

# Elements of Macroeconomics Spring 2024

## Week 3

### 4 Working With Graphs (continue)

When analysing a model (such as demand and supply), we distinguish between:

1. Movements along the graph
2. Shift of the graph
3. Rotation of the graph

The linear function can be written as

$$y = m * x + b \quad (1)$$

In the case of demand and supply, the quantity ( $q$ ) is a function of prices ( $p$ ) or:

$$q(p) = m * p + b \quad (2)$$

You may wonder, why we put  $q$  on the x-axis and  $p$  on the y-axis. The answer is **convention!**

#### 4.1 Movements along the graph

In this case, the graph does not move! The only thing which adjusts is that we **change**  $p$  and get a different  $q$ . For instance, a company changes it's price from 7.5\$ to 2.5\$, the demand increases from 5 to 15 (see figure 1).

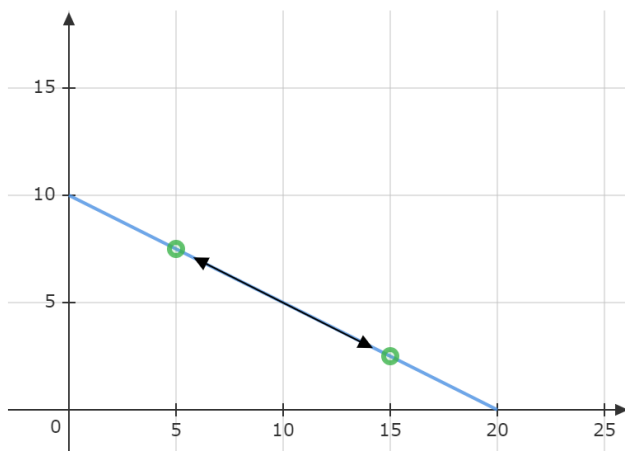


Figure 1: Movements along the graph

## 4.2 Shift of the graph

A graph shifts left or right if variables **outside** the market change! In this case, the **intercept**  $b$  changes. For instance, real income increased and we look at a normal good. The result is that the demand curve shifts to the right (see figure 2).

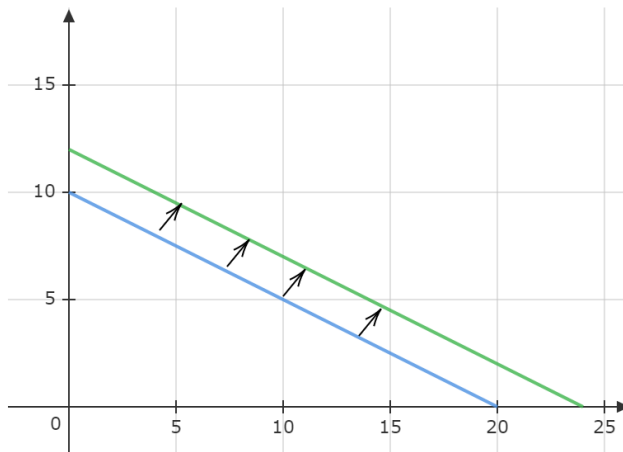


Figure 2: Shift of the graph

## 4.3 Rotation of the graph

Lastly, a graph can also rotate inwards or outwards. This means that the relationship between  $p$  and  $q$  changes. In economics, the **slope** ( $m$ ) of a graph depends on the **price elasticities**, eg how sensitive does the demand change if prices change. A demand curve is completely elastic if it's slope is 0 (flat; eg customers react a lot of prices change a little) and inelastic if it's slope approaches  $\infty$  (vertical line; eg customers react not at all when prices change such as cancer treatment). One example is that a competing firm closes a branch directly next to the firm we analyze. As customers cannot shift to the other branch anymore if prices increase, demand falls slower!

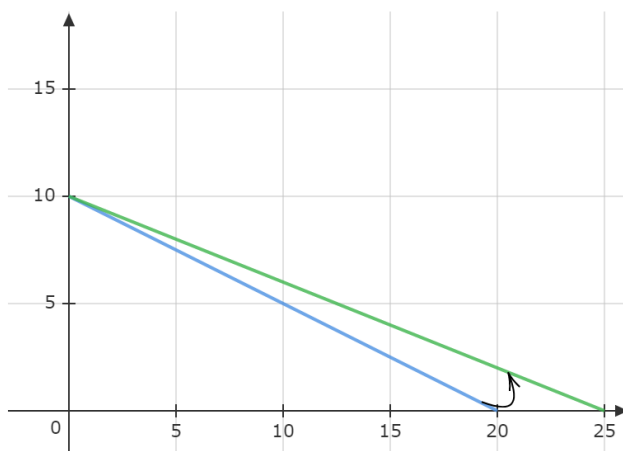


Figure 3: Rotation of the graph

## 5 Economic Efficiency, Government Price Setting, and Taxes

First, let's review some important concepts:

- **Marginal Cost (MC):** The additional cost of producing one additional good/service  
→ Producing one more coffee costs 1\$
- **Marginal Benefit (MB):** The additional benefit of consuming one additional good/service  
→ The next coffee would be worth 2\$
- **Market Equilibrium:** The point where  $MC = MB$   
→ Market price is 1.50\$ for a quantity of 20 coffees.
- **Individual Consumer Surplus:**  $MB - \text{Market price}$   
→ I would pay 2\$, but have only to pay 1.50\$. My surplus is 0.50\$
- **Individual Producer Surplus:**  $\text{Market price} - MC$   
→ It would cost 1\$ to produce, but I can charge 1.50\$. My surplus is 0.50\$
- **Deadweight Loss:** In comparison to the efficient outcome, there are consumers whose MB is bigger than the efficient market price, but lower than the new market price. Similarly, there are producers whose MC is smaller than the efficient market price, but higher than the new market price. The surplus of these consumers and firms is the DWL.  
→ Due to a tax, the coffee costs now 2.50\$. Neither the example consumer nor producer will participate in the market.

For the total surplus in an economy, we need the supply and demand curve. This means, we sum all producers and consumers in the economy. Next, we calculate the area underneath the curve:

$$\text{Producer Surplus (PS)} = \frac{(\text{Market Price} - \text{Supply curve intercept}) * \text{Market Quantity}}{2}$$

$$\text{Consumer Surplus (CS)} = \frac{(\text{Demand curve intercept} - \text{Market Price}) * \text{Market Quantity}}{2}$$

$$\text{Economic Surplus (ES)} = \text{Producer Surplus} + \text{Consumer Surplus}$$

**Example Question:** You are given a demand and supply curve. Please graph it and calculate Consumer Surplus, Producer Surplus, and Economic Surplus.

$$\text{Demand: } Q^D = 13 - 0.5P$$

$$\text{Supply: } Q^S = -2 + P$$

### Cookbook Recipe:

1. Calculate Market Price  $P^* \rightarrow Q^D = Q^S$
2. Calculate Market Quantity  $\rightarrow$  Plug  $P^*$  in  $Q^S$  or  $Q^D$
3. Rearrange to  $P(Q) = mQ + b$ !
4. Draw Graph: Q on X-axis and P on Y-axis
5. Calculate CS, PS, ES: Triangle formula  $(\text{base} * \text{height})/2$

**Example Question Continue: Tax** Now, suppose we have a tax on the producer of 3\$ per item. Calculate new consumer surplus, producer surplus, tax revenue and dead weight loss.

**Cookbook Recipe: Tax**

6. Tax: Which graph shifts (Demand or Supply?)
7. New Equilibrium: (Repeat point 1 and 2)
8. What is the tax revenue?  $\rightarrow$  Equilibrium quantity  $\times$  Tax
9. Calculate CS, PS, DWL  
 $\rightarrow$  Make sure that the original ES is equal to CS + PS + Tax revenue + DWL

**Example Question Continue: Price Floor** Instead of a tax, the government introduces a price floor of 12\$. Calculate the amount of shortage/excess, as well as consumer Surplus, Producer Surplus, and Deadweight Loss.

**Cookbook Recipe: Price Floor/Ceiling**

6. Price Floor/Ceiling: Add horizontal line to graph
7. Is there a shortage or an excess?  
 $\rightarrow$  Mark points where horizontal line crosses demand and supply curve  
 $\rightarrow$  shortage/excess is the difference between those two points
8. New Equilibrium: Smallest point of 7)
9. Calculate CS, PS, DWL  
 $\rightarrow$  Trapezoid formula  $(a+c)/2 \times \text{height}$   
 $\rightarrow$  Make sure that the original ES is equal to CS + PS + DWL