1 Getting Started

1.1 Data Preparation

Definition 1. ***Time Series***. *A sequence of random variables spaced at an uniform time interval.*

Chain Index:

$$z_t = \frac{x_t}{x_{t-1}} \tag{1}$$

where: x - variable of interest. For the log-linearised variables Eq. (1) becomes:

$$z_t = x_t - x_{t-1} \equiv \Delta x_t. \tag{2}$$

Fixed base index:

$$z_t^* = \frac{x_t}{x_S} \tag{3}$$

where: S - base period. Usually, the base period is the first available observation. The purpose of re-scaling the variables by using the fixed base index is to compare various scales, e.g. money supply and number of unemployed persons. In (econometric) practice, the applied formulas are as follows:

$$z_t = \ln\left(\frac{x_t}{x_{t-1}} \cdot 100\right),$$

$$z_t^* = \ln\left(\frac{x_t}{x_S} \cdot 100\right).$$

Exercise 1.1. ***Money Supply and Unemployment in Poland.*** Using the data on monetary aggregate M2 and the number of unemployed persons present a figure. Calculate both fixed base (January 1997 = 100) and chain indices and present the results graphically. According to the macroeconomic theories, try to interpret the results.

2 Measures of Location

Definition 2. ***Population***. *A collection of all elements of interest in a particular study.*

Definition 3. ***Sample***. *A subset of population.*

2.1 Arithmetic Mean

$$\bar{x} = T^{-1} \sum_{i=1}^{T} x_i, \tag{4}$$

where: T - sample size, $\sum$ - summation operator.

Exercise 2.1. ***Washington Redskins Salaries.*** Using the data on salaries of the Washington Redskin Palyers estimate the mean salary for offence and defence. Compare the results. What is more important to Daniel M. Snyder: selling tickets or winning championships? [Excel file: redskins.xls]

2.2 Geometric Mean

$$\bar{x}^G = \left(\prod_{i=1}^{T} x_i \right)^{-T} = \sqrt[T]{x_1 \cdot x_2 \cdot \ldots \cdot x_{T-1} \cdot x_T}, \tag{5}$$

where: $\prod$ - product operator.

Make sure you do not employ the arithmetic mean to evaluate a product of several factors (e.g. interest rate).

Exercise 2.2. ***Deposit Interest Rate.*** Calculate the average deposit rate for households. [Excel file: deposit.xls]

2.3 Trimmed Mean

Remove the a% of the smallest and largest data values and re-estimate the arithmetic mean. Compute the number of re-moved elements by using the following formula:

$$\mathfrak{T} = \frac{a}{100} \cdot T, \tag{6}$$

and then round $\mathfrak{T}$ (if necessary) to the nearest integer value.

Exercise 2.3. ***Redskins' Payroll Again.*** Calculate the 5% trimmed mean sallary for defence and offence.

2.4 Weighted Mean

Weighted mean is used when some of the variables do not contribute equally to the average (e.g. prices of bread and spacecrafts for the consumer price index). The weighted mean is estimated as:

$$\bar{x}^W = \frac{\sum_{i=1}^{T} \omega_i x_i}{\sum_{i=1}^{T} \omega_i}, \tag{7}$$

where: ω - weights. For normalised weights, i.e. $\sum_{i=1}^{T} \omega_i = 1$, formula (7) becomes simply:

$$\bar{x}^W = \sum_{i=1}^{T} \omega_i x_i. \tag{8}$$

Exercise 2.4. ***CPI for Students.*** List 5 most important consumer products along with their prices and weights. Calculate the average price.

2.5 Median

Median separates the lower half of a sample from the higher half. For the odd number of observations, the median is estimated as:

$$m = x_{\frac{T+1}{2}}, \tag{9}$$

whilst for the even number of observations:

$$m = \frac{x_{\frac{T}{2}} + x_{\frac{T+1}{2}}}{2}. \tag{10}$$