Data Analytics for Social Science
Distributions and descriptives

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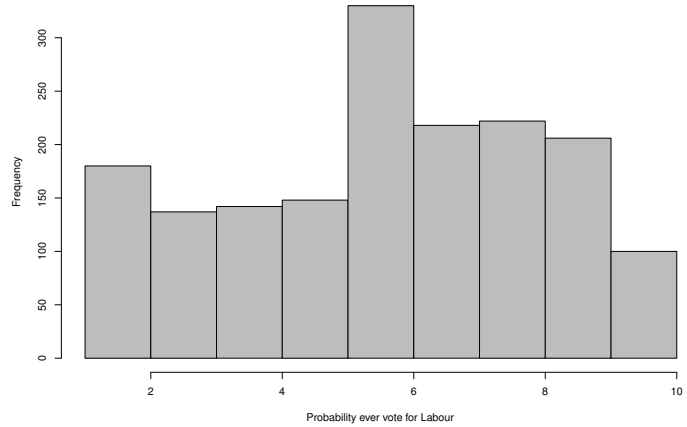
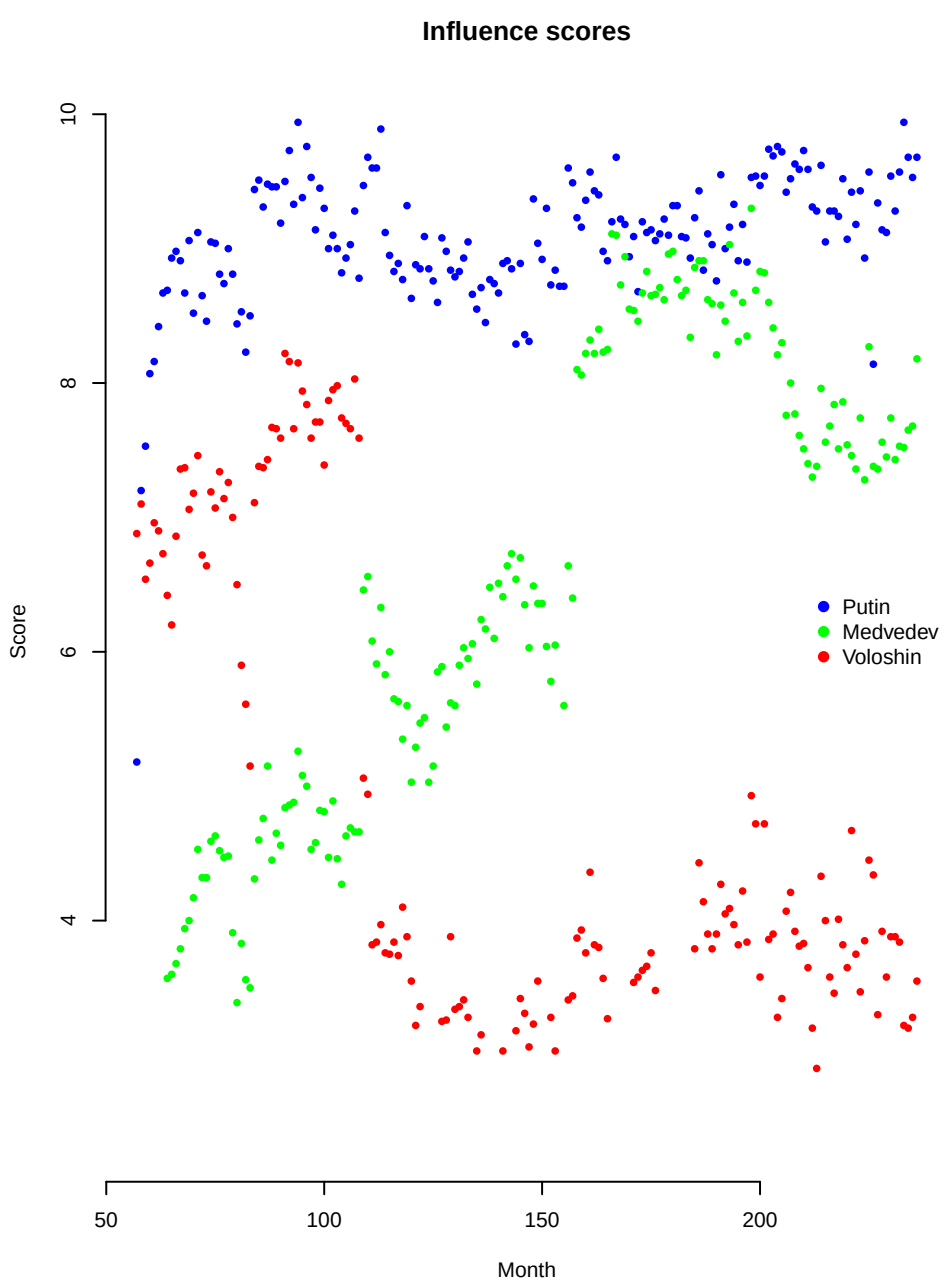
Histogram

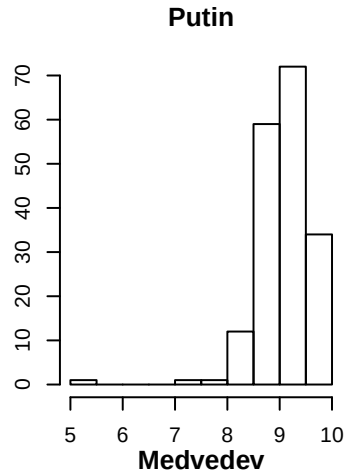
For continuous (or scale) variables, we often want to get an idea of the **distribution** of values. How many low, medium, high values?

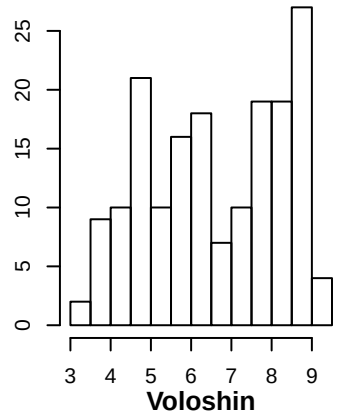
Histograms are useful to get an impression.

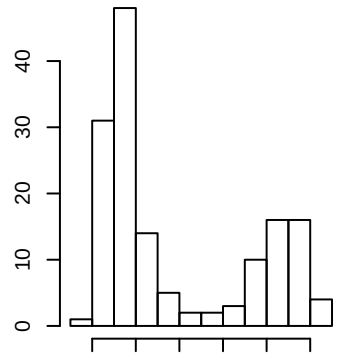
- bin the data using equal-distance cut-off points
- then produce a barplot of the number in each bin.





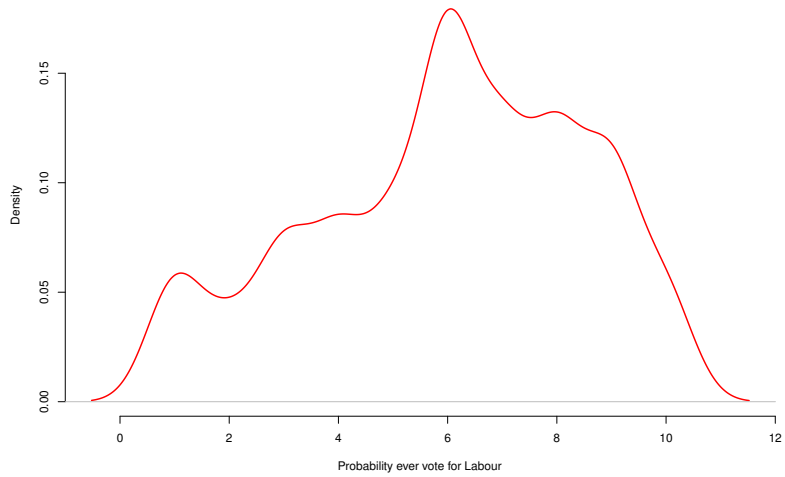






Density plot

A density plot is a smoothened version of a histogram, based on a non-parametric estimation of the shape of the distribution.



(Irish National Election Study 2011)

Distributions

For graphs of distributions (histogram, density plot, boxplot, etc.) you want to get an impression of:

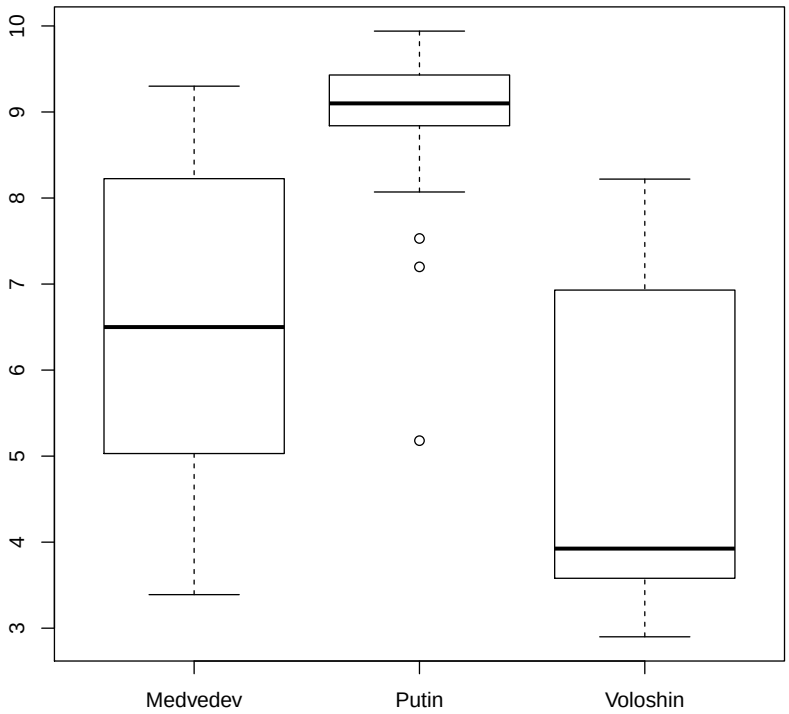
- the **shape** of the distribution;
- the **center** and **spread** of the distribution;
- the presence of **outliers**.

(Moore, 2003, 12)

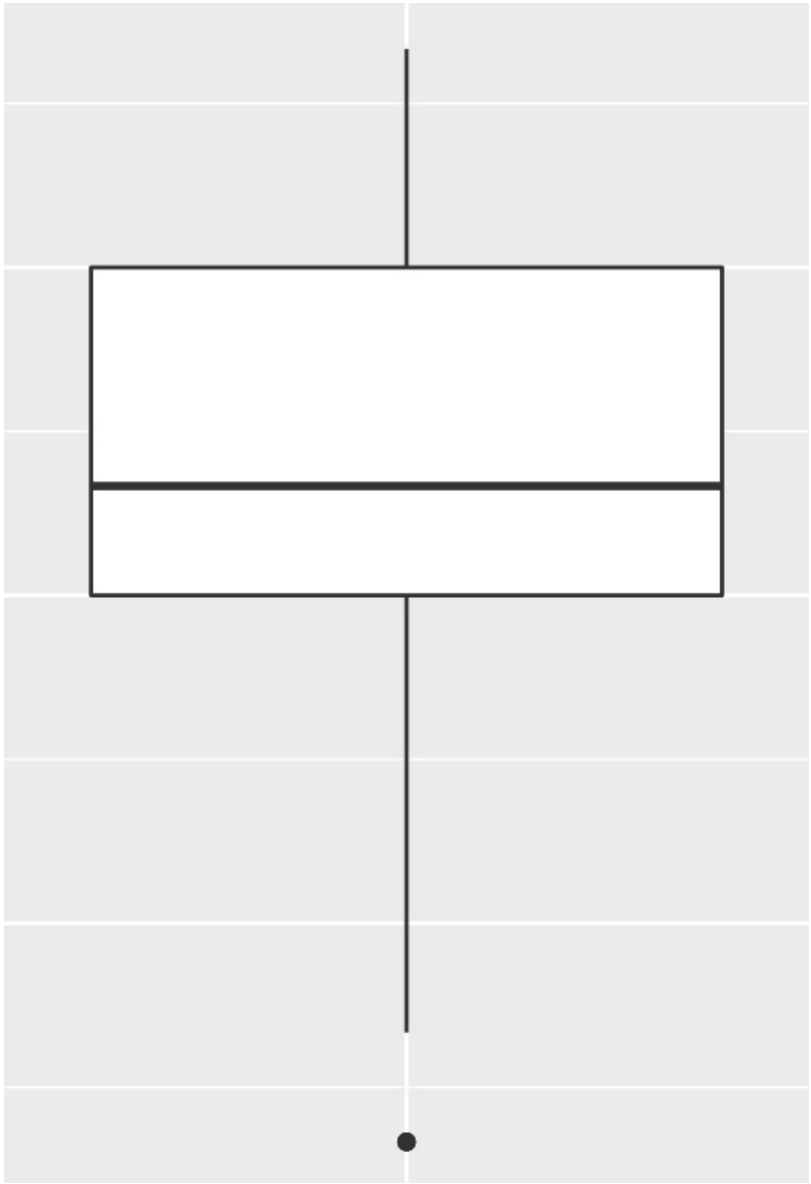
Boxplot

Another way of looking at the distribution of a continuous variable is to find out where the lowest 25% are located, where the lowest 50% are located, and where the top 25% are located.

A plot that shows this is the **boxplot**.



Boxplot



approximately 100% below this point

75% of cases below, 25% above this point

50% of cases below, 50% above this point

25% of cases below, 75% above this point

approximately 100% above this point

an outlier case

Outline

Measures of central tendency

Measures of central tendency provide information about the centre of a distribution, roughly put: "what is a typical value for this variable?"

Different measures are available for different levels of measurement:

	mode	median	mean
nominal	x		
ordinal	x	x	
scale	(x)	x	x

Mode

The **mode** is the category with the highest frequency.

Median

The **median** is the value where 50% of the cases has a lower value on this variable and 50% a higher value.

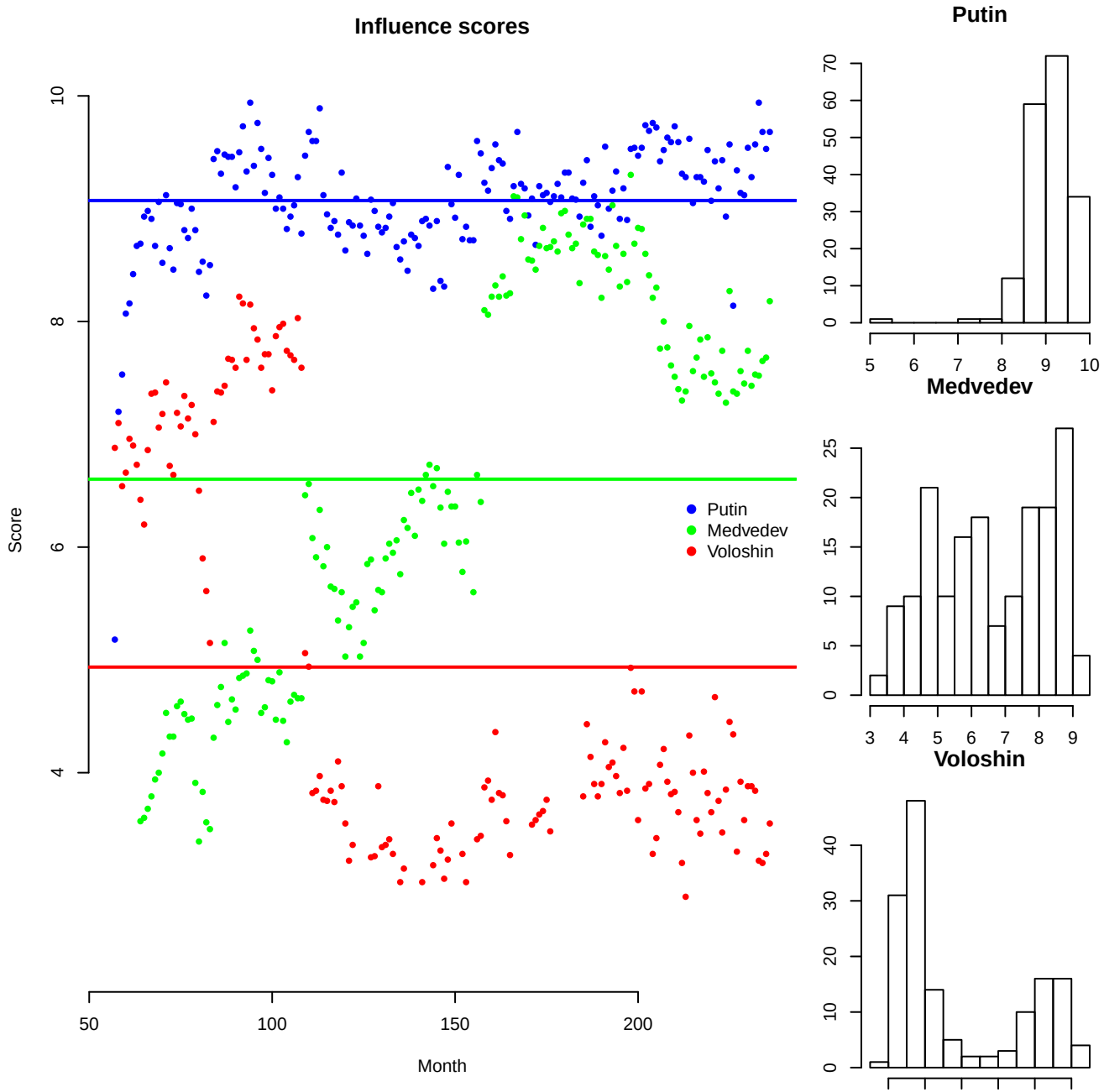
If N is uneven: the middle value after sorting in ascending order.

If N is even: the average of the two middle values after sorting in ascending order.

Mean

The **mean** is the sum of all values, divided by the number of values.

$$\bar{x} = \frac{\sum_{i=1}^{N} x_i}{N}$$



Mean or median?

Outliers is a general term of values that are very far from the main values of the distribution.

- For a symmetric distribution, median and mean are the same.
- The more **skewed** the distribution, the more mean and median differ.
- Mean is sensitive to outliers, while the median is not.
- Mean has better understood mathematical properties.

Outline

Measures of dispersion

Measures of dispersion provide an indication of the amount of variation or heterogeneity in a variable.

The **range** is the highest value minus the lowest value.

The **interquartile range** (IQR) is the range between the lowest 25% and the top 25%. A boxplot typically provides the median and the IQR, with some indication of outliers.

Variance

$$Var(x) = s_x^2 = \frac{\sum_{i=1}^{N}(x_i - \bar{x})^2}{N}$$

Note that many software packages do not calculate this sample variance, but the unbiased estimator of the population variance:

$$\hat{\sigma}_x^2 = \frac{\sum_{i=1}^{N}(x_i - \bar{x})^2}{N-1}$$

Standard deviation:

$$s_x = \sqrt{Var(x)} = \sqrt{\frac{\sum_{i=1}^{N}(x_i - \bar{x})^2}{N}}$$

Baturo, Alexander and Johan A. Elkink. 2014. "Office or Officeholder? Regime Deinstitutionalisation and Sources of Individual Political Influence." *Journal of Politics* 76(3).

Baturo, Alexander and Johan A. Elkink. 2015. "Dynamics of Regime Personalization and Patron-Client Networks in Russia, 1999–2014." *Post-Soviet Affairs* 32(1):75–98.

Moore, David S. 2003. *The basic practice of statistics*. 3rd ed. New York: W.H. Freeman.