SO5041 Unit 3: Numbers as Information – Data

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SO5041 Unit 3

Processing information numerically

Number as information

- In the Lab we will begin by coding data in numerical form, entering it on the computer and using Stata to make simple descriptive summaries of it
- This activity is an important stage of the quantitative research process: turning information into numbers and numbers into information

Steps

- There are several important steps in this process
  - Determine a clear set of information items to collect (i.e., what questions you want to ask)
  - Determine a simple way of representing this information
    - Represent it as a single "quantitative" number, e.g., Euros per annum for income, or
    - Determine a fixed set of categories grouping every possible answer, and attach a number to each category
  - Collect it (easier said than done) and enter on a computer
  - But for the analysis to make sense we need to bring in information about that the numbers mean: variable labels and value labels restore some part of the meaningful information hidden by coding as numbers

Example: Gender

- In the past, widely treated as unproblematic
- Interviewer ticked the box
- Increasing awareness that it's not:
    - People may feel it's none of your business (especially online)
    - Some people are non-binary

Let's ask it as M/F/prefer not to say: example

Please enter your gender:

- ☐ Female
- ☐ Male
- ☐ Other/Prefer not to say

Case no.	gndr
1	1
2	2
3	2
4	3
5	2
6	1
7	1

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Raw table

```
    gndr |      Freq.     Percent        Cum.
---------+-----------------------------------
       1 |          3       42.86       42.86
       2 |          3       42.86       85.71
       3 |          1       14.29      100.00
---------+-----------------------------------
   Total |          7      100.00
```

- Label gndr as "Respondent's gender"
- Label the values:
  - 1 = "Female"
  - 2 = "Male"
  - 3 = "Declined to say"

Table with labels

```
    Respondent's |
          gender |     Freq.     Percent        Cum.
-----------------+-----------------------------------
          Female |        3       42.86       42.86
            Male |        3       42.86       85.71
Declined to say |         1       14.29      100.00
-----------------+-----------------------------------
           Total |        7      100.00
```

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Univariate summaries

Descriptive summaries

- When we enter data on a computer we can easily present descriptive univariate summaries (i.e., summarising one variable at a time)

- For categorical or grouped variables (i.e., where there is a "small" number of different values) we can use a frequency table: how many of each sort are there? what proportion of each sort are there?

- For variables with a "quantitative" interpretation (i.e., where the number measures something like age, income, duration, distance, or where it is a count like number of children, number of cigarettes per day) we can explore the mean or average, or perhaps the median

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Frequency Table

```
. tab rjbstat

current economic
      activity  |      Freq.     Percent        Cum.
----------------+-----------------------------------
   self-employed |        929        6.82        6.82
       employed |      6,749       49.58       56.41
     unemployed |        468        3.44       59.84
        retired |      3,034       22.29       82.13
 maternity leave |         75        0.55       82.68
    family care |        786        5.77       88.46
ft studt, school |        878        6.45       94.91
lt sick, disabld |        608        4.47       99.38
 gvt trng scheme |         22        0.16       99.54
          other |         63        0.46      100.00
----------------+-----------------------------------
          Total |     13,612      100.00
```

Summarising a "quantitative" variable

```
. su rfimn

    Variable |        Obs        Mean    Std. Dev.        Min         Max
-------------+--------------------------------------------------------------
       rfimn |     13,612    1454.687    1459.462          0    56916.67
```

```
. codebook rfimn
────────────────────────────────────────────────────────────────────────────────
rfimn                                                      total income: last month
────────────────────────────────────────────────────────────────────────────────

                 type:  numeric (double)
                label:  rfimn, but 9658 nonmissing values are not labeled

                range:  [0,56916.668]              units:  1.000e-08
        unique values:  9,658              missing .:  0/13,612

             examples:  470.71835
                        925.07501
                        1401.9929
                        2175.7588
```

- The mean is defined as the sum total of the variable, divided by the number of cases:

$$\bar{x} = \frac{\sum x_i}{n}$$

- The median is defined as the value such that 50% of cases are lower and 50% of cases are higher

Calculating the median

- To calculate the median "by hand":
    - sort the values in order
    - if there is an odd number of cases (e.g., 101), find the middle one (e.g., 51st) – its value is the median
    - if there is an even number of cases (e.g., 100), find the middle pair (e.g., 50th and 51st) – the median is half way between their values

Median via Stata

```
. centile rfimn
```

Variable	Obs	Percentile	Centile	— Binom. Interp. — [95% Conf. Interval]	
rfimn	13,612	50	1141.668	1119.325	1166.667

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Univariate graphs

Graphs

- We can also make graphical summaries
- For categorical variables the bar-chart is very good: this is like a frequency table where the height of the bars is proportional to the number/proportion in that category
- We can also use Pie-charts: these are circles with segments (pie-slices) whose angle is proportional to the size of the category (there are some arguments that bar-charts are better)
- For quantitative variables we can use histograms: these are very like bar-charts, but break the "continuous" variable into groups. The bars in a histogram touch, to show that the variable is really continuous. In a histogram, the area under the "curve" (or stepped line) for a given range is proportional to the numbers in that range. It is sometimes interesting to vary the group size (the "bin size") to get more or less detail

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Bar chart
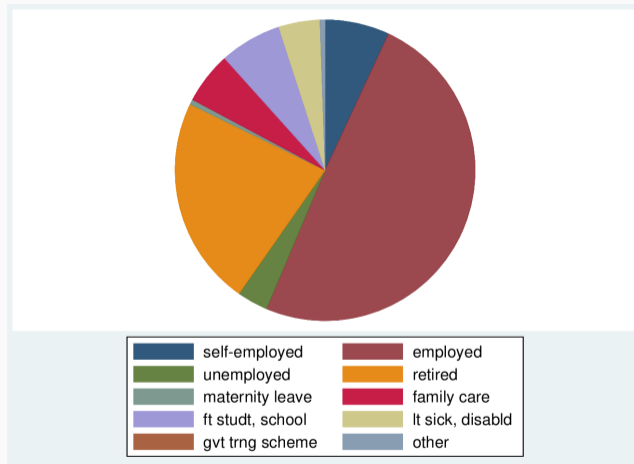
```
graph hbar, over(rjbstat)
```
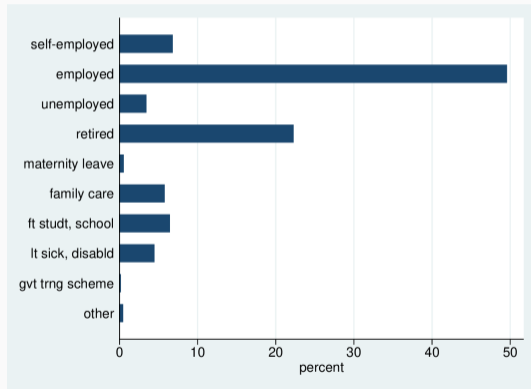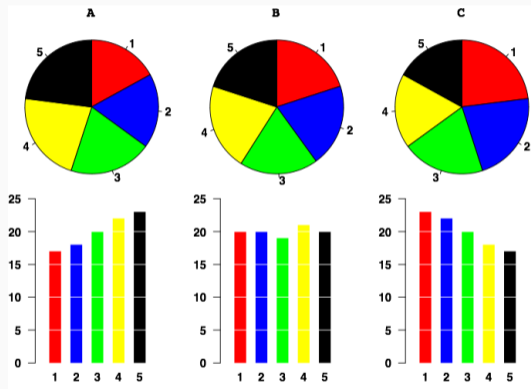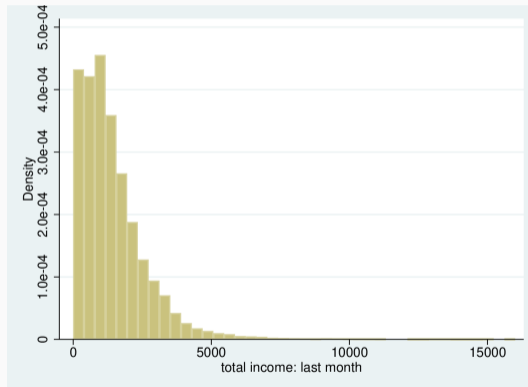
Zero is important
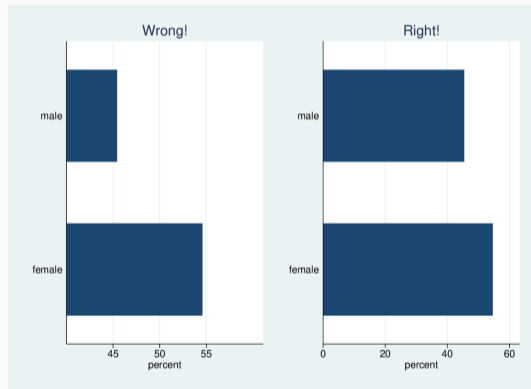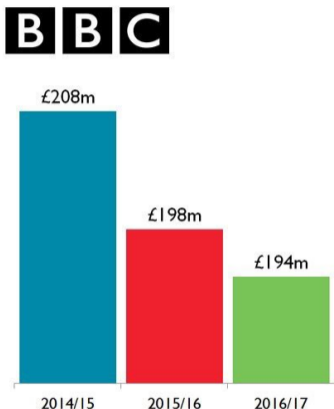
Pie chart

Pie is bad for you

Source: http://junkcharts.typepad.com/junk_charts/2009/08/community-outreach-piemaking.html
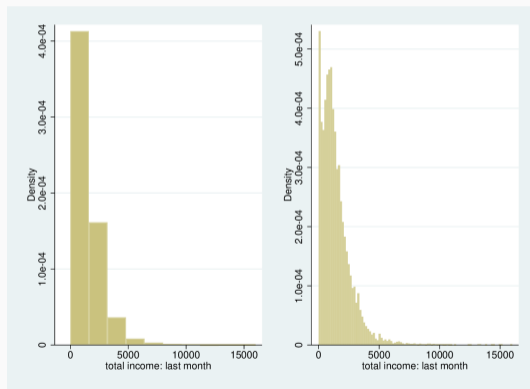
Histograms

```
hist rfimn if rfimn<=16000
```

```
hist rfimn if rfimn<=16000, bin(10)
hist rfimn if rfimn<=16000, bin(100)
```

Some interesting reading on graphics

- William S Cleveland *The Elements of Graphing Data*. Rev. ed. Murray Hill, N.J.: AT&T Bell Laboratories, 1994

- Edward Tufte, *The Visual Display of Quantitative Information*. Cheshire, Conn.: Graphics Press, 1983

- Kieran Healy, *Data Visualization: A Practical Introduction* 2018. Focused on R, but Chapter 1 is a general discussion. Online at https://socviz.co/

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