ECONOMIC STATISTICS

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Course Material Developed by Department of Economics,

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Week 2

Data types, descriptive statistics, indices

Data types I

- Time series:
  - Variables ordered in time
  - Freqency of observations (e.g. monthly, yearly)
  - Notation: Y_t
  - Examples (macroeconomic, financial – individual?)
- Cross sectional:
  - Sample of economic agents at a given time point
  - Examples (individuals, enterprises, countries)
  - Notation: Y_i
  - Random sample

Data types II

- Panel:
  - Time series + cross sectional jointly
  - Observation of the cross sectional sample throughout more time periods
  - Notation: Y_{it}
  - Examples (GDP of European countries, panel of individual households)

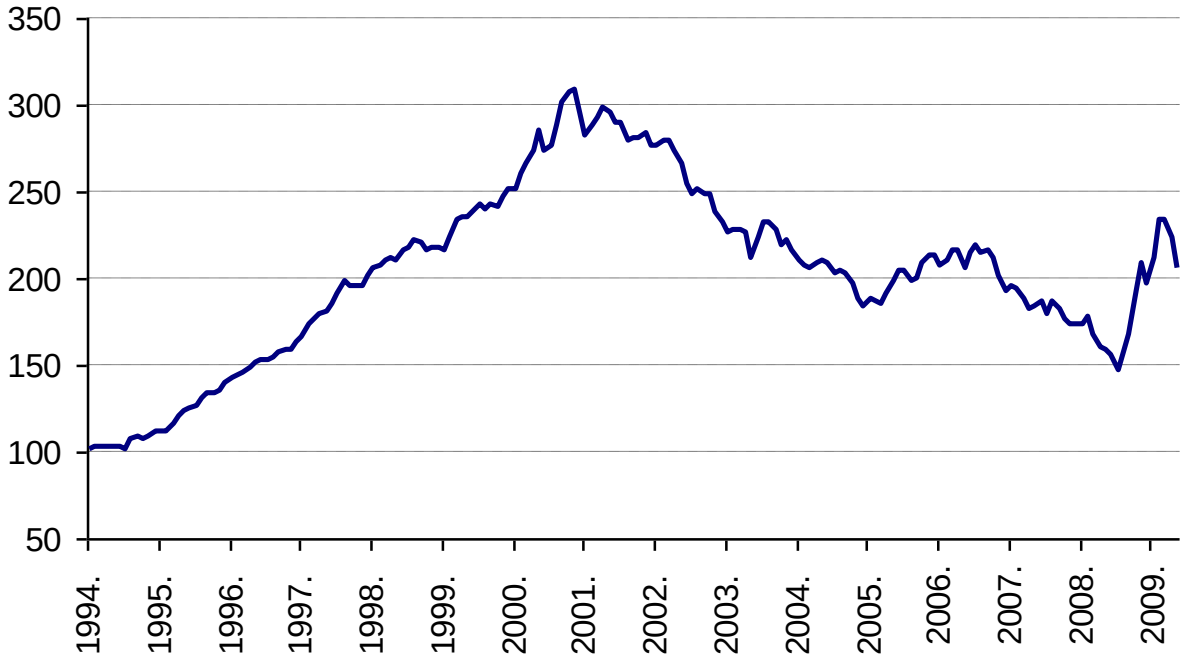
Data types III

- Quantitative and qualitative
  - Quantitative: e.g. inflation, income
  - Qualitative: e.g. male/female, education level – code as numbers
- Level and dynamics
  - E.g. number of employed vs. change in employment

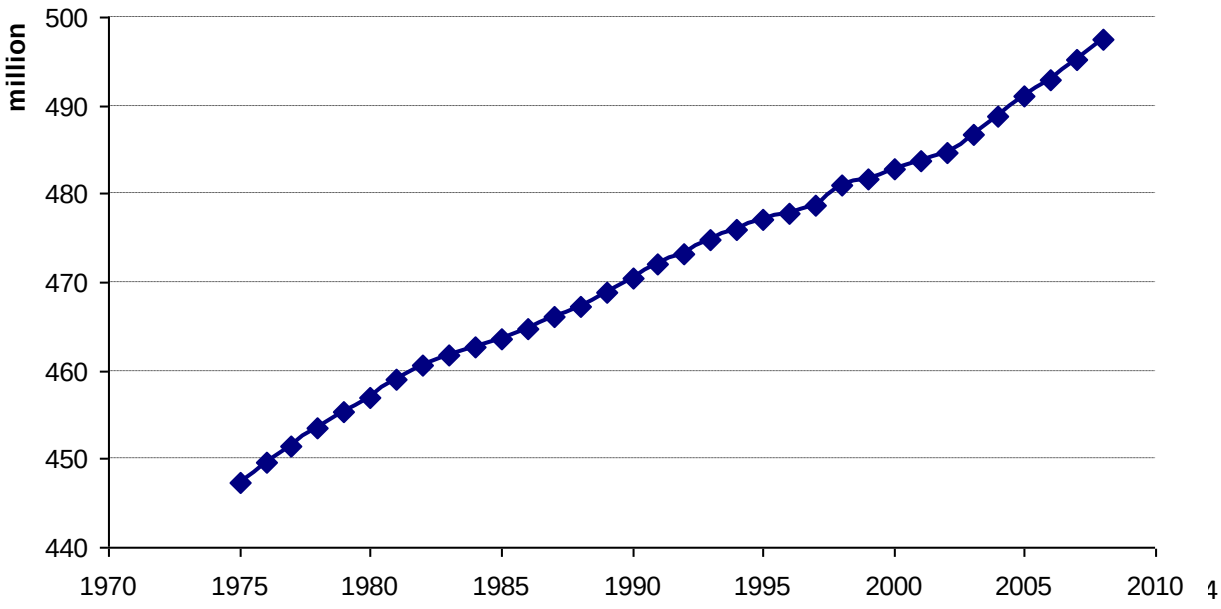
$$\%\text{change} = \frac{(Y_{t+1} - Y_t)}{Y_t} \cdot 100$$

Time series graphs

HUF/USD monthly exchange rate



EU27 population

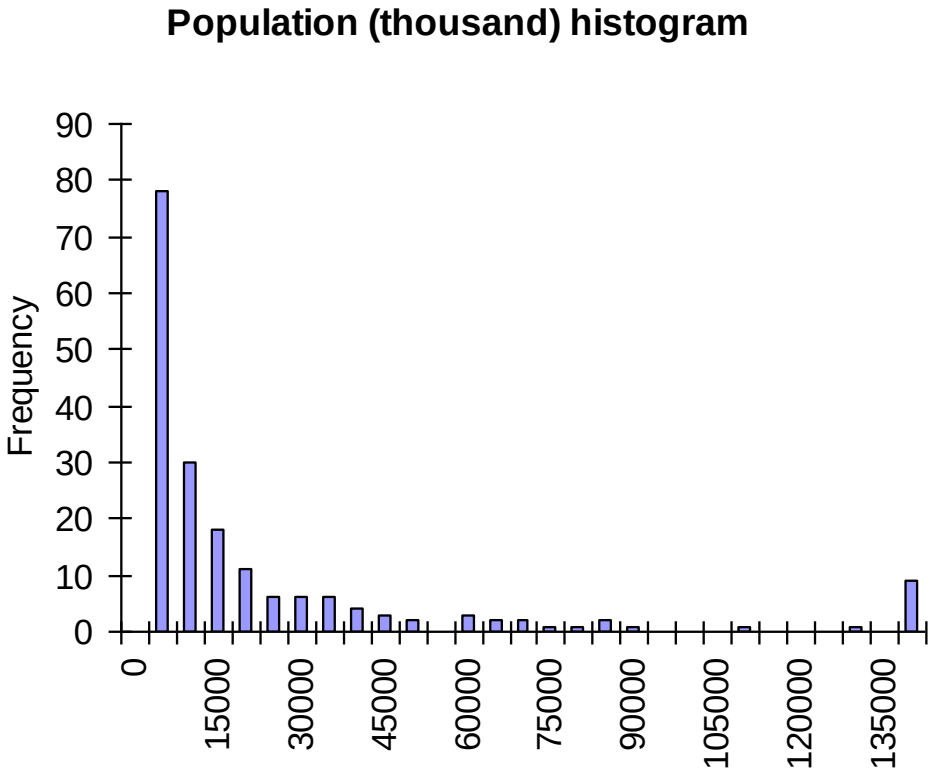


Histograms

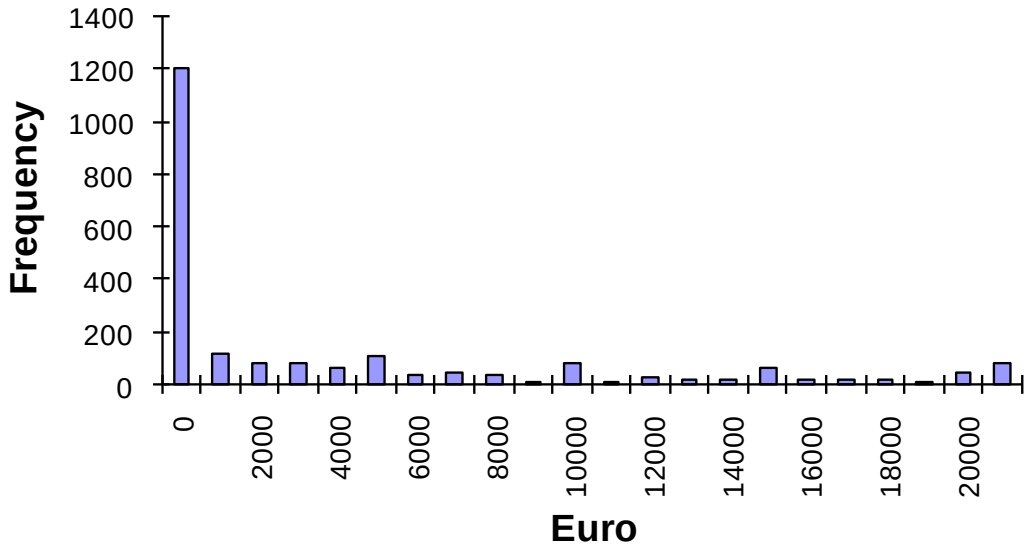
- Plotting cross sectional data
- Example: distribution of income per capita
- Equal intervals (brackets) – determine it in Excel according to the data
- Frequency within the intervals

Histogram, example

- Penn World: distribution of countries according to population (bracket size: 5000)



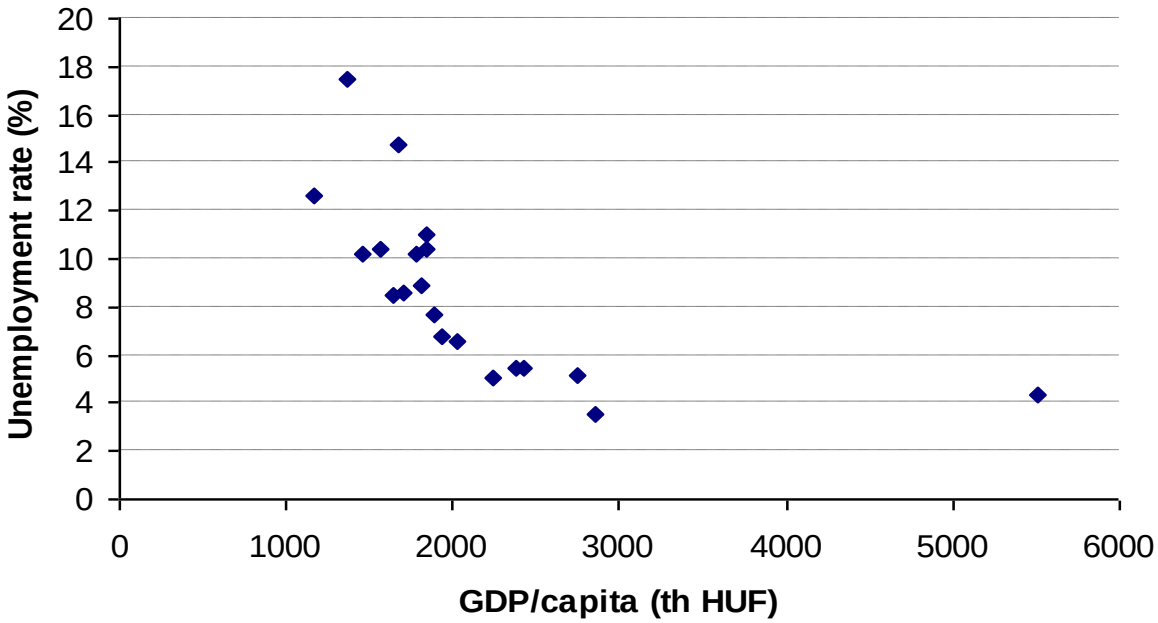
Histogram of car value – Austria, 50+



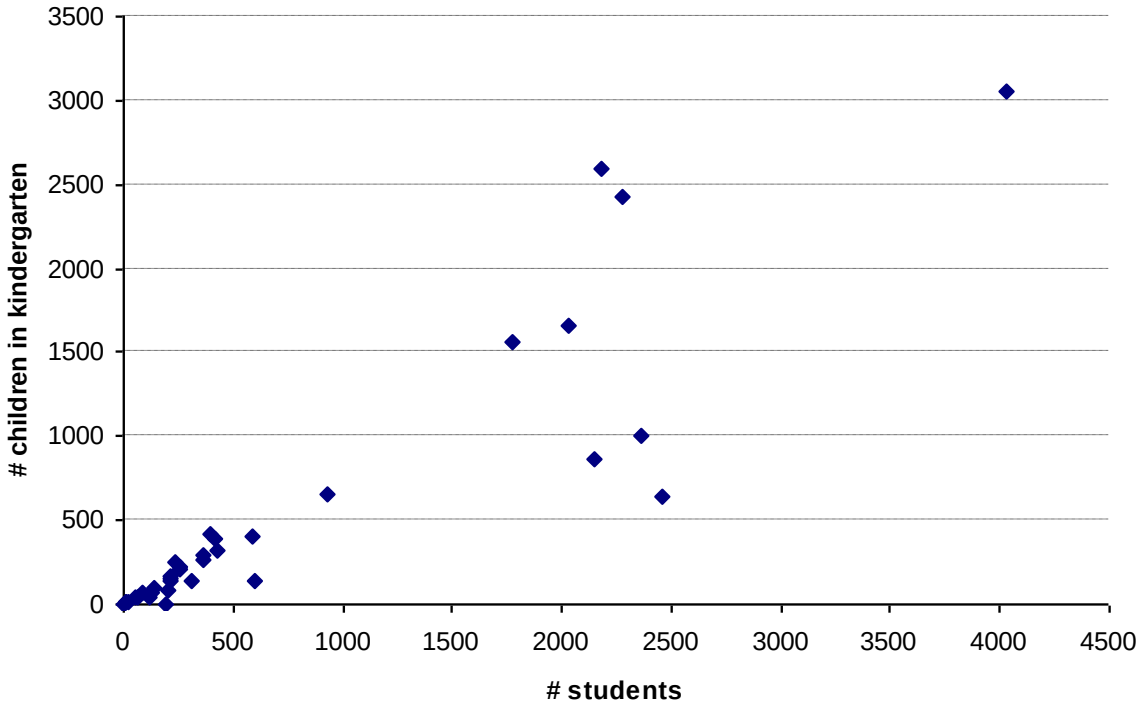
- SHARE: cross sectional sample of people aged 50+
- Value of the car, Austrian subsample (bracket size: 1000)

Point diagram

- Relationship between two variables
- KSH: data on counties



Eurostat: number of students and children in kindergarten by countries, 2007



Descriptive statistics

- Up to now: graphical methods
- Descriptive statistics: numerical summary of some characteristics of the variables
  - Level? – mean, median, mode
  - Variability? – standard deviation, range

Mean

$$\overline{Y} = \frac{\sum_{i=1}^{N} Y_i}{N}$$

- N: number of observations
- Example: mean of country population (Penn World Table) – ca. 34 million

Mode

Mode: most frequent observation

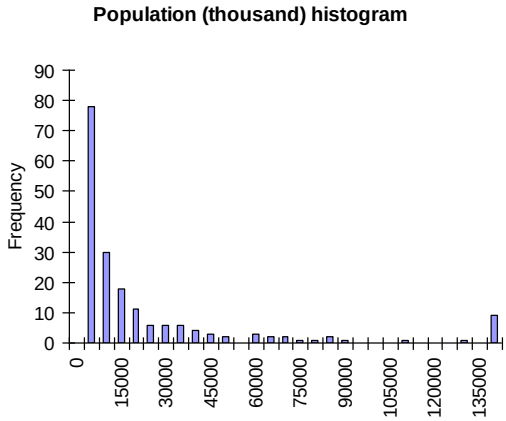
- Problem: does not always exist (e.g. one from each value), there can be more modes
- Possible solution: highest point of the histogram (depends on brackets) – center of the interval

Median, percentile

- Median: value in the middle – half of the observations below the median
- Xth percentile: X% of the observations below X
- Quartile: cuts the observations into four
  - 1st quartile: 25% below, 2nd quartile = median

Skewness

- Example: mean > median
- Some large values – mean is large
- Skewed to the left
- Long right tail



Standard deviation

- Range: difference between maximum and minimum
  - Not reliable (outlier values)
- Variance: mean of squared differences from the mean
- Standard deviation:

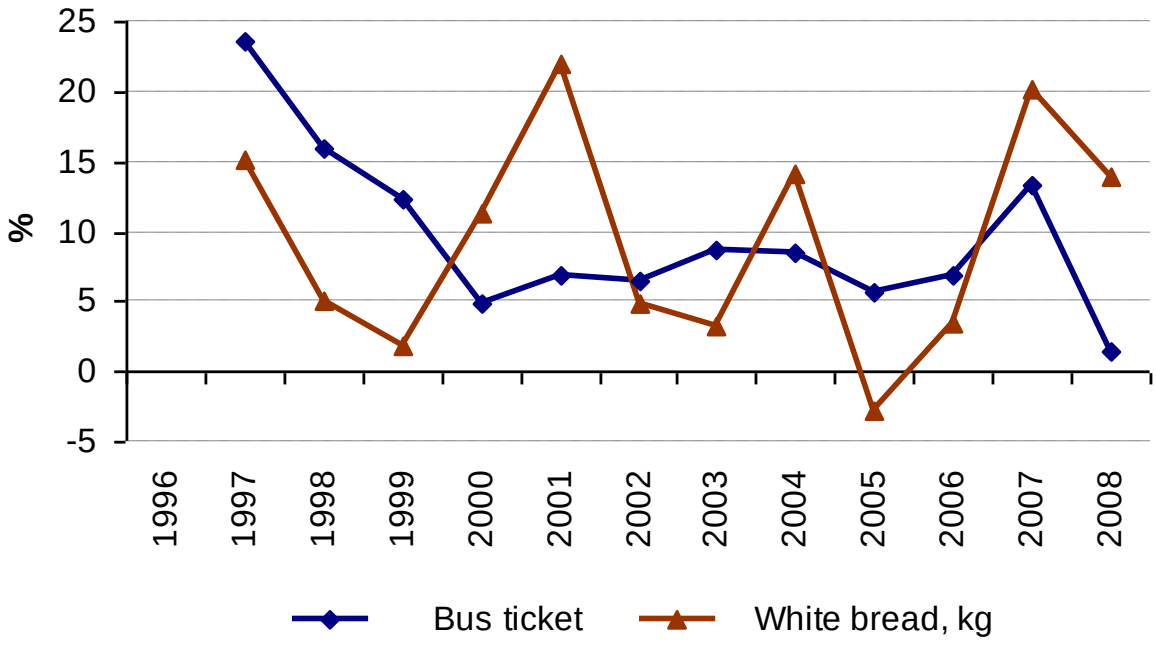
$$s = \sqrt{Var} = \sqrt{\frac{\sum_{i=1}^{N}(Y_i - \bar{Y})^2}{N-1}}$$

  - Difficult to interpret on its own

Indices

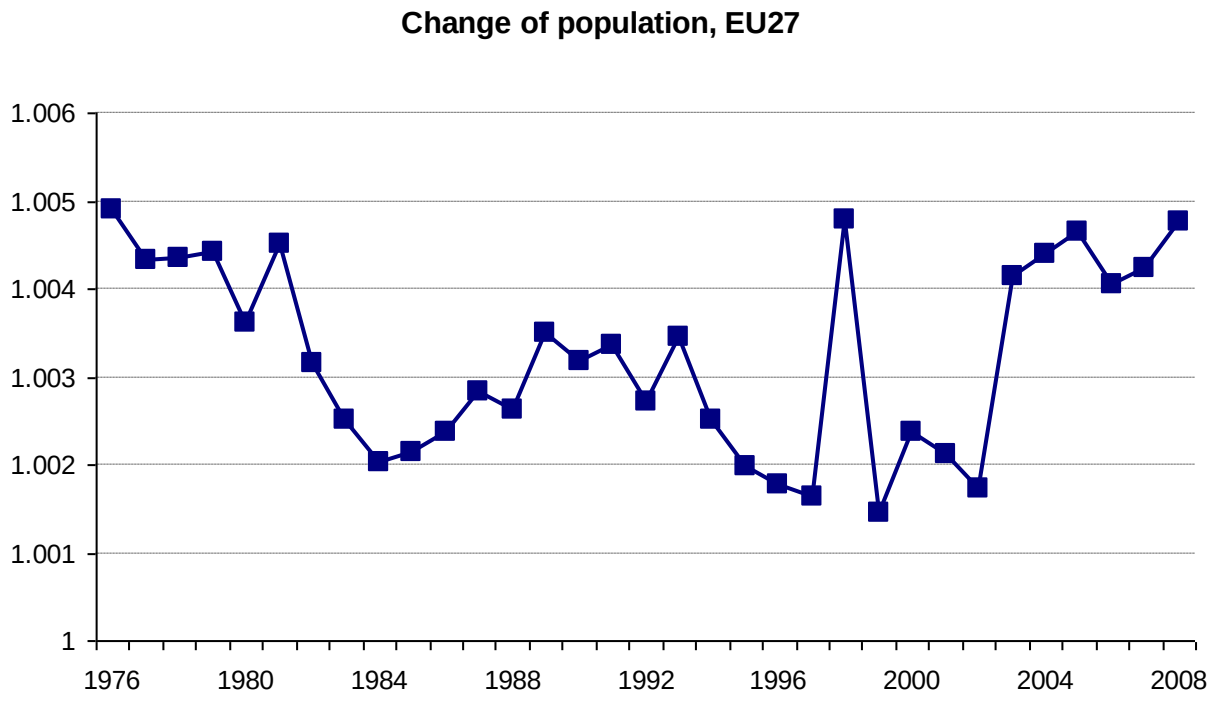
- Price index
  - Price level, average price are difficult to interpret
  - Price index: price level as % of price level at the basic period
  - Annual inflation: basic period changes yearly

Annual price indices, example



Change of population

- Base: previous year



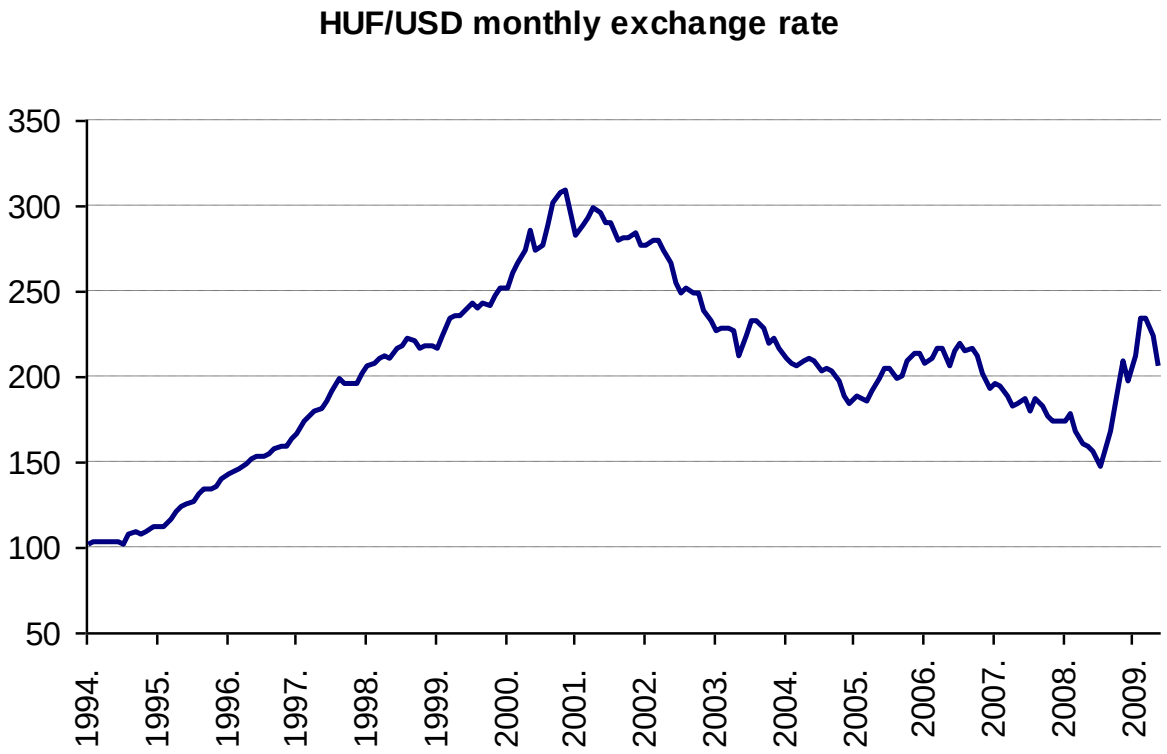
Summary

- Data types:
  - Time series, cross sectional, panel
  - Quantitative, qualitative
- Graphical methods: time series, histogram, point diagram
- Descriptive statistics:
  - Mean, mode, median
  - Skewness
  - Standard deviation

Data types, descriptive statistics, indices

Seminar 2

Time series graphs



HUF/EUR exchange rate? – graph, analysis

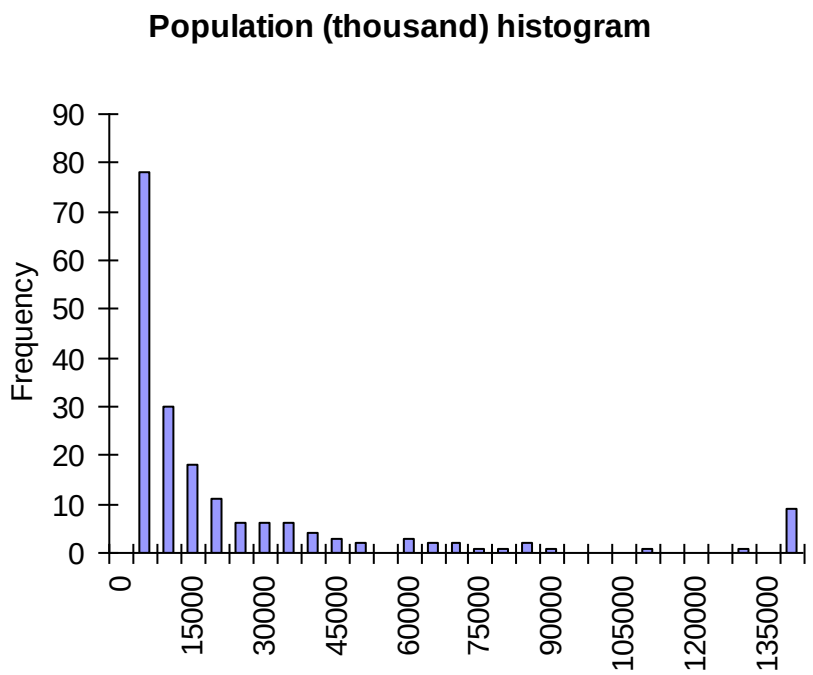
Histograms

- Graphical analysis of cross sectional data
- Excel: Analysis ToolPak extension
- Equal intervals (brackets) – determine it in Excel according to the
- Frequency within the brackets

- Excel: missing observations cause problems – solution: sorting

Histogram, example

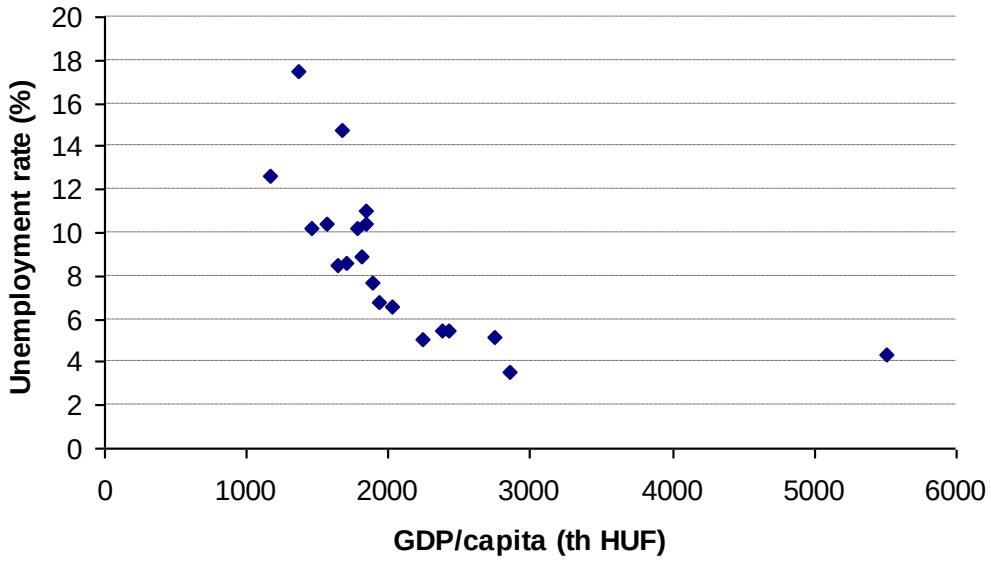
- Penn World: distribution of countries according to population



- Histogram of GDP/capital? Suggested bracket size: 2000

Point diagram

- Relationship between two variables
- KSH: data on counties



- GDP/capital and number of registered enterprises? – What is expected? What can be seen?

Mean

$$\overline{Y} = \frac{\sum_{i=1}^{N} Y_i}{N}$$

- N: number of observations
- Examples: average population of countries, average income/capital (Penn World Tables)

Mode

Mode: most frequent value

Examples:

- Country populations
- GDP per capita

- Based on histograms!

Median, percentile

- Median: middle value – half of the observations below
- Xth percentile: X% of the observations below
- Excel: descriptive statistics (median) + percentile function
  - Example: median, 3rd quartile of population and GDP/capita?
  - E.g. Median=PERCENTILE(B3:B189;0.5)

Standard deviation

- Range: difference between maximum and minimum
  - MIN(), MAX() functions
  - Not reliable (outliers)
- Variance: mean of squared differences

- Standard deviation:

$$s = \sqrt{Var} = \sqrt{\frac{\sum_{i=1}^{N} (Y_i - \overline{Y})^2}{N-1}}$$

- Range, variance, and standard deviation based on Penn World GDP/capita data (descriptive statistics table + functions)

Indices

KSH data

Price indices of bread and bus ticket

- Fix base
- Yearly changing base
- Graphical analysis

Homework 1 (groups)

1. Graphical analysis of a time series variable
2. Analysis of an economic indicator of a cross sectional sample with the help of histogram
3. Analysis of the relationship between two indicators of a cross sectional sample with the help of point diagram

For all three tasks: graph + one paragraph analysis!