

EC 131 - Demand and Supply functions

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1 Demand functions

A demand function is a function $Q(P)$ that gives quantity demanded of a good for each price P . We usually assume that this function is decreasing in P .

1.1 Examples

- $Q(P) = 10 - P$
- $Q(P) = \frac{1}{P}$
- $Q(P) = a - bP$, for $a \geq 0$ and $b \geq 0$ (if $b = 0$, this function represents a perfectly inelastic demand)

2 Inverse Demand functions

A function $P(Q)$ that, given a quantity demanded, returns the price that will yield such demand. It is also usually assumed to be decreasing in Q . The inverse demand function is useful especially when drawing demand curves

2.1 Examples

- $P(Q) = 10 - Q$
- $P(Q) = \frac{1}{Q}$
- $P(Q) = c - dQ$, for $c \geq 0$ and $d \geq 0$ (if $d = 0$, this function represents a perfectly elastic demand)

In general, we can derive one function from the other. For example, take $Q = 10 - P$:

$$Q = 10 - P \implies P = 10 - Q$$

Or take $Q = a - bP$:

$$Q = a - bP \implies bP = a - Q \text{ implies } P = \frac{a}{b} - \frac{1}{b}Q$$

3 Market equilibrium

If we have demand and supply functions, we can solve for the market equilibrium (equilibrium price P^* and equilibrium quantity Q^*) by solving the system of two equations presented by the two functions:

$$\text{Demand: } Q = 10 - 2P$$

$$\text{Supply: } Q = 5P$$

Equating the two Q :

$$10 - 2P = 5P \implies 7P = 10 \implies P^* = \frac{10}{7}$$

Replacing P in demand or supply function we get Q^* :

$$Q^* = \frac{5 \times 10}{7} = \frac{50}{7}$$

4 General solution for linear supply and demand

Let the demand function be $Q = a - bP$ and the supply $Q = c + dP$. Then we can equate the two and get:

$$a - bP = c + dP \implies a - c = bP + dP \implies p(b + d) = a - c \implies P^* = \frac{a - c}{b + d}$$

Replacing P^* in the demand function (replacing in the supply would yield the same value):

$$Q^* = a - b \left(\frac{a - c}{b + d} \right) = \frac{ab + ad - ab - bc}{b + d} = \frac{ad - bc}{b + d}$$

Note that we must have both $a > c$ and $ad > bc$ for those values to be possible (that is, for the market equilibrium to exist).