finaret, Chapter 2 (Sections 2.2 & 2.3)

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