Elements of Macroeconomics

February 2023

2 Working With Graphs

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

$$y = m * x + b \tag{1}$$

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

$$q(p) = m * p + b \tag{2}$$

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

2.1 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).

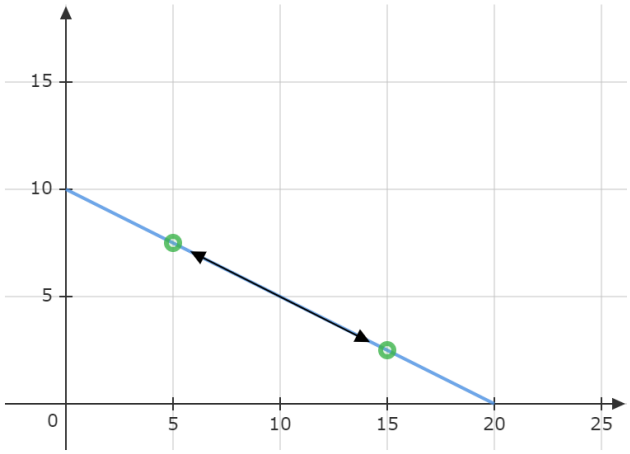

Figure 1: Movements along the graph

2.2 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).

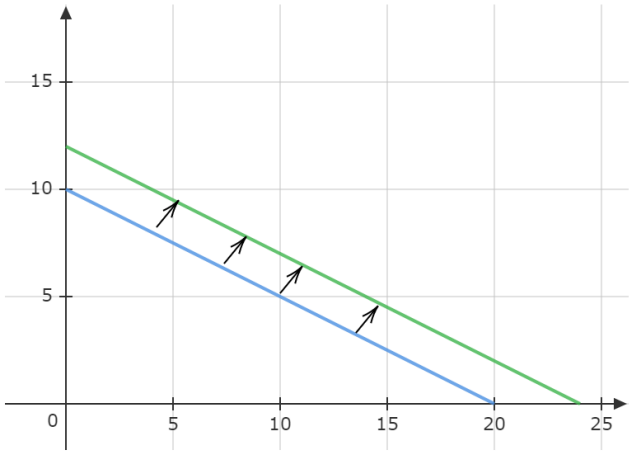

Figure 2: Shift of the graph

2.3 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) and inelastic if it's slope approaches ∞. One example is that a competing firm opens a branch directly next to the firm we analyze. As customers can shift to the other branch if prices increase, demand falls faster!

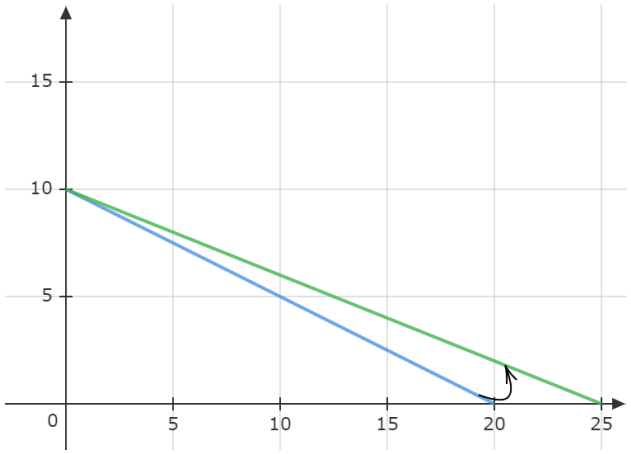

Figure 3: Rotation of the graph

3 National Accounting

3.1 Growth rates

Growth rates are percentage changes of variables over time:

$$\text{Growth Rate in \%} = \frac{X_t - X_{t-1}}{X_{t-1}} * 100$$

For instance, GDP in Q4 2022 was 26,132.458 Billion US$ while in Q3 2022 it was 25,723.941 (https://fred.stlouisfed.org/series/GDP). To calculate the growth rate, we use:

$$\text{Growth Rate in \%} = \frac{26,132.458 - 25,723.941}{25,723.941} * 100 = 1.588\%$$

3.2 Annualizing Growth rates

We often have monthly or quarterly growth rates. How do we **annualize** them, eg convert into a yearly growth rate? We multiply them multiple times!

Example 1: quarterly inflation is 0.5%. What is annualized inflation? For this we multiply (1 + 0.5%) with itself as often as there are quarters in a year and subtract 1.

$$(1 + 0.5\%) * (1 + 0.5\%) * (1 + 0.5\%) * (1 + 0.5\%) - 1 = (1 + 0.5\%)^4 - 1 = 2.015\%$$

Example 2: Similarly, when we have data for longer than a year. Eg GDP growth between 5 quarters was 3.5%. What is the anualized growth rate? Again, we multiply (1 + 3.5%) with itself as often as there are 5 quarters in a year (4/5).

$$(1 + 3.5\%)^{4/5} - 1 = 2.79\%$$

3.3 Gross National Product, National Income, Personal Income, Disposable Income

Sometimes it is useful to apply other concepts other than GDP as well.

Gross NATIONAL Product While GDP looked at **domestic** production, eg within the country's borders, GNP looks at **national** production, eg production from the country's residents and firms!

For instance, if GM (a US company) produces cars in Mexico, the production counts as GDP of Mexico and GNP of the US.

National Income For GDP we said it is *gross* and we do not care about depreciation. For national income we do!

National Income = GDP - Depreciation of Capital

Personal Income Personal income can be seen as **gross** income of households. It covers all gross payments the households receive, eg all gross wages, dividends, transfer payments. In practice, we use

Personal Income = National Income - Corporation savings + government transfers and bonds interests

Disposable Personal Income Disposable personal income is the amount households can actually spend or save. For this, we subtract taxes from personal income.

Disposable Personal Income = Personal Income - Taxes