

Cobweb model of economics

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The *cobweb model* is a theoretical explanation of the cyclical nature of prices and quantities through time. We describe the price by a sequence of numbers p_1, p_2, p_3, \dots with p_1 representing the price for the first year, p_2 representing the price for the second year, and so forth.

The model involves three related quantities.

- ☞ The price p_t of the product in year t .
- ☞ The supply S_t for the product in year t – that is, how many units of the product are being made in this year. The supply is very low when the price is low and the supply rises as the price rises.
- ☞ The demand D_t for the product in year t – that is, how many units of the product are being bought in this year. When the price is low the demand is high and as the price rises the demand falls.

We will make the following three assumptions.

- 👉 A time lag exists between the decision to produce a particular product and actual production.

Most agricultural commodities are good examples of lagged production. Farmers typically plant their crops in the spring and harvest them in the fall. Farmers determine how much they will plant in the spring based on the price they received the preceding year and they try to charge the same price in the fall.

- 👉 Producers are assumed to base production plans on current price. For agricultural commodities the production plans are made after the harvest. The output corresponding to these production plans appears on the market a year later. *Due to the time lag, the current supply is a function of the price last year.*

$$S_t = S(p_{t-1})$$

- 👉 It is assumed that the current price is such that current demand is equal to the current supply. This implies that no producer is left with unsold stocks and no consumer with an unsatisfied demand.

$$S_t = D_t$$

Consider the linear demand and supply functions $D_t = a - bp_t$,

$$S_t = -\alpha + \beta p_{t-1}.$$

In the equilibrium the demand meets the supply

$$D_t = S_t$$

... equilibrium on the market

$$a - bp_t = -\alpha + \beta p_{t-1}$$

... linear demand and supply

$$p_t = \frac{a + \alpha}{b} - \frac{\beta}{b} p_{t-1}$$

... isolate p_t

$$p_t = A - Bp_{t-1}$$

... define new parameters

$$p_{k+1} = A - Bp_k$$

... substitute t by $k + 1$

$$p_k = (-B)^k C + \frac{A}{1 + B}$$

... solve linear ΔE

If $0 < B < 1$, then the price is oscillatory and converges to the equilibrium price

$$p^* = \frac{A}{1 + B}.$$