1 Equilibrium

Where do prices come from?

We will study just one market at a time.

Partial Equilibrium.

Ignore the feedback effects that a change in one market can have on other markets.

1.1 Supply and Demand

A market consists of the consumers represents by the demand function. Suppliers represented by the supply function.

Demand function: $Q_d(p)$ (how much do consumers want)

Supply function: $Q_s(p)$ (how much do suppliers produce).

$Q_d(p) = \frac{2500}{p}, Q_s(p) = 100p$

Market Demand, Market Supply

$Q_d(10) = \frac{2500}{10} = 250$

At a price of 10, consumers demand 250 units.

$Q_s(10) = 100(10) = 1000$

1.2 Equilibrium

In the example above, at a price of 10. There is an **over-supply of the good**.

This puts downward pressure on prices.

Whenever there is an over-supply, there is incentive for firms with unsold inventory (unsold units) to lower the price.

An equilibrium is a price such that there is no tendency for the price change. There is no downward pressur or upward pressure on prices.

Suppose $p = 2$

$Q_d(2) = \frac{2500}{2} = 1250, Q_s(2) = 100(2) = 200$

There is an overdemand for the good. Any of the consurs who don't get to buy would like to convince a firm who didn't produce to produce at a higher price.

If $Q_s(p) > Q_d(p)$ over-supply, downward pressure on prices.

If $Q_d(p) > Q_s(p)$ over-demand, upward pressure on prices.

An equilibrium is a "state of rest" for the economy. A **stable state**.

We say a price p^* is an equilibrium if (**equilibrium condition**).

$$Q_d(p^*) = Q_s(p^*)$$

1.3 Example

$Q_d(p) = \frac{2500}{p}, Q_s(p) = 100p$

$$\frac{2500}{p} = 100p$$

Find the p^* that makes these equal.

$$p\frac{2500}{p} = 100p * p$$

$$2500 = 100p^2$$

$$25 = p^2$$

$$5 = p$$

Equibrlim quantity:

$$Q_d(5) = \frac{2500}{5} = 500, Q_s(5) = 100(5) = 500$$

The equilibrium price is $p^* = 5$. The equilibrim qunaity is $Q^* = 500$.

1.4 Fixed Supply Example

$Q_d(p) = \frac{500}{p}, Q_s(p) = 1000$

$$\frac{500}{p} = 1000$$

$$500 = 1000p$$

$$p^* = \frac{1}{2}$$

1.5 Linear Demand Example

$Q_d(p) = 300 - 50p, Q_s = 100p$

Find the equilibrium price:

$$Q_d(p^*) = Q_s(p^*)$$

$$300 - 50p = 100p$$

$$300 = 150p$$

$$p^* = 2$$

Equilibrium quantity can be found by plugging this into either the supply or demand:

$$Q_s(p) = 100p$$

$$Q_s(2) = 200 = Q^*$$

1.6 Graphing Equilibrium

On the equilibrium graph, we put price on the vertical axis. That means we to plot $p(q)$ rather than $q(p)$.

Find the inverse demand and supply function:

$Q_d(p) = 300 - 50p, Q_s = 100p$

Demand:

$$Q = 300 - 50p$$

$$50p = 300 - Q$$

$$p = \frac{300}{50} - \frac{1}{50}Q$$

$$p = 6 - \frac{1}{50}Q$$

Inverse demand function for consumers is $p(Q) = 6 - \frac{1}{50}Q$.

What price is responsible for consumers buying 200 units of the good?

$$p = 6 - \frac{1}{50}200 = 6 - 4 = 2$$

The inverse supply function is found by "inverting" the supply:

$$Q = 100p$$

$$p = \frac{1}{100}Q$$

Inverse supply is line with slope of $\frac{1}{100}$.

Equilibrium is $p = 2$, $q = 200$

1.7 Surplus

Surplus is a way of measuring how well of consumers/produces are because of the existence of the market.

The **consumer suplus** is the area below the inverse demand but above price (to the left of equilibrium quanity).

The **producer suplus** is the area above the inverse supply but below price (to the left of equilibrium quanity).

Total surplus = consumer surplus + producer surplus.

Fact: Total surplus is maximized in equilibrium.

The area of a triangle is $\frac{1}{2}h * b$.

Consumer surplus: $\frac{1}{2} * 4 * 200 = 400$

Producer surplus: $\frac{1}{2} * 2 * 200 = 200$

Total surplus: 600.

1.8 Taxes

A tax creates a wedge between what consumers pay and what price producers get.

1.9 Tax Burden

1.10 Surplus Under Tax

1.11 Example

$Q_d(p) = 200 - 40p, Q_s(p) = 10p$

a) What is the equilibrium price and quantity?

$$200 - 40p = 10p$$

$$200 = 50p$$

$$p^* = 4, Q^* = 40$$

b) What is the inverse demand and supply.

$Q_d(p) = 200 - 40p, Q_s(p) = 10p$

Inverse demand:

$$Q = 200 - 40p$$

$$40p = 200 - Q$$

$$p = 5 - \frac{1}{40}Q$$

Inverse supply:

$$Q = 10p$$

$$p = \frac{1}{10}Q$$

c) Plot the equilibrium, mark the equilibrium price and quantity.

d) What are the consumer and producer surplus?

$$CS = \frac{1}{2} * 1 * 40 = 20$$

$$PS = \frac{1}{2} * 4 * 40 = 80$$

Total surplus: 100.

e) What is the price elasticity of demand at the equilibrium price?

$Q_d(p) = 200 - 40p$

$$\frac{\partial (200 - 40p)}{\partial p} \frac{p}{200 - 40p}$$

$$= -40 \frac{p}{200 - 40p}$$

$$-40 \frac{4}{40} = -4$$