Macroeconomics Winter term 2023

Tutorium 1

1. Given are the following two functions:

$$F_1: \quad y = 4 + 3x \qquad F_2: \quad y = 5x$$

   (a) Graph both functions in the range $x \geq 0$.

   (b) Calculate the intersection of the two functions by

      i. equating both sides

      ii. the Gaussian elimination method

      iii. the Cramer-rule

   (c) Determine the difference of the two functions $F_2 - F_1$ and plot it graphically.

   (d) Interpret the two functions and their difference economically in classical business theory.

   (e) Consider the following general functions

$$F_1: \quad y = a_1 + b_1 x \qquad F_2: \quad y = b_2 x \quad \text{mit } a_1, b_1, b_2 > 0$$

      i. Against the background of the previous economic interpretation, why does one generally demand $a_1, b_1, b_2 > 0$?

      ii. What condition must hold for b_1 and b_2 so that the intersection of both functions is in the positive range?

      iii. Assume that the intersection of F_1 and F_2 is in the positive range. Determine in general the intersection of F_1 and F_2 and investigate the dependence of the intersection on the parameters a_1, b_1, b_2. Also represent the dependencies graphically.

2. Given is the following time series:

Time	x
2015	103
2016	110
2017	97
2018	105
2019	121

   (a) Determine the arithmetic mean of x.
   (b) Bestimmen Sie die jährlichen Wachstumsraten von x.
   (c) Determine the annual growth rates of x between 2015 and 2019 via
      i. the arithmetic mean of the annual growth rates
      ii. the geometric mean of the growth factors. Surprise?
   (d) Give an economic interpretation of the data.

3. Given is the following number series:

$$2 + \frac{2}{3} + \frac{2}{9} + \frac{2}{27} + \frac{2}{81} + ...$$

   (a) How will the series continue?
   (b) What is this type of number series called?
   (c) Calculate the sum $A_4 = 2 + \frac{2}{3} + \frac{2}{9} + \frac{2}{27} + \frac{2}{81}$
   (d) What results if you continue the series to infinity?
   (e) What results in general for the series?

$$A_N = \sum_{n=0}^{N} q^n \quad \text{or} \quad A_\infty = \sum_{n=0}^{\infty} q^n \quad 0 < q < 1$$

   (f) Give economic applications for this type of number series?