1 Equilibrium

1.1 Market Demand and Supply

Market demand comes from consumers maximizing their preferencs subject to budget and then we add up those consumer's demands. **For any price how much will consumer's demand?**

$Q_d(p)$

$u(x_1, x_2) = x_1 x_2$. $x_1 = \frac{\frac{1}{2}m}{p_1}, x_2 = \frac{\frac{1}{2}m}{2}$.

Market demand for x_1. $Q(p) = \frac{\frac{1}{2}M}{p}$. For example $Q_d = \frac{2500}{p}$.

Market supply (we have not studied) $Q_s(p) = 2p$.

How do consumers and producers interact in market?

Where do prices come from?

1.2 What is an equilibrium?

Equilibrium is a state of some system in which there is no tendency for change.

In the context of a market, it is a price under which there is no tendency for that price to change. A "settled" state of the market.

Equilibrium occurs when supply equals demand.

Suppose otherwise.

Suppose that there price for which supply exceeds demand.

Some firms have made a thing that isn't being sold. They can't sell it at the current price because everyone willing to buy has already bought. *But they sell at a lower price.*

This creates downward pressure on prices.

Suppose that there is price for which demand exceeds supply.

There is upward pressure on prices.

The only time we can have an equilibrium is when p^* is such that:

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

If we want to plot an equilibrium, we need to find the inverse demand $p(Q_d)$ and inverse supply $p(Q_s)$.

$Q_d = 100 - p$

$p = 100 - Q_d$ (inverse demand)

$Q_s = p$

$p = Q_s$ (inverse supply)

Equilibrium occurs where:

$$Q_d(p) = Q_s(p)$$

$$100 - p = p$$

$$2p = 100$$

$$p^* = 50$$

$$Q_d(50) = 100 - 50 = 50$$

$$Q_s(50) = 50$$

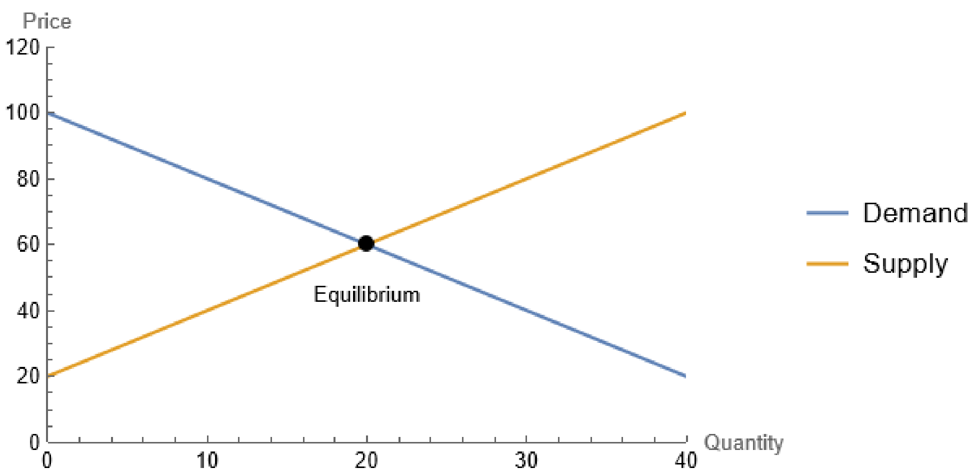

Figure 1: An Equilibrium Plot

1.3 Example

Suppose $Q_d = \frac{2500}{p}, Q_s = 100p$.
To plot this, solve for the inverse demand:

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

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

Inverse supply:

$$q = 100p$$

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

Solve for the equilibrium price and quatity:

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

$$2500 = 100p^2$$

$$25 = p^2$$

$$p = 5$$

$$q = 500$$

1.4 Effect of a Tax

$Q_s(p) = Q_d(p+t)$
Suppose we have $t = 1$.

$$Q_d(p+1) = Q_s(p)$$

$$\frac{2500}{p+1} = 100p$$

Price firms get in equilbrium with a tax of 1:

$$p = 4.52494$$

$$Q_s(4.52494) = 100(4.52494) = 452.494$$

Price consumers pay:

$$p + 1 = 5.52494$$

$$Q_d(5.52494) = \frac{2500}{5.52494} = 452.494$$

1.5 Example

Suppose $Q_s = 100p$ and $Q_d = 300 - 50p$. The government imposes a tax of $t = 3$. Before the tax:

$$300 - 50p = 100p$$

$$300 = 150p$$

$$p = 2$$

$$q = 200$$

With a tax of 3:

$$300 - 50\left(p + 3\right) = 100p$$

$$300 - 50p - 150 = 100p$$

$$150 = 150p$$

$$p^{*} = 1$$

$$q = 100$$

Calculate the quantity from consumer price:

$$p + 3 = 1 + 3 = 4$$

$$Q_d\left(4\right) = 300 - 50\left(4\right) = 300 - 200 = 100$$

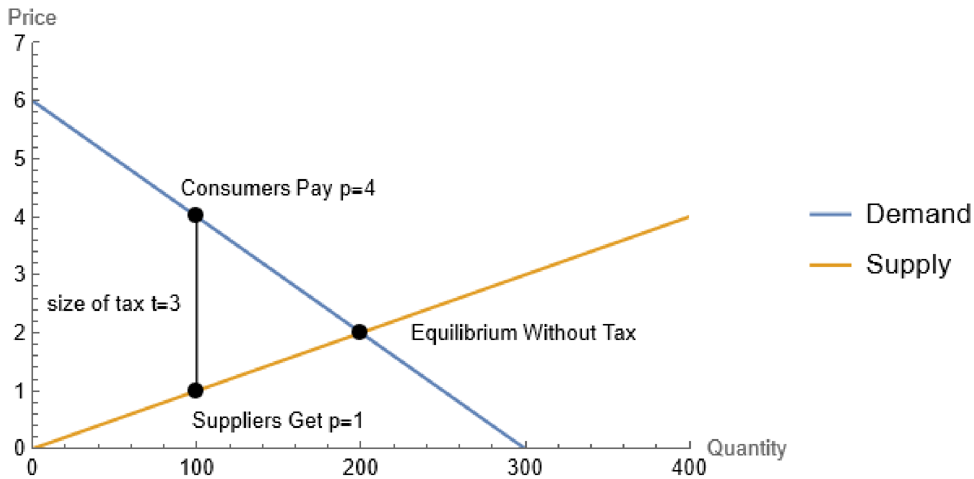

Figure 2: Effect of a Tax

A tax will always change a market relative to equilibrium.

Consumer will end up paying more.

Firms will end up getting less.

Quantity sold will decrease. We can use this to decrease the quantity of things that we don't like (cigarettes, gasoline).

1.6 Surplus and Deadweight Loss

Surplus is the attempt to calculate "happiness" in dollar amounts.

Consumer surplus is the area under the inverse demand curve but above price and the left of equilibrium quantity.

Producer surplus is the area above the inverse supply, below price, and the left of equilibrium quantity.

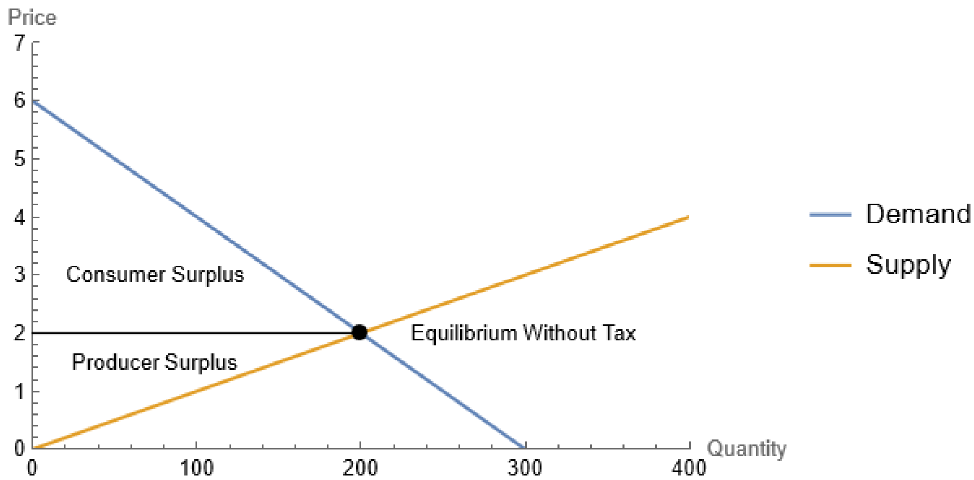

Figure 3: Surplus Without Tax

Consumer surplus is $\frac{(200)*(6-2)}{2} = 400$
Producer surplus is $\frac{(200)*(2)}{2} = 200$
Total surplus (welfare) of this market $400 + 200 = 600$

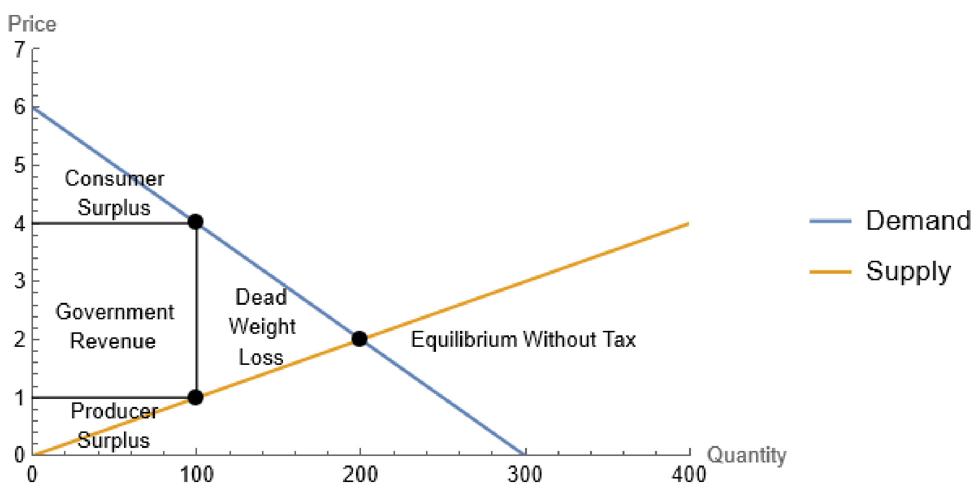

Figure 4: Surplus With Tax

$CS = \frac{100(6-4)}{2} = 100$
$PS = \frac{100(1)}{2} = 50$
$Rev. = 3\,(100) = 300$
$Total = 100 + 50 + 300 = 450$

1.7 Tax Burden