Data Visualization in Official Statistics

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Statistics Netherlands

Statistics Netherlands / CBS

- Creates and publishes official statistics on economics, demographics, health care and others.

- Since 1899

- Website: www.cbs.nl

Types of data

1. Survey data = data collected by CBS
   with questionnaires

2. Admin data = administrative (register) data
   collected by third parties such
   as the Tax Office

3. Big data = machine generated data of events
   caused by human activity

Mobile phones

Road sensors

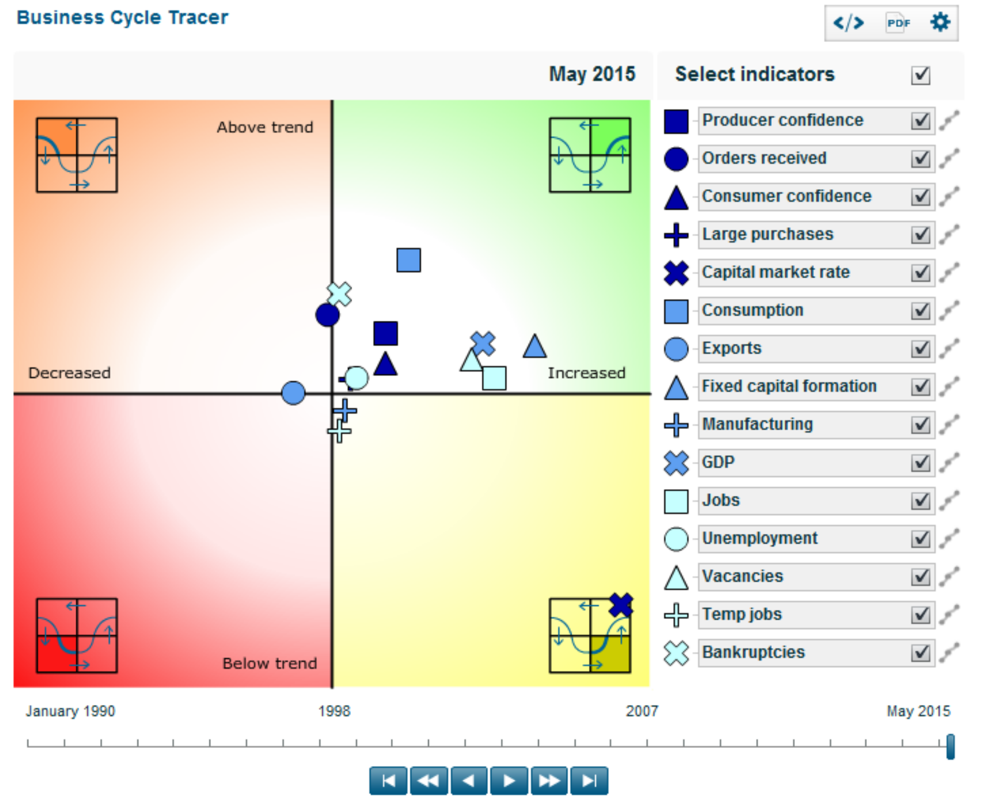
Social media

Current output

StatLine: a large database (http://statline.cbs.nl)

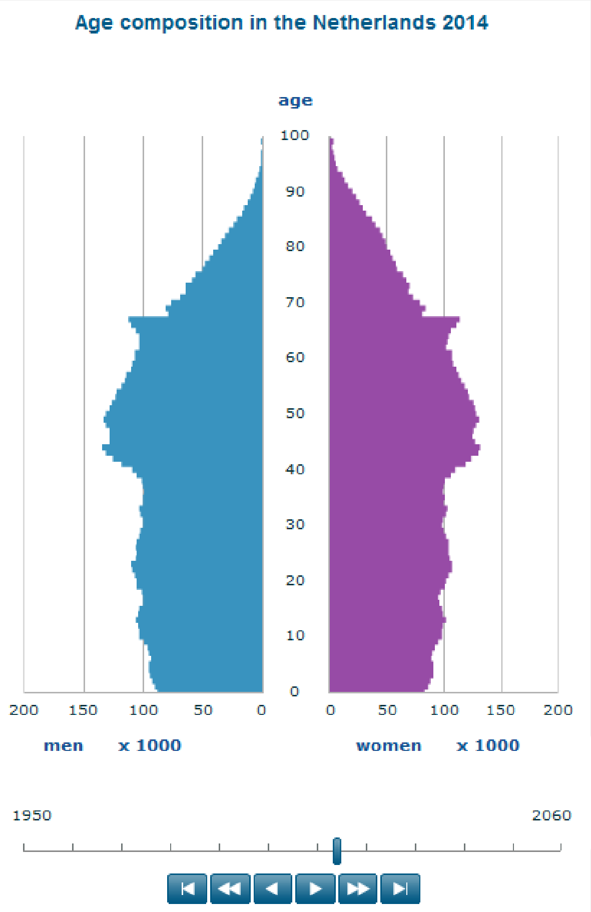
- More than one billion (10^9) facts in more than 3000 stand-alone tables
- Output statistics contain uncertainty: published only rarely

A few interactive visualizations (www.cbs.nl)



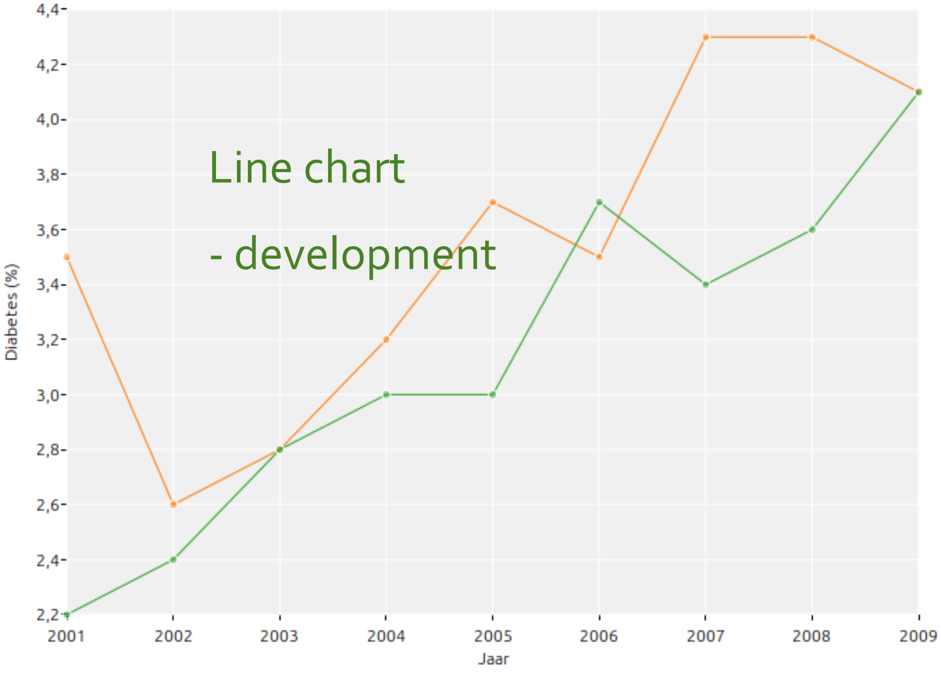
Select indicators ☑

- ■ Producer confidence ☑
- ● Orders received ☑
- ▲ Consumer confidence ☑
- ✚ Large purchases ☑
- ✖ Capital market rate ☑
- ■ Consumption ☑
- ● Exports ☑
- ▲ Fixed capital formation ☑
- ✚ Manufacturing ☑
- ✖ GDP ☑
- □ Jobs ☑
- ○ Unemployment ☑
- △ Vacancies ☑
- ✚ Temp jobs ☑
- ✖ Bankruptcies ☑



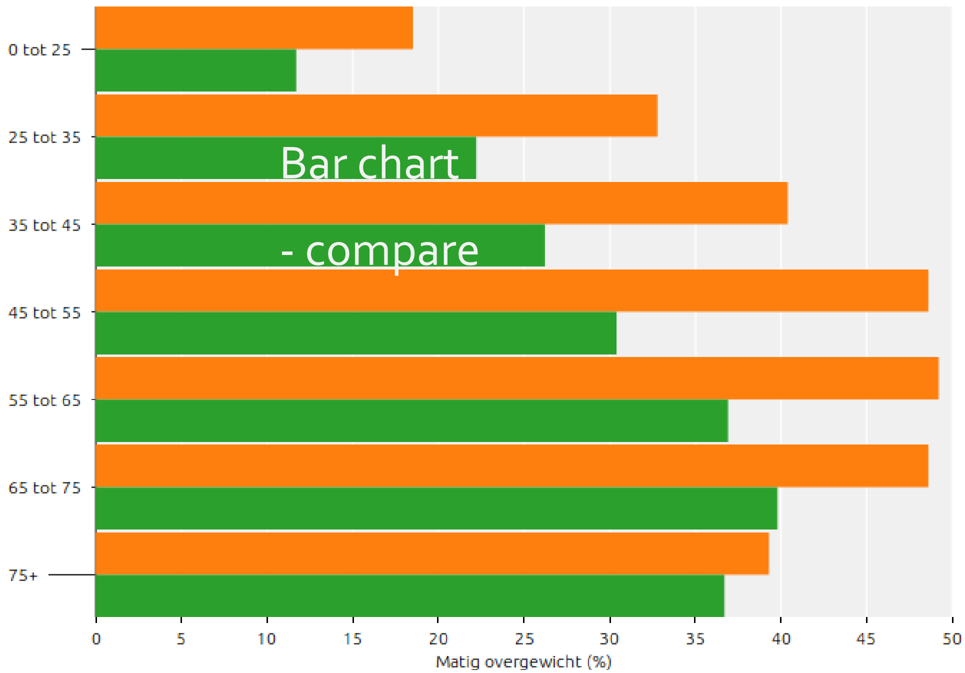
StatMine

- Interactive visual analysis layer on top of StatLine
- Target population: Policy makers, Journalists, Citizens, Enterprises, Economists, Social scientists, Historicians, etc
- Goals:
  - Facts should be presented **visually** and **interactively**
  - Users should be able to **combine tables**
  - Present **uncertainty** understandable to users
- StatMine will soon be available in public



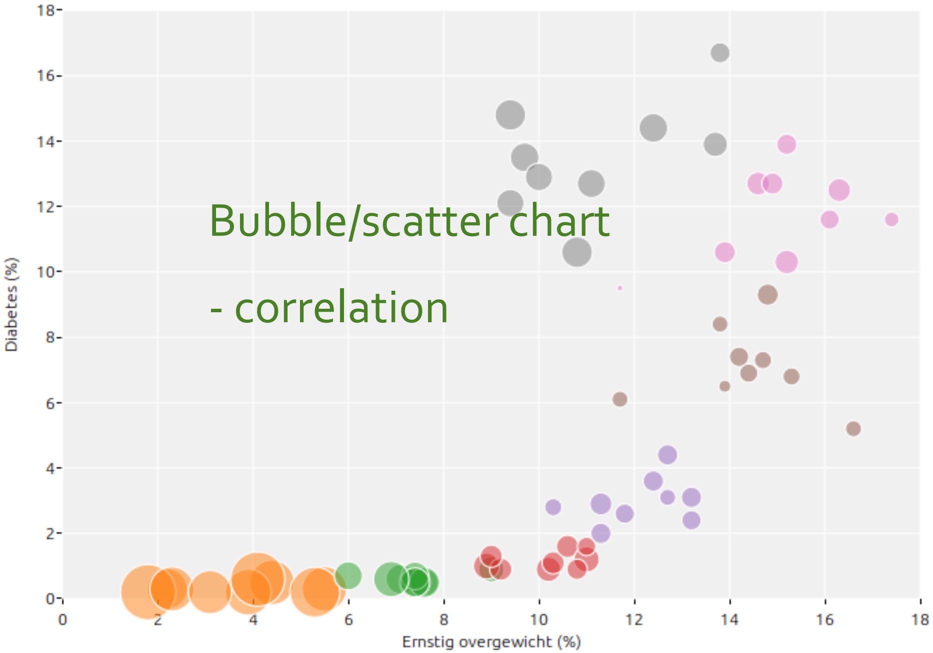
Line chart

- development



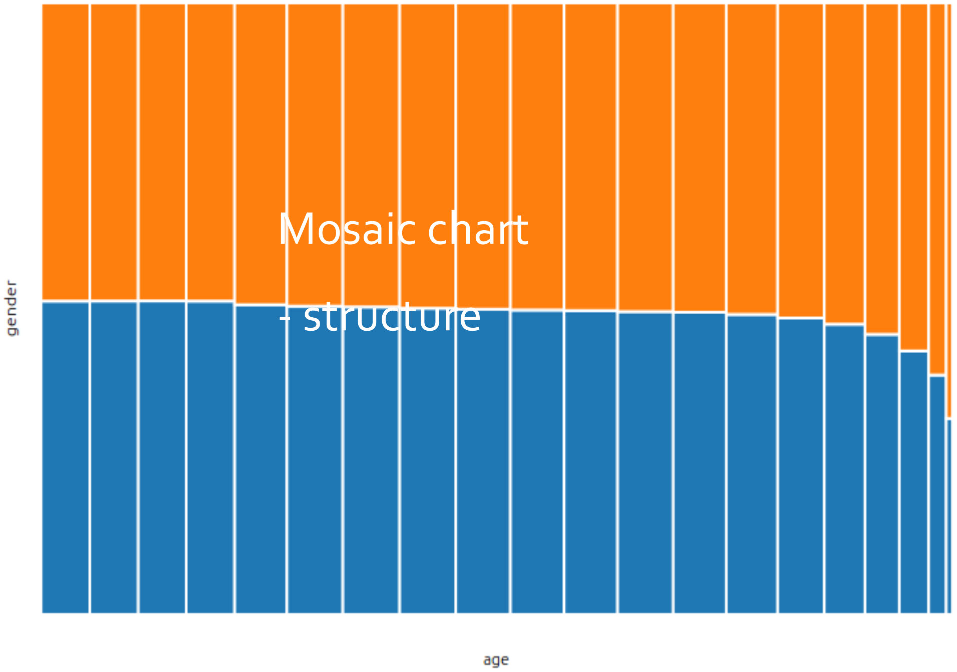
Bar chart

- compare



Bubble/scatter chart

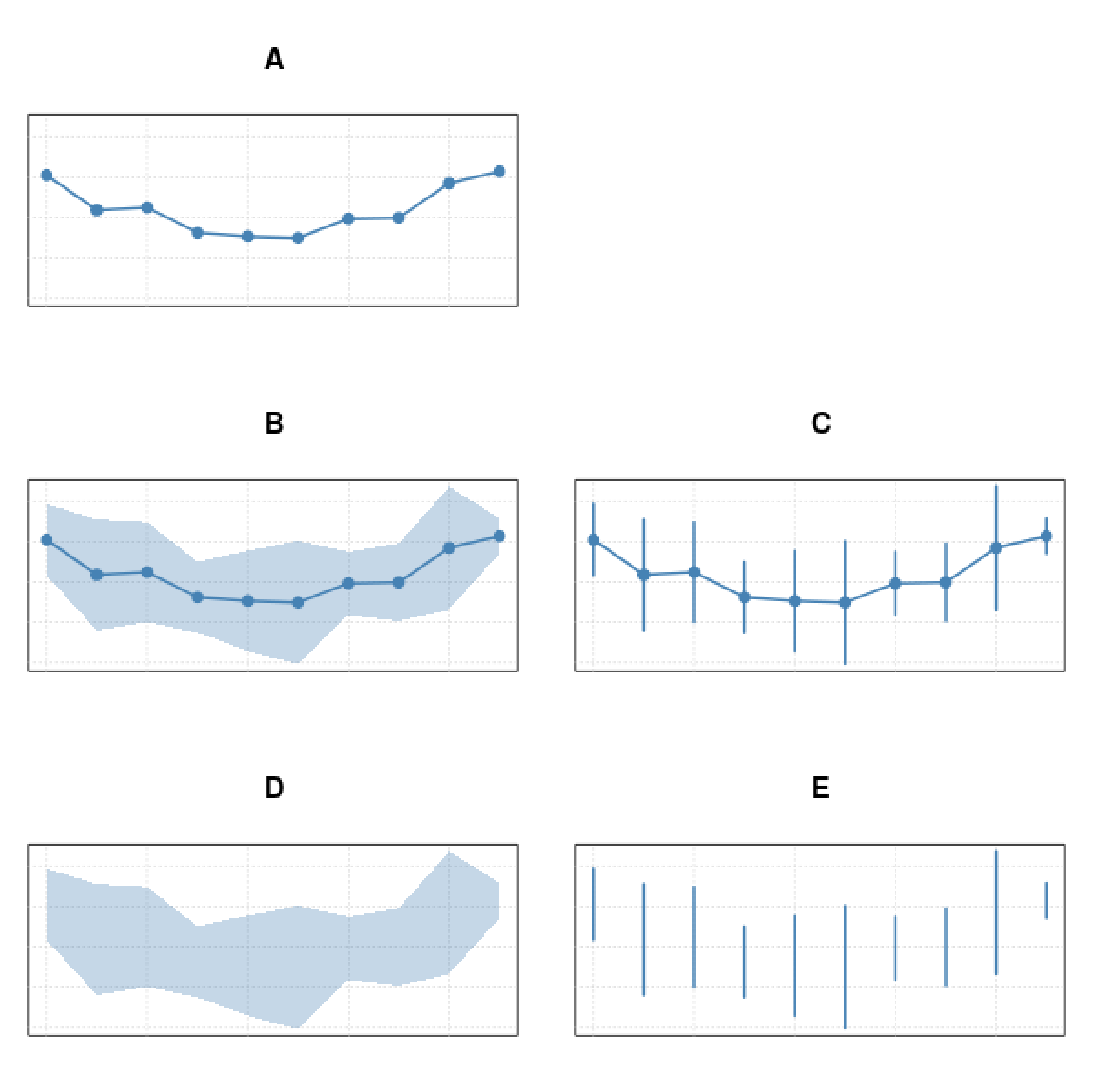
- correlation



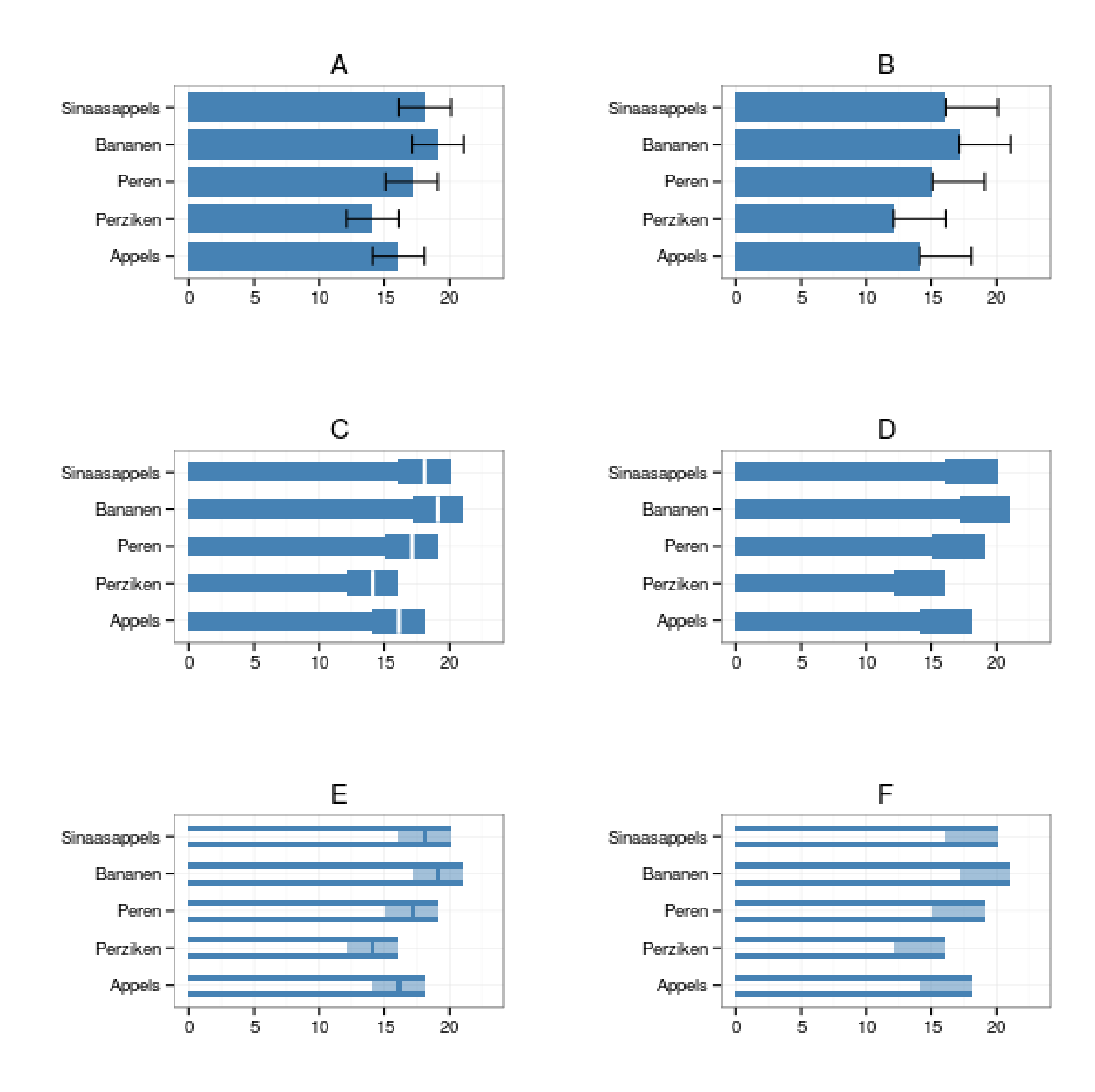
Mosaic chart

- structure

Uncertainty research – line chart types



Uncertainty research – bar chart types



Chisel chart

Cigarette chart

Uncertainty research - user study results

Showing uncertainty improves validity of user statements

Line chart:

- With point estimate: ribbon
- Without point estimate: error bars

Bar chart:

- With point estimate: chisel/cigarette
  - Although users prefer bar chart with error bars
- Without point estimate: chisel/cigarette

Users appreciate uncertainty intervals and are able to interpret graphs with uncertainty intervals.

Reference:
Laan, D. van der, Jonge, E. de, Solcer, J. (2015), Effect of Displaying Uncertainty in Line and Bar charts – Presentation and Interpretation, Proceedings IVAPP 2015, Berlin.

Visualization of Large Datasets

Goal: to empower data analysts with visual tools to explore (large) raw datasets, and to examine the data during statistical processes.

Software:

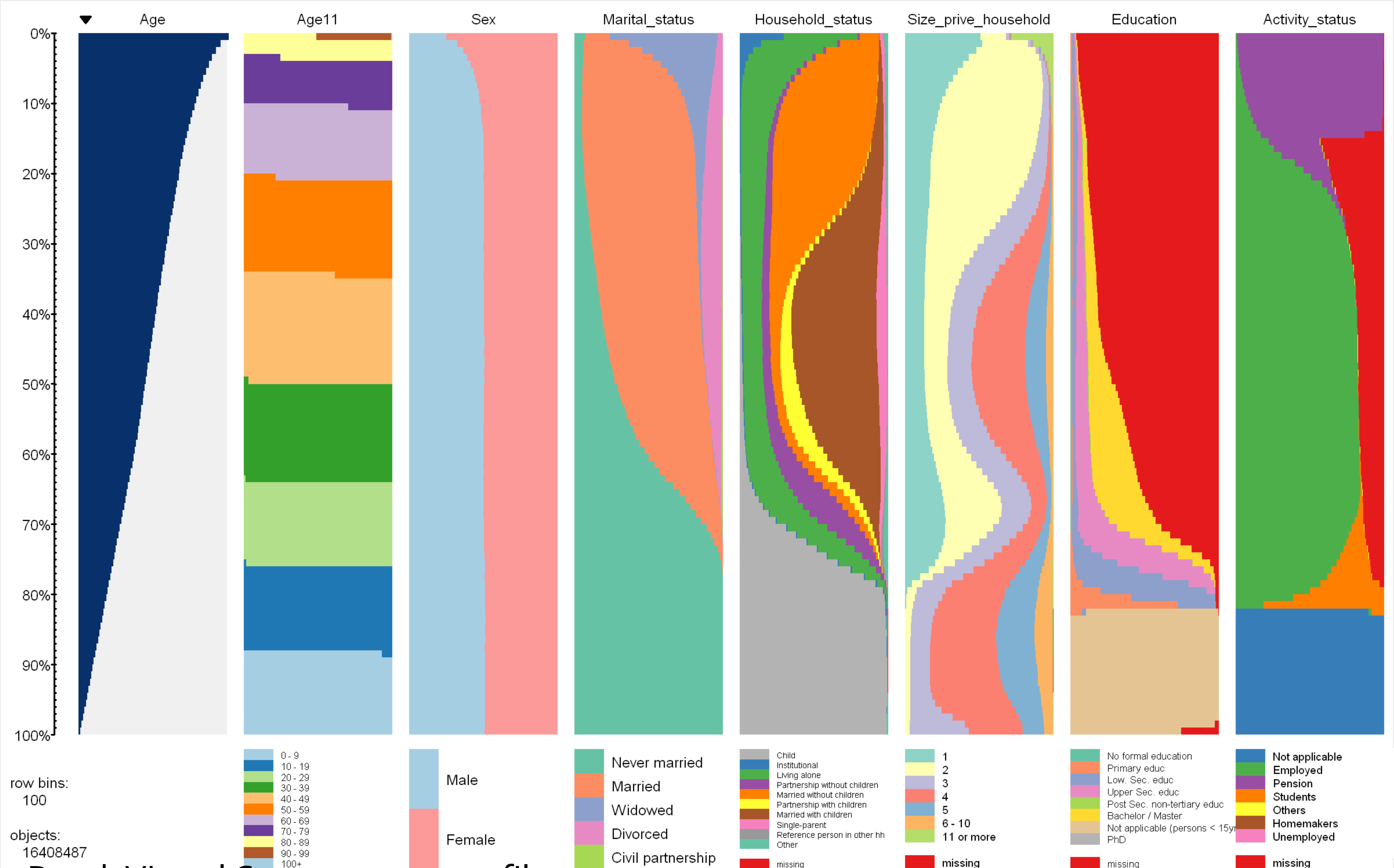
– R

– Python

– Javascript d3

Tableplot

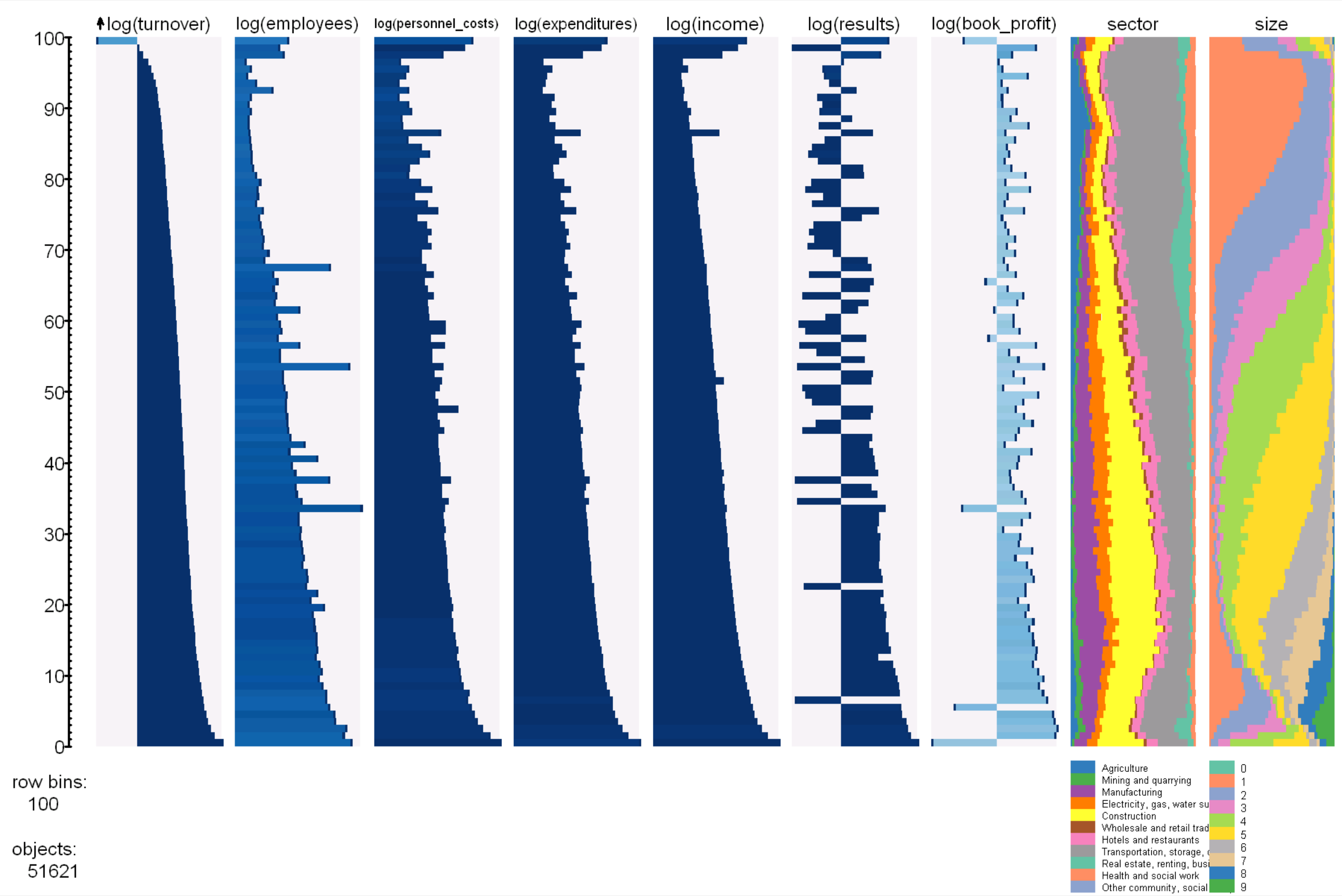
R-package **tabplot**



Dutch Virtual Census, 2011 test file

Tableplot

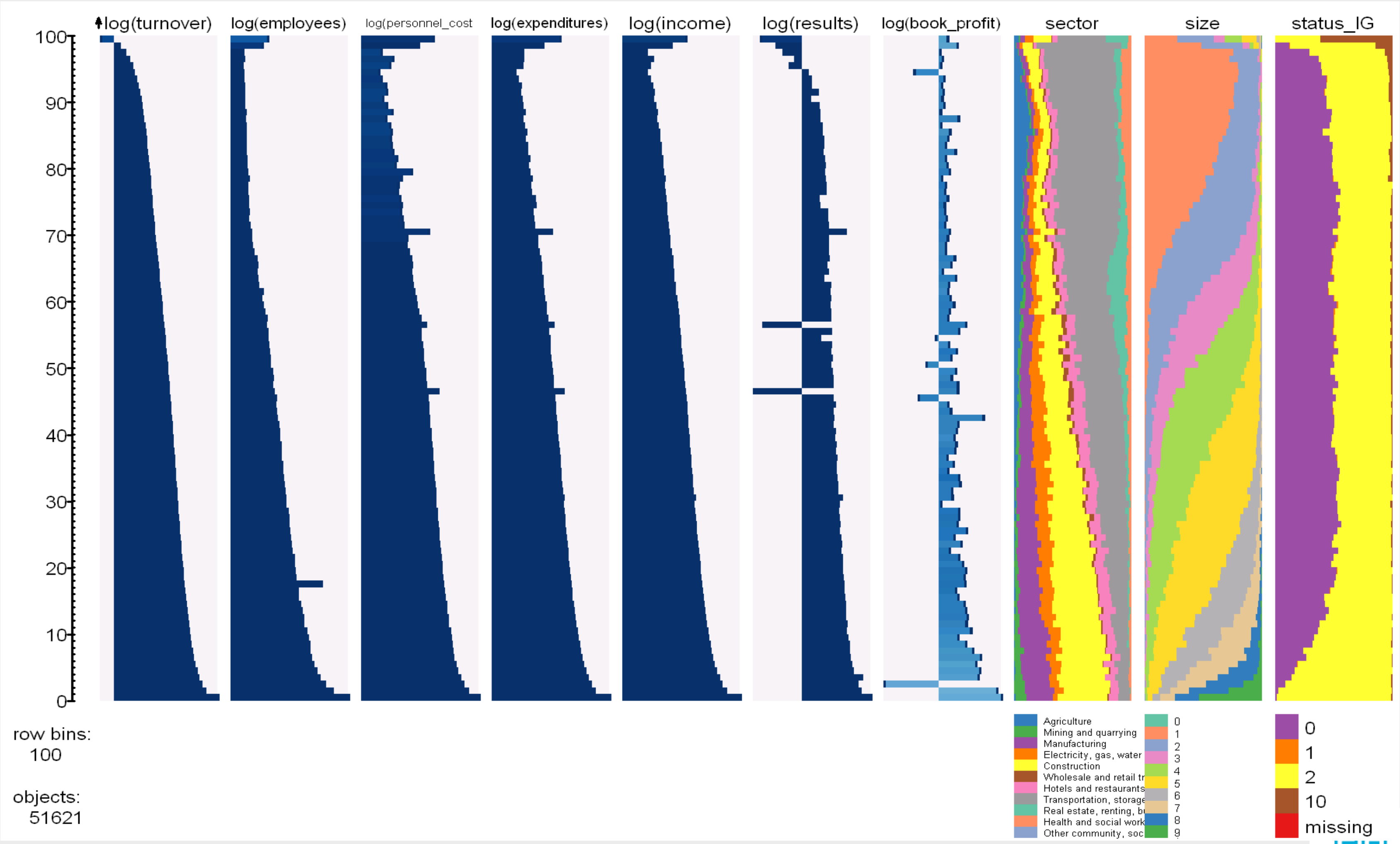
R-package **tabplot**



Structural Business Statistics: **raw** survey data (sorted by turnover)

Tableplot

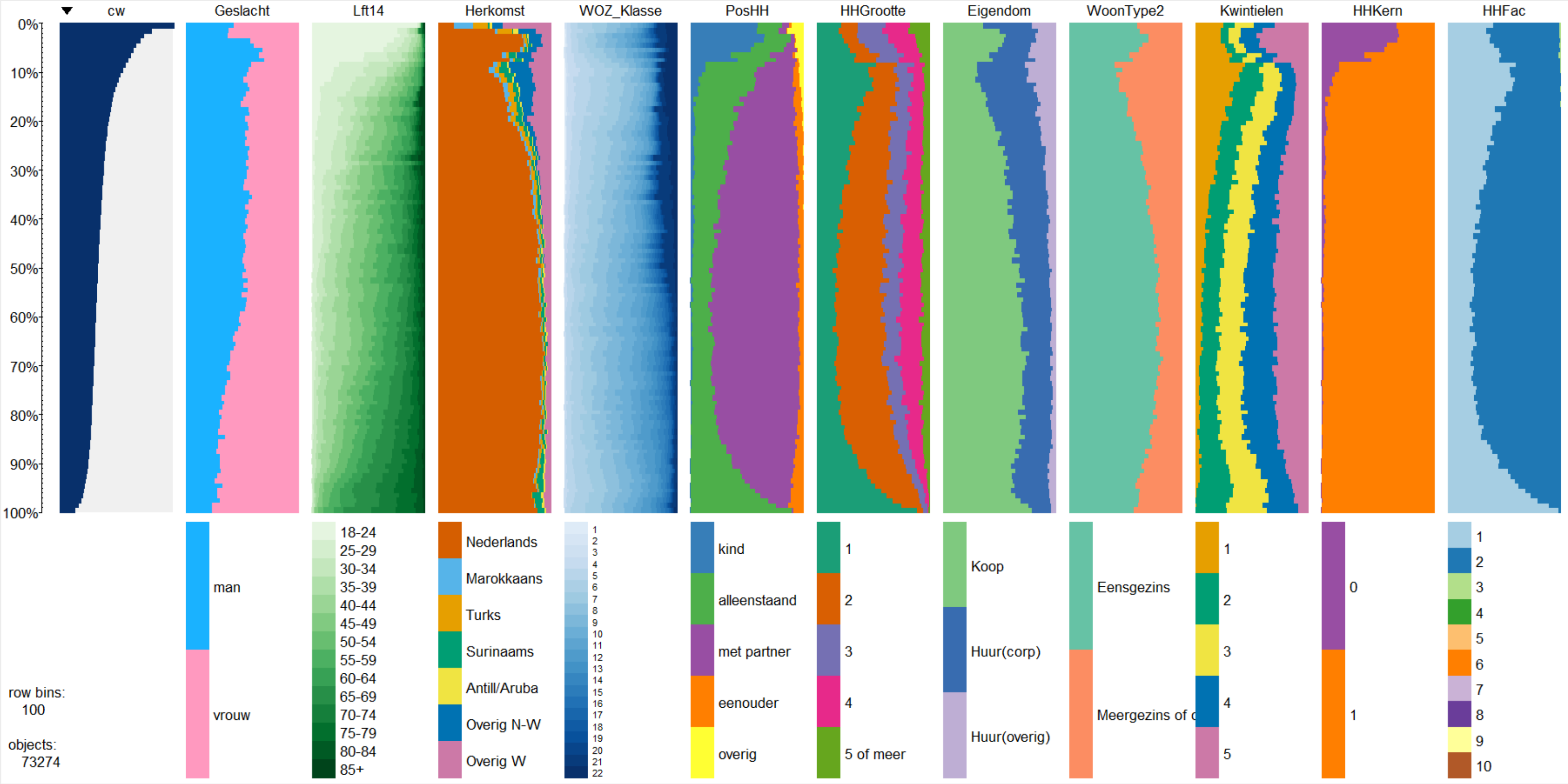
R-package **tabplot**



Structural Business Statistics: **edited** survey data (sorted by turnover)

Tableplot

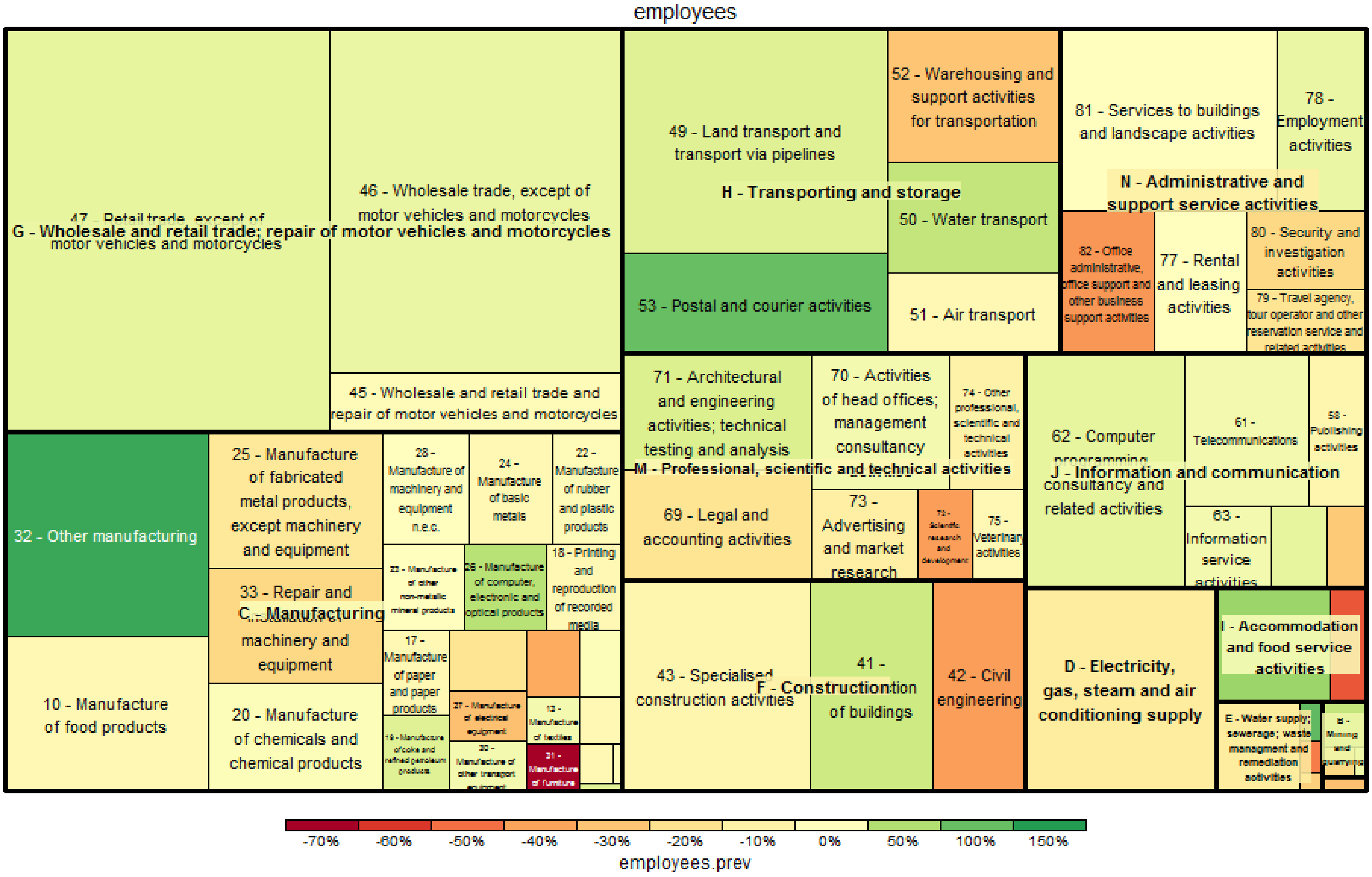
R-package **tabplot**



How representative is our survey sample?
Analysis of demographics when sorted by calibration weight

Treemap

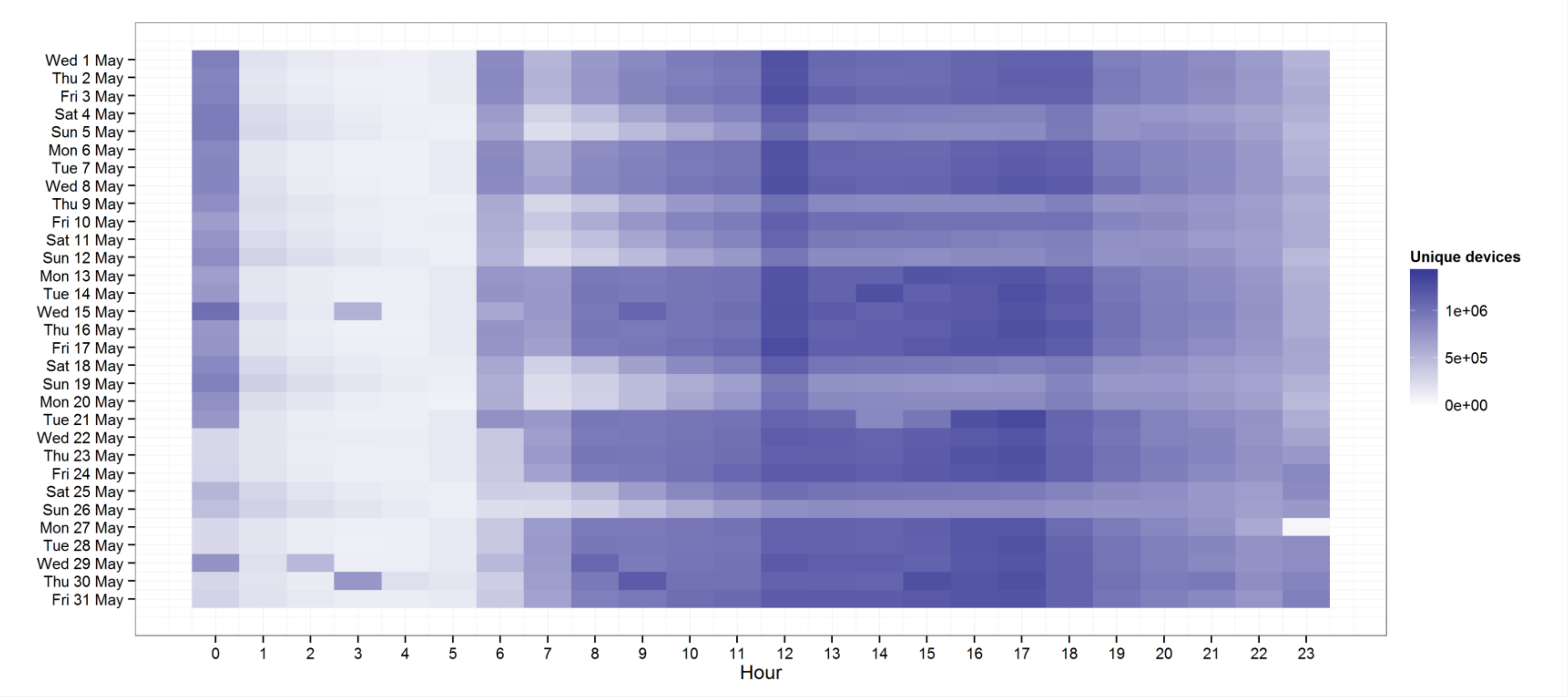
R-package **treemap**



Structural Business Statistics: aggregated by economic activity

Heatmap

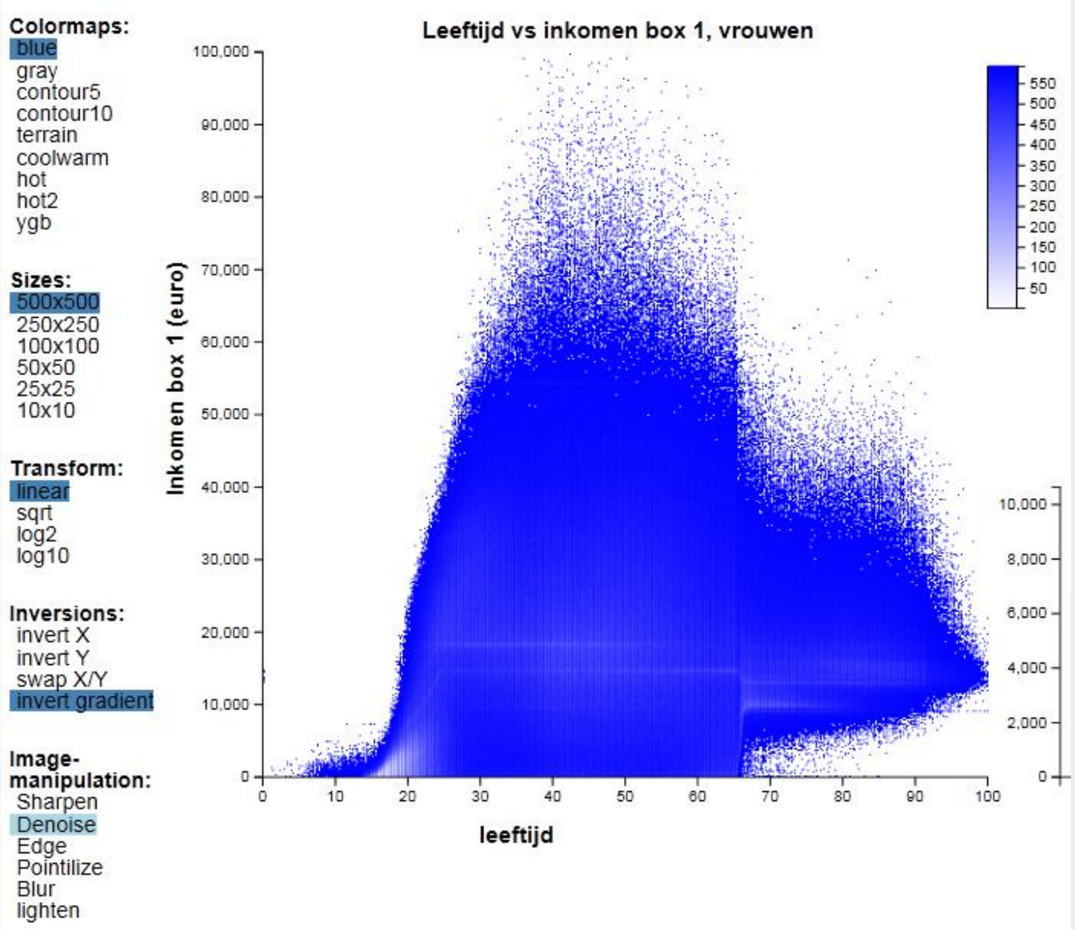
R-package **ggplot2**



Mobile phone metadata (raw): number of unique devices

Heatmap

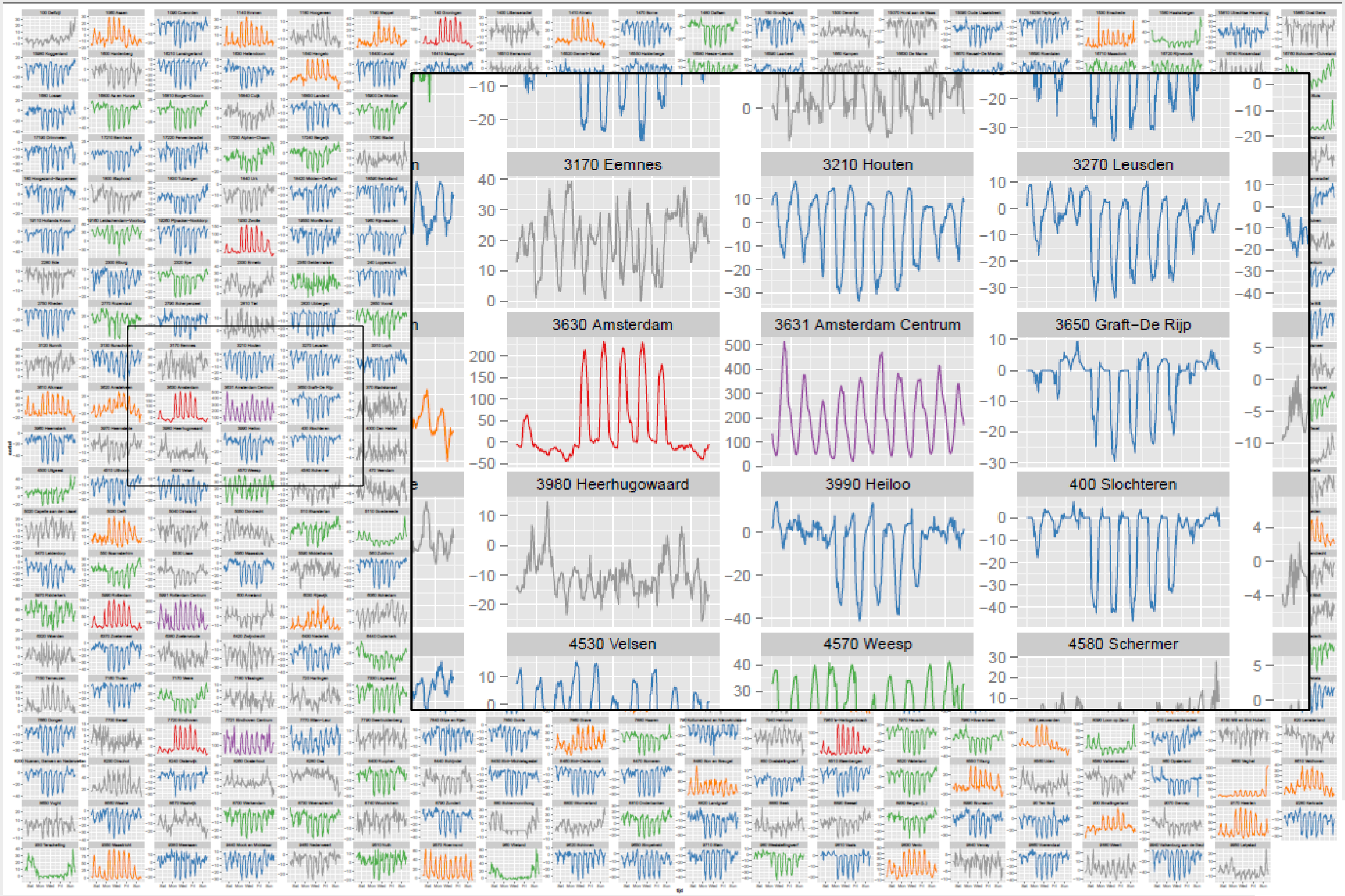
Python + HTML/Javascript



Interactive tool to analyse income data

Small multiples

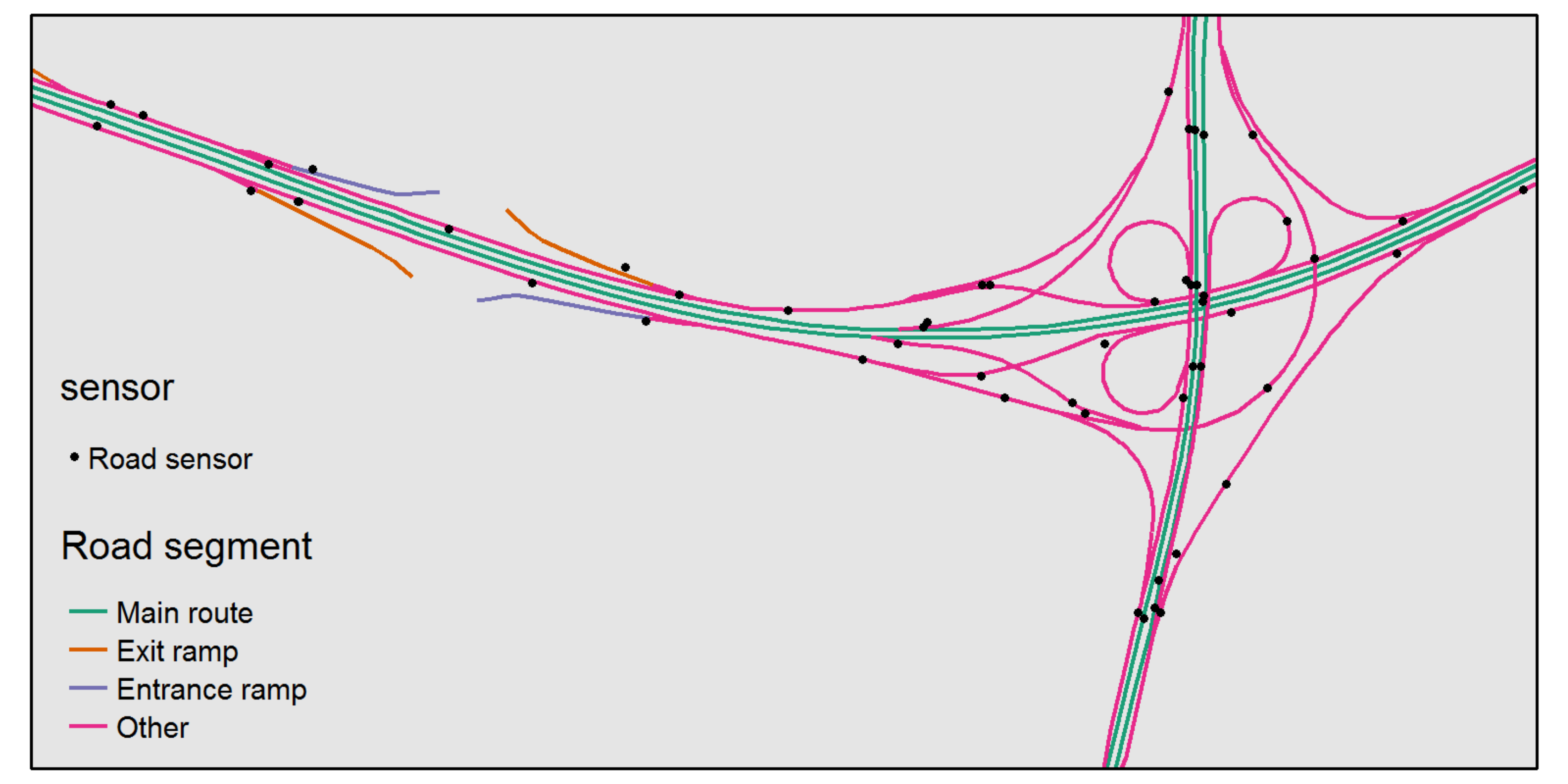
R-package **ggplot2**



Analysis of Daytime Population estimates based on mobile phone metadata

Thematic Maps

R-package **tmap**



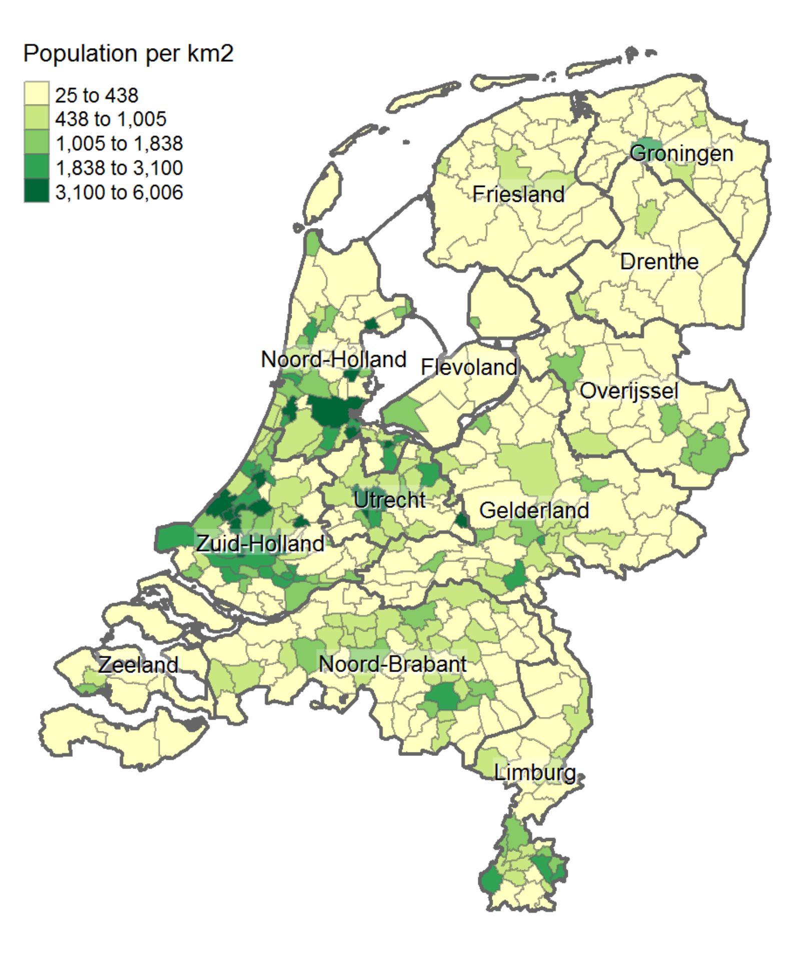
Interchange with traffic sensors

Thematic Maps

R-package **tmap**

R package tmap:

- Layered maps
  - Polygons
  - Lines
  - Points
  - Raster
- ggplot2 style
- small multiples
- Open Street Map



Population density

@ useR! 2015
Thursday 13:00

Thematic Maps

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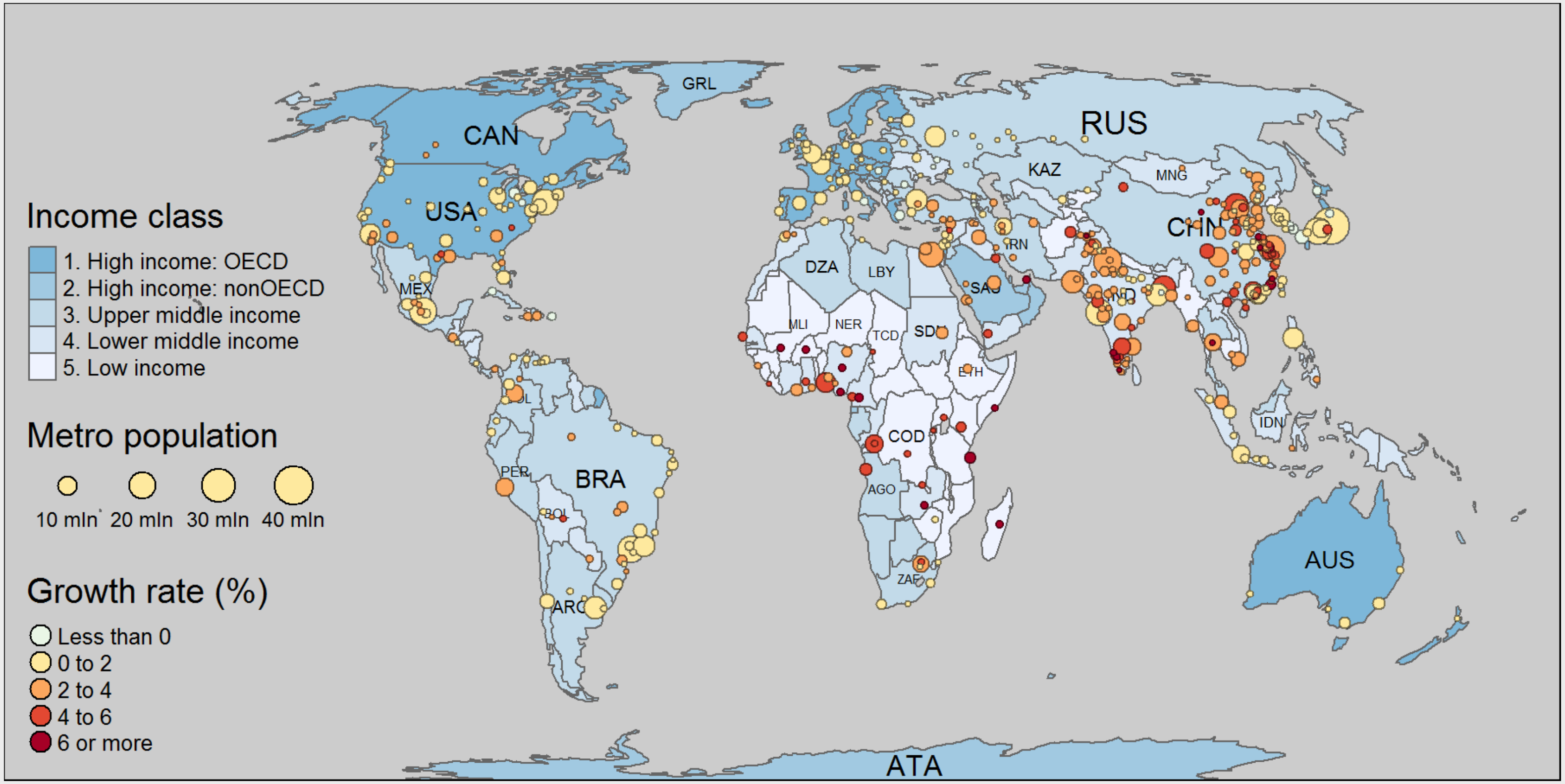
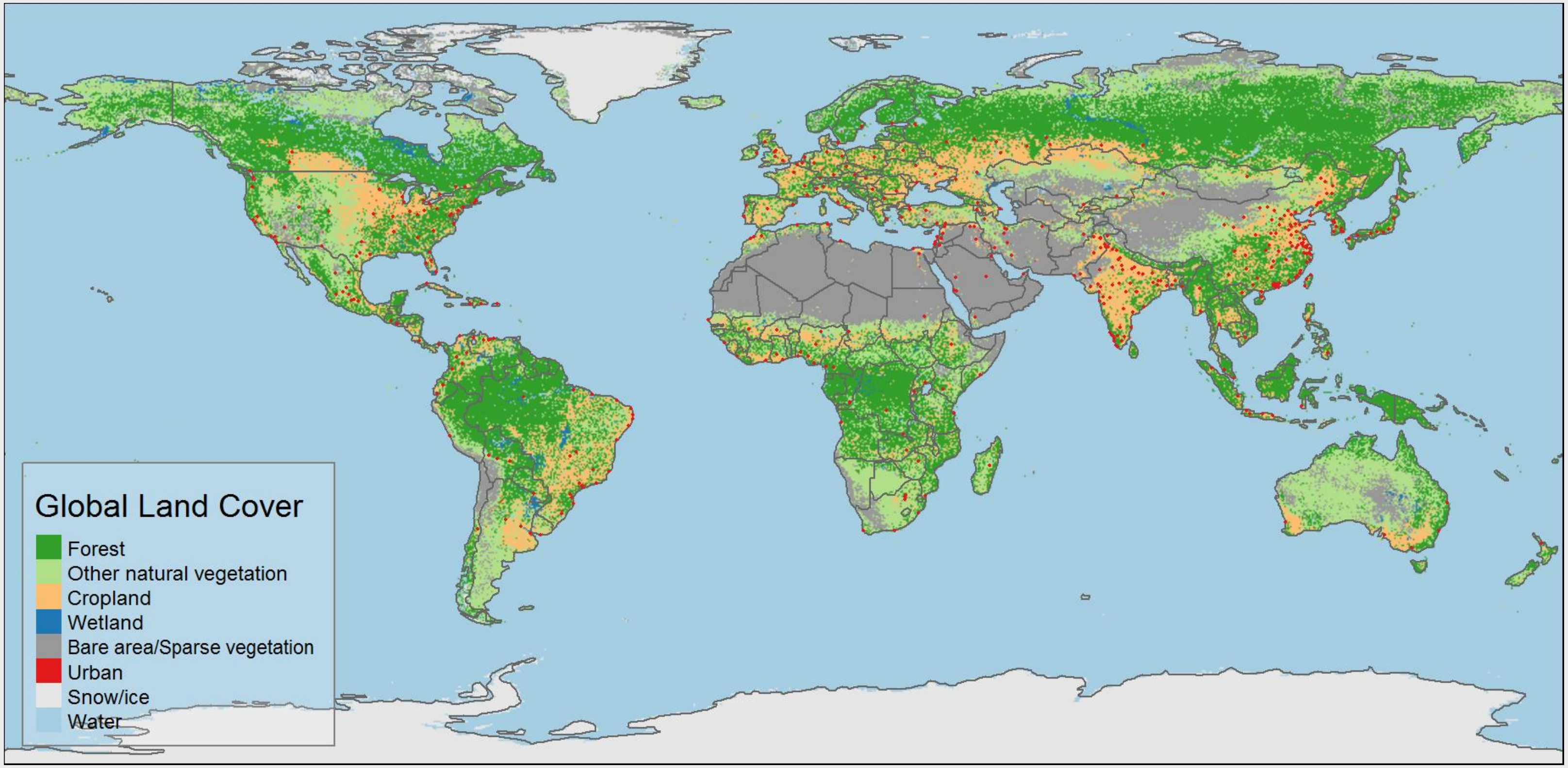


The relation between metropolitan areas and income class

@ useR! 2015
Thursday 13:00

Thematic Maps

R-package **tmap**

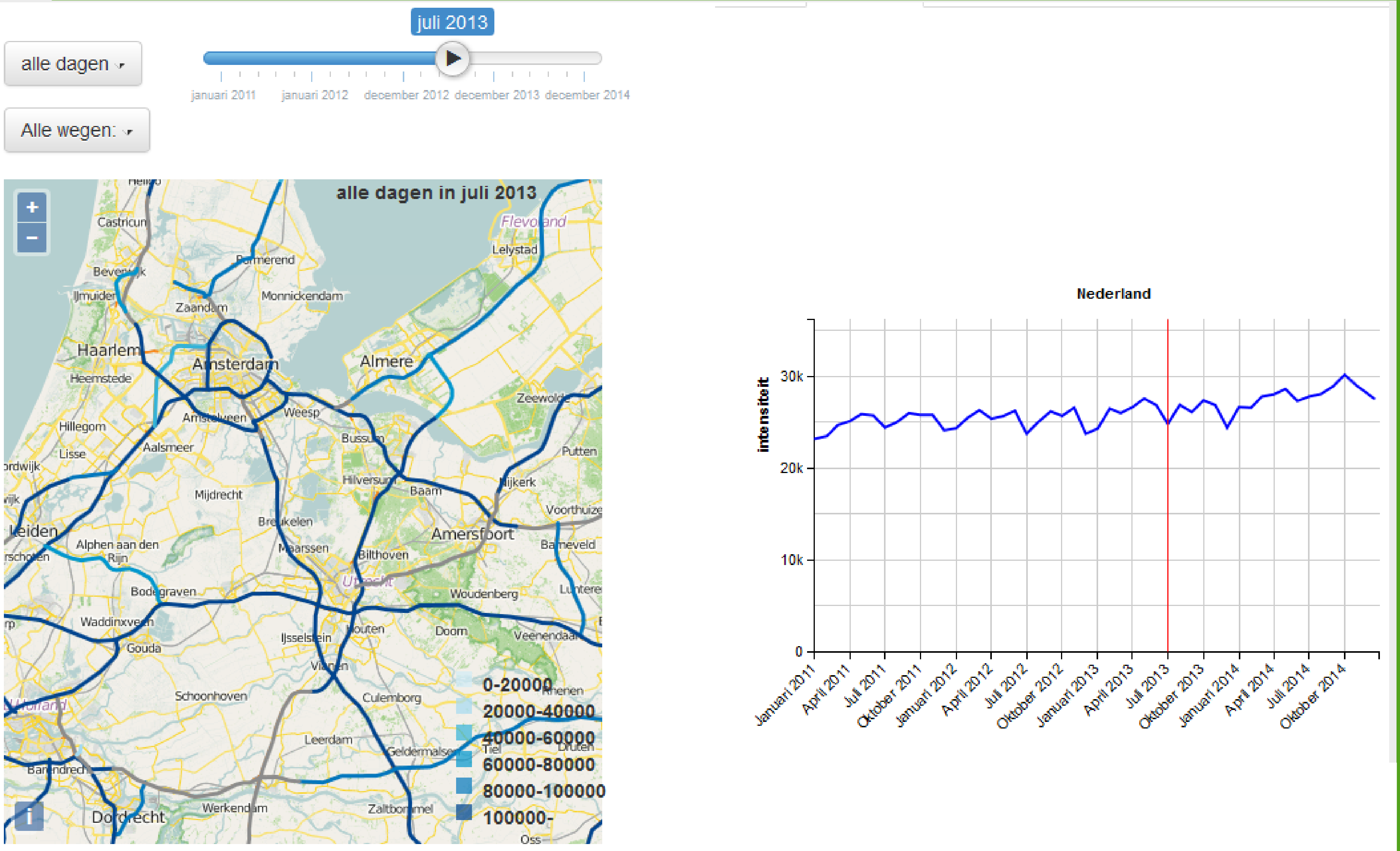


Global land cover (urban areas accentuated with dot map)

@ useR! 2015
Thursday 13:00

Maps

Python + HTML/Javascript



juli 2013

alle dagen

Alle wegen:

Interactive tool to analyse traffic on Dutch highways

Summary

- Data visualization is essential in Official Statistics for
  - Exploring new data sources
  - Analysing new deliveries of existing data sources
  - Analysing data throughout the statistical production process
  - Presenting the data (to collegues, policy makers, and the general public)

- Need for
  - Visualization of confidence intervals
  - Interactive data exploration tools
  - Big data visualization