

## Methods in Transportation Econometrics and Statistics (Master)

Winter semester 2023/24, Tutorial No. 12

### Problem 12.1: Econometric Input-Output-Model (IOM)

In a national economy, we consider the two sectors electrical energy (power plants producing electricity) and mechanical engineering (turbines, machines and other engineering products). All other sectors, including the consumers in the strict sense, are summarized as the “consumers sector”.

In a certain (small) time interval, the power plants produce a gross output of 500 kWh of electricity while the engineering sector produce machines worth 200 €. The power plants need 10 % of their energy for their own purposes (losses, lightning of the power plants, and others) while the mechanical engineering sector needs 5 % of their machines for itself to ensure the further production.

For each kW of installed power, the managers of the power plants need to buy machines and equipment for €1752. The average lifetime of the power plants is 20 years during which they operate, on average, at half the installed power, i.e., a total of 87 600 kWh electrical energy can be produced per installed kW. The mechanical engineers, in turn, need 1 kWh of electrical energy to produce 4 € of their products.

- (a) Draw the diagram of the product flows  $x_{ij}$  between the energy sector 1 and the mechanical engineering sector 2 and calculate the numerical values.

*Hint:* Express all flows in € (per time interval) and assume a price of electricity of 25 Eurocents per kWh. Furthermore, assume a steady state, i.e., neither buildup nor depletion of stored reserves (which, for electricity, would last for a few hours only, anyway).

- (b) How much electricity (in kWh and €) and machines are delivered to the consumers and the other sectors in the same time interval?
- (c) Specify the IO-coefficients  $A_{ij}$  and derive from the resulting  $\underline{A}$  matrix the coefficient matrix  $\underline{B}$  of the final demand.
- (d) Suddenly, the external demand for machines rises by 11 % while that for electricity remains constant. Give the percentaged increase of the products of mechanical engineering *and* of electrical energy in order to maintain the steady state of the production and demand flows. Discuss the obtained values.