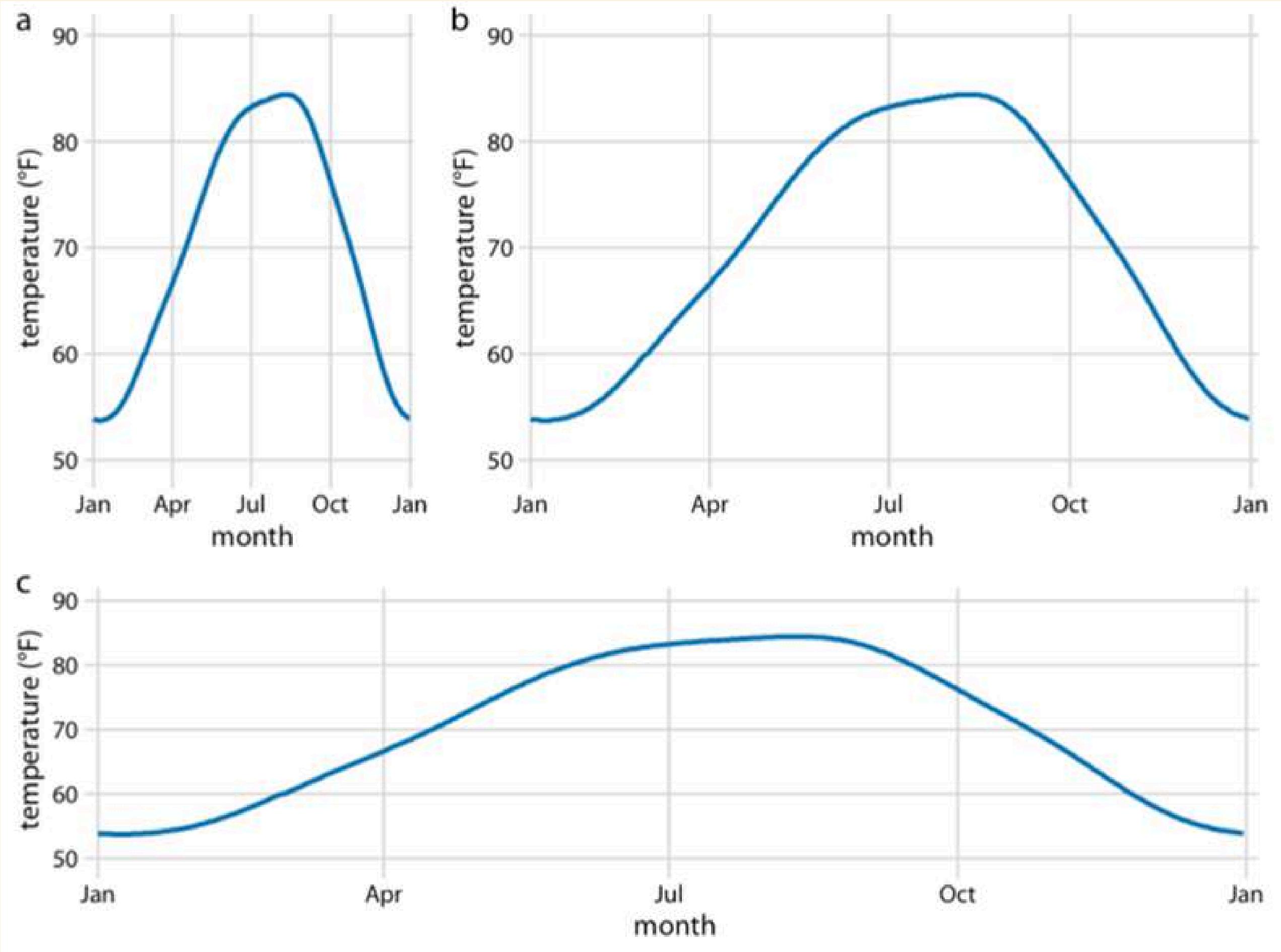


# Coordinate Systems and Axes

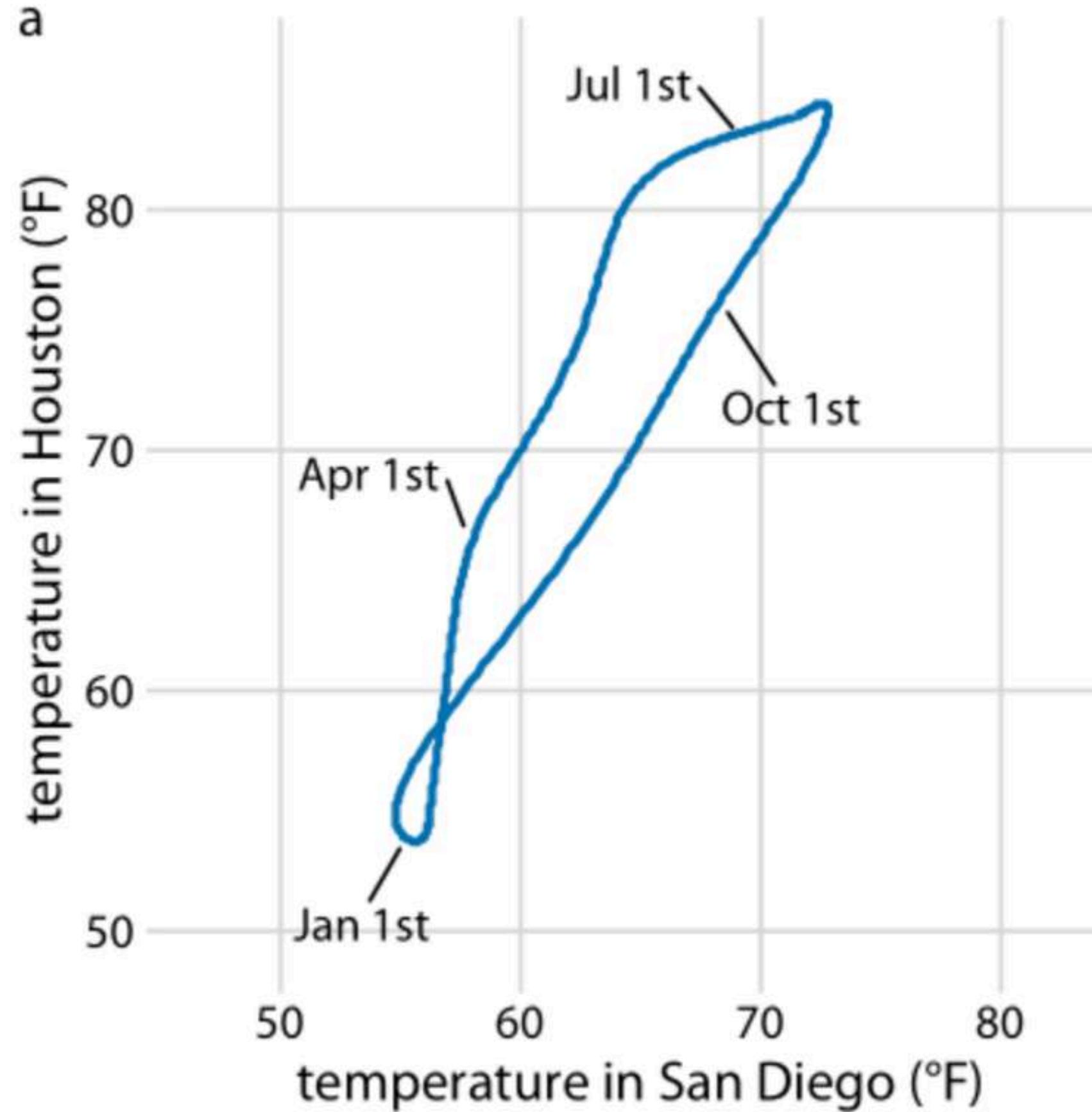
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#3046

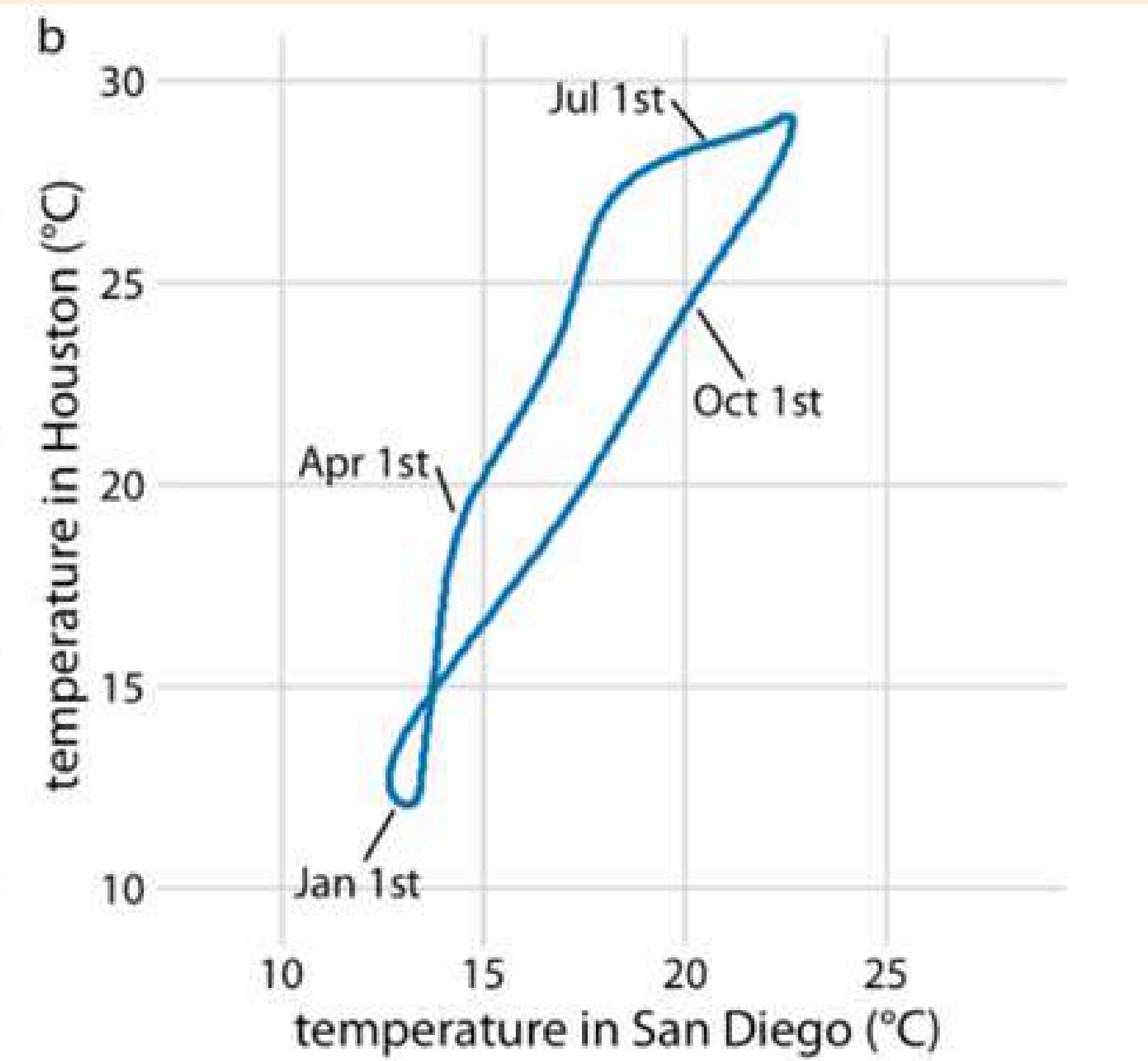
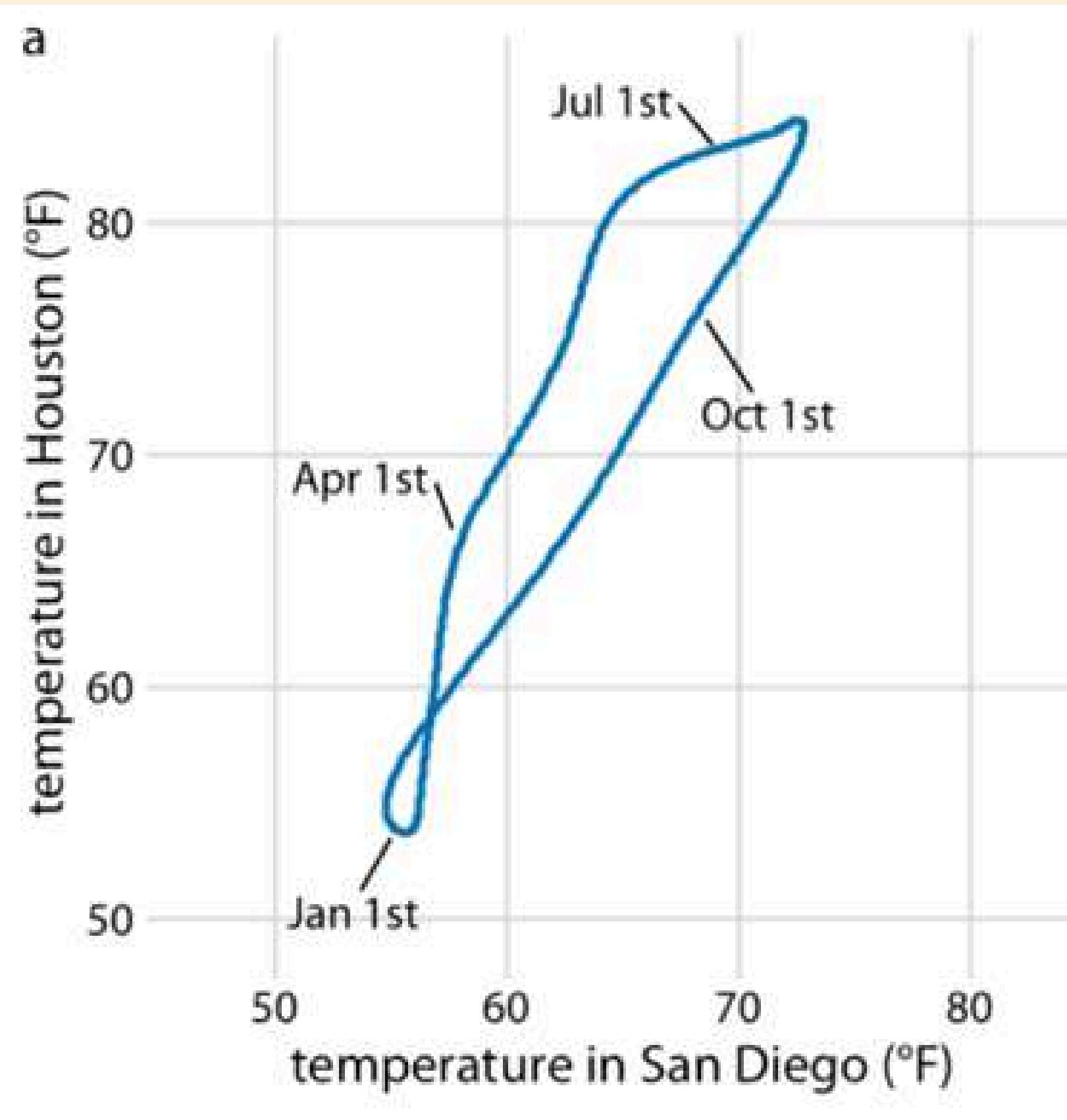




**Daily temperature normals for Houston, TX.**  
Temperature is mapped to the y axis and day of the year to the x axis. Parts (a), (b), and (c) show the same figure in different aspect ratios. All three parts are valid visualizations of the temperature data.  
Data source: NOAA.

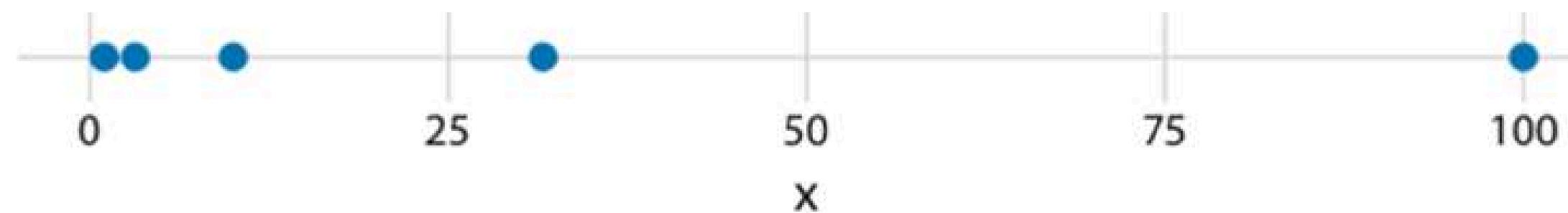


**Daily temperature normals for Houston, TX, plotted versus the respective temperature normals of San Diego, CA. The first days of the months January, April, July, and October are highlighted to provide a temporal reference.**

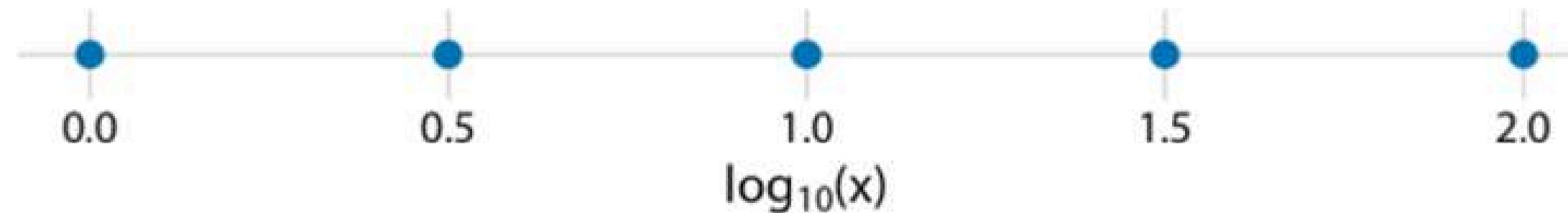


(a) Temperatures are shown in degrees Fahrenheit. (b) Temperatures are shown in degrees Celsius.

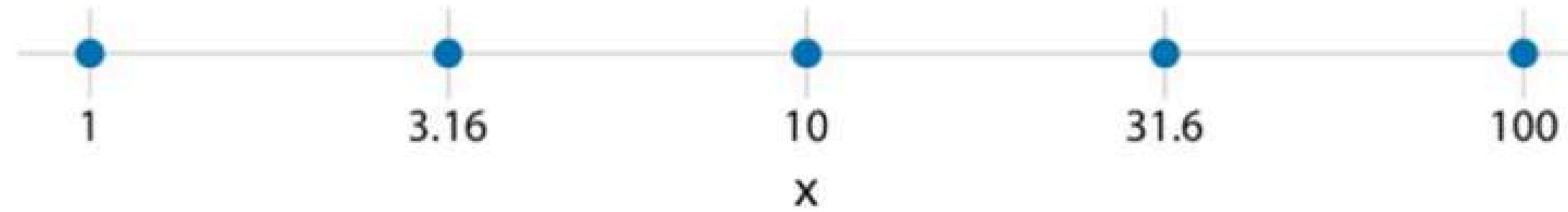
original data, linear scale



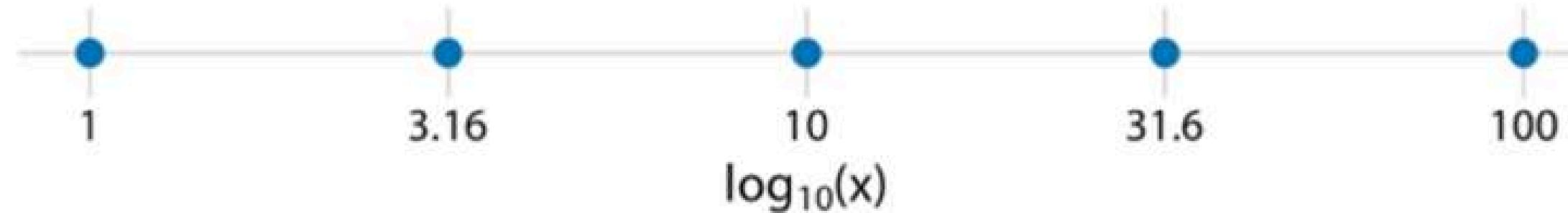
log-transformed data, linear scale



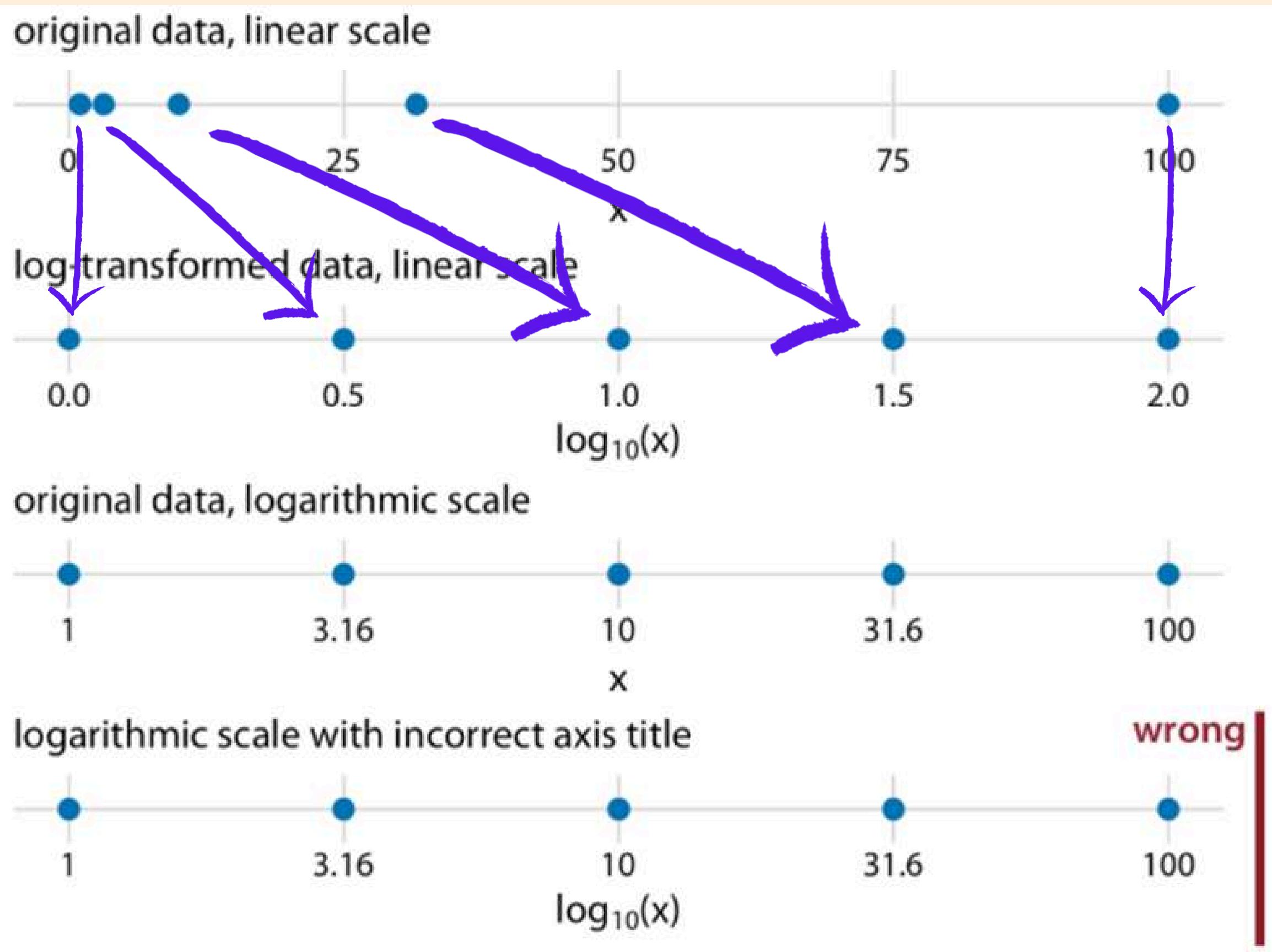
original data, logarithmic scale



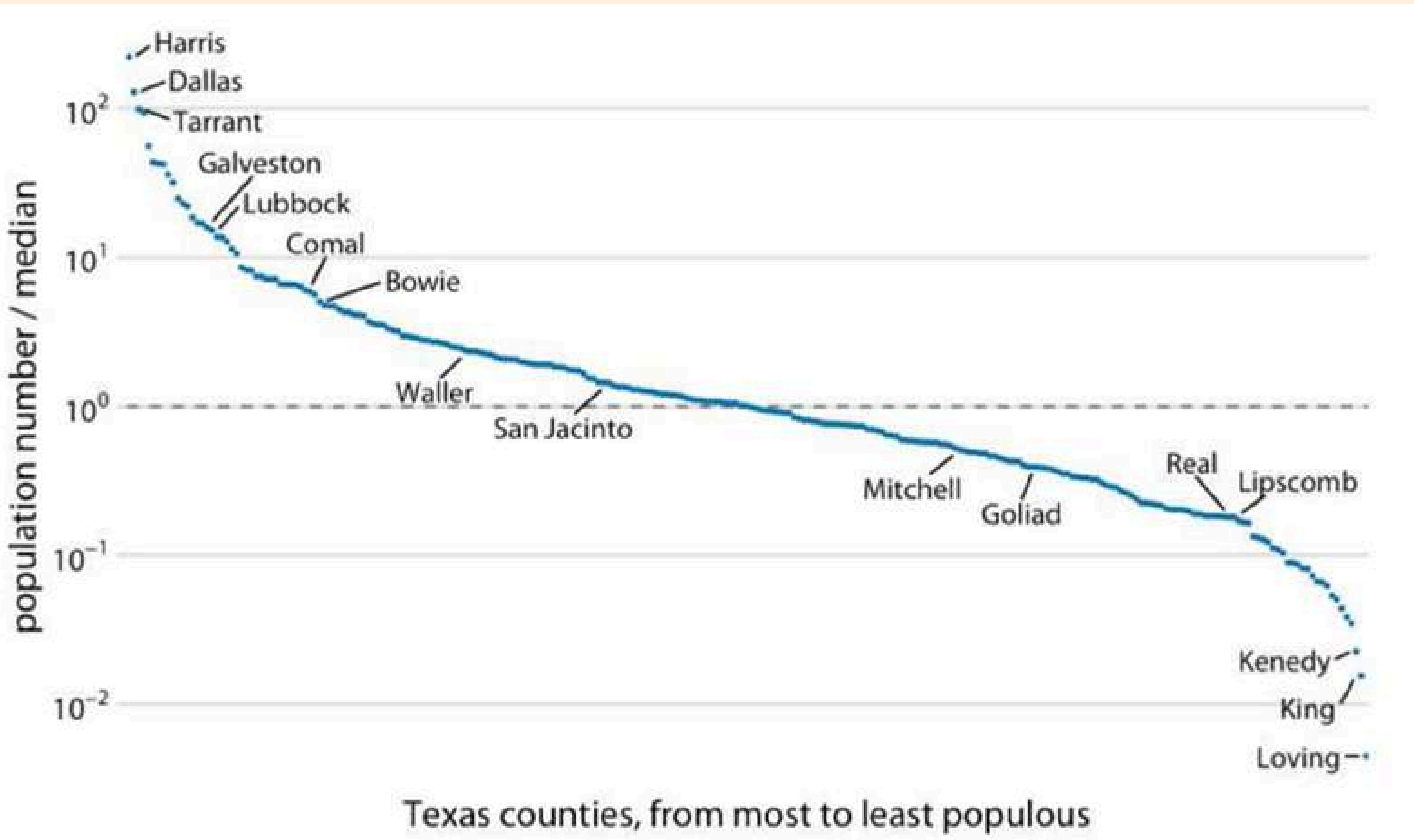
logarithmic scale with incorrect axis title



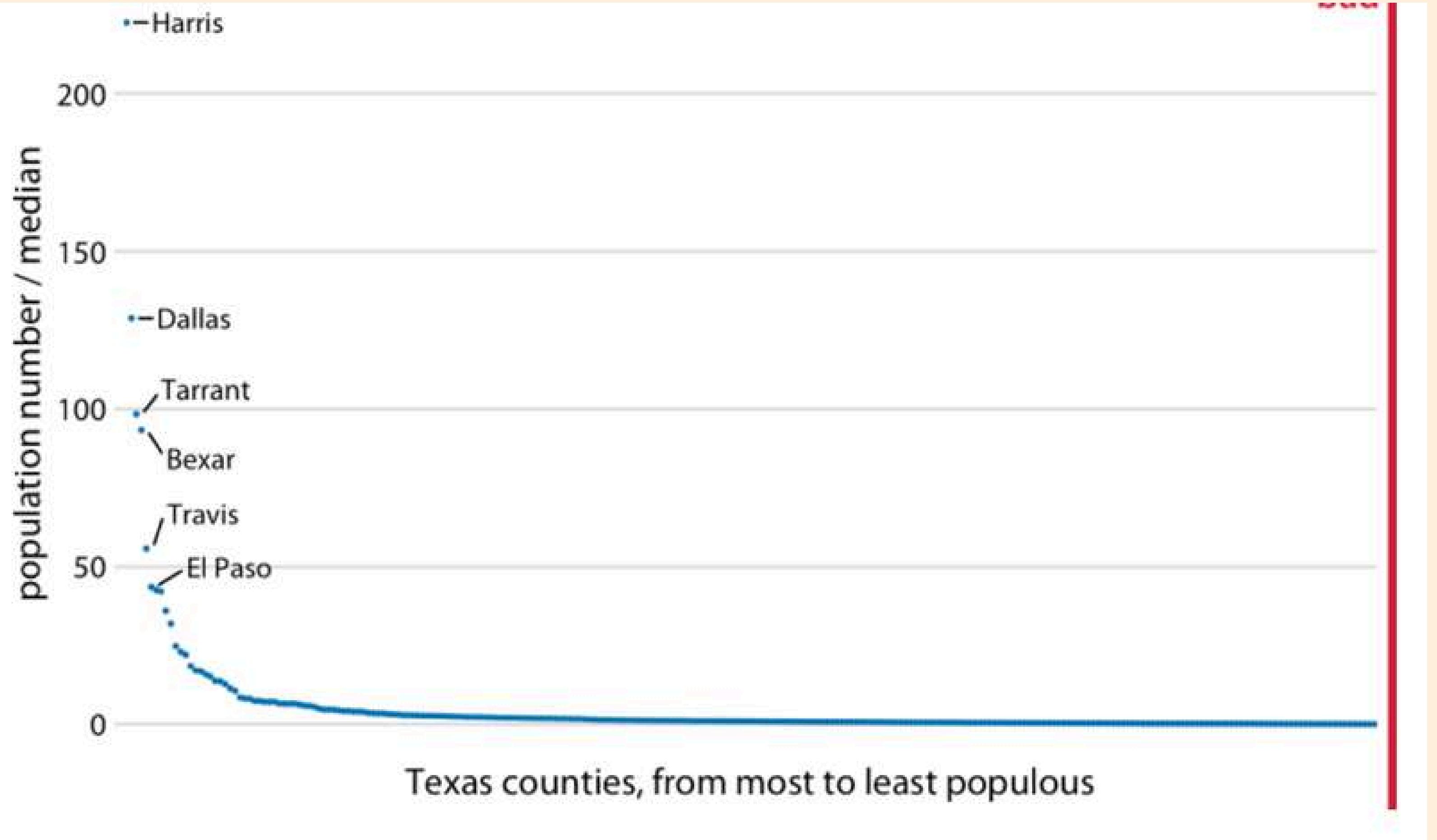
Relationship between linear and logarithmic scales. The dots correspond to the data values 1, 3.16, 10, 31.6, and 100, which are evenly spaced numbers on a logarithmic scale.



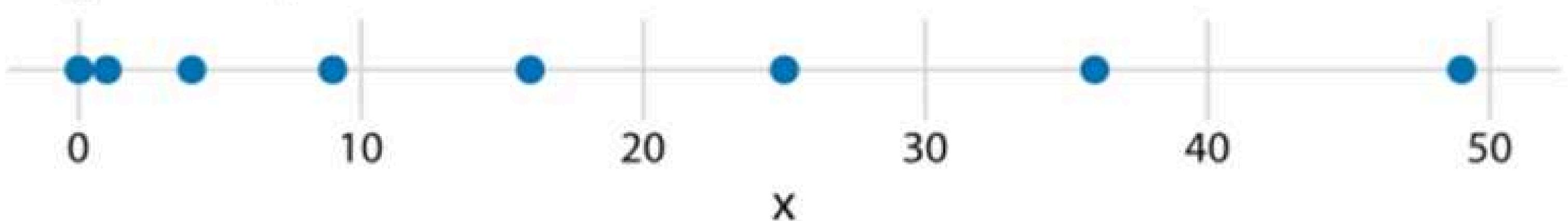
Relationship between linear and logarithmic scales. The dots correspond to the data values 1, 3.16, 10, 31.6, and 100, which are evenly spaced numbers on a logarithmic scale.



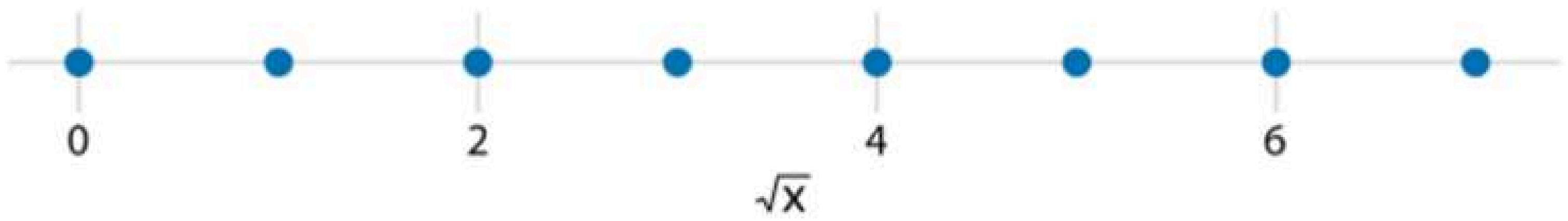
**Population  
numbers of Texas  
counties relative to  
their median value**



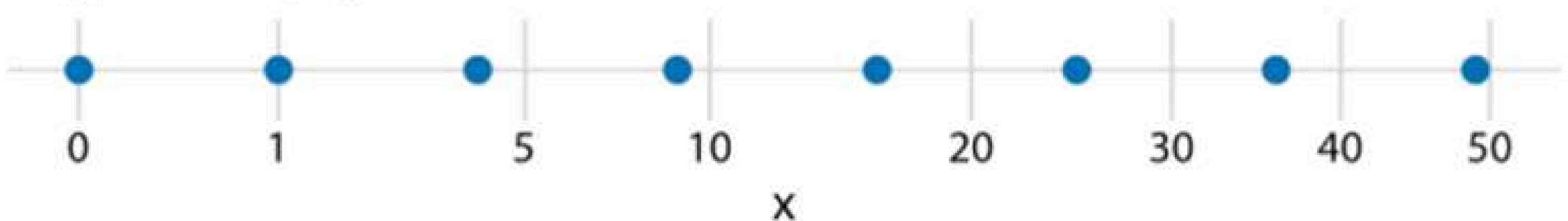
original data, linear scale



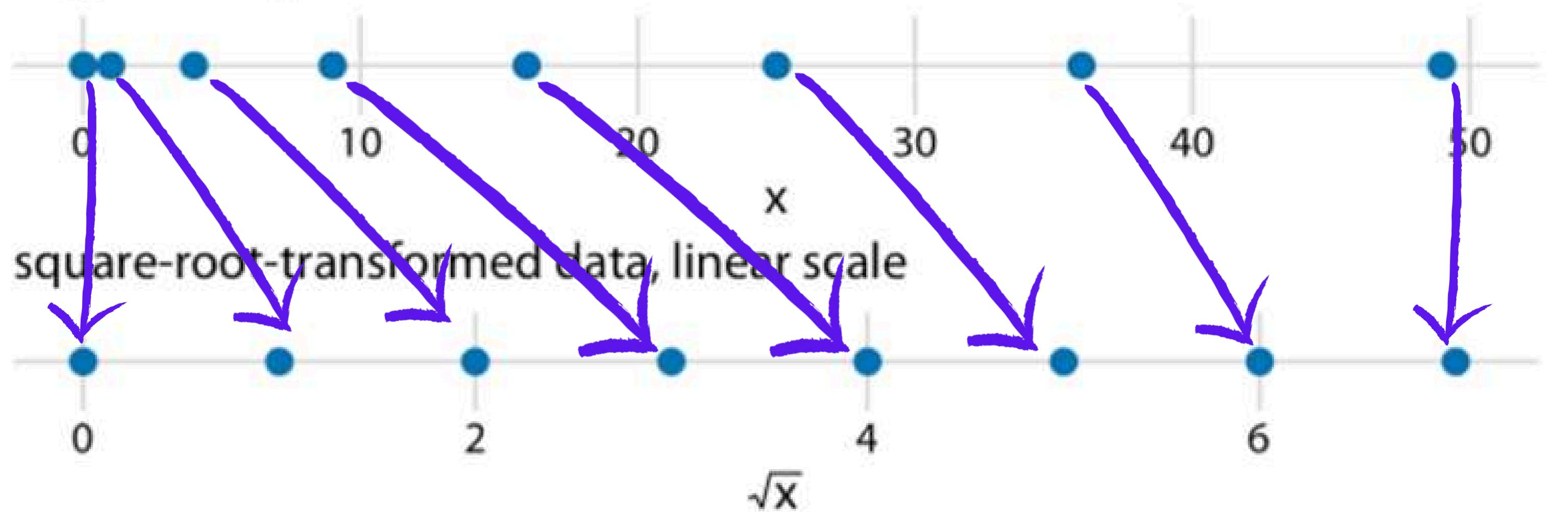
square-root-transformed data, linear scale



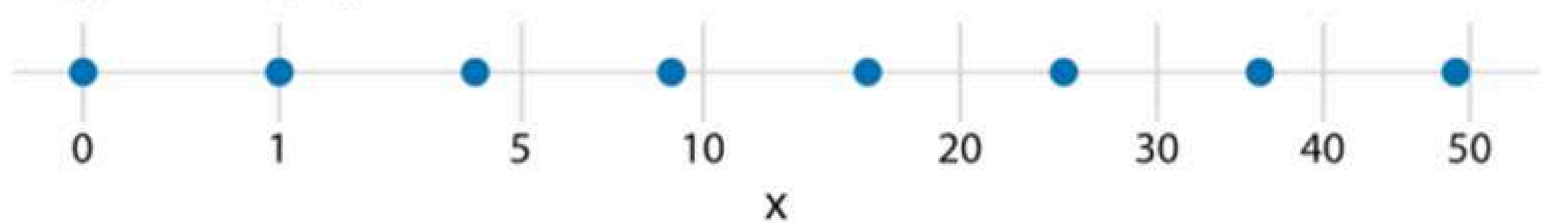
original data, square-root scale

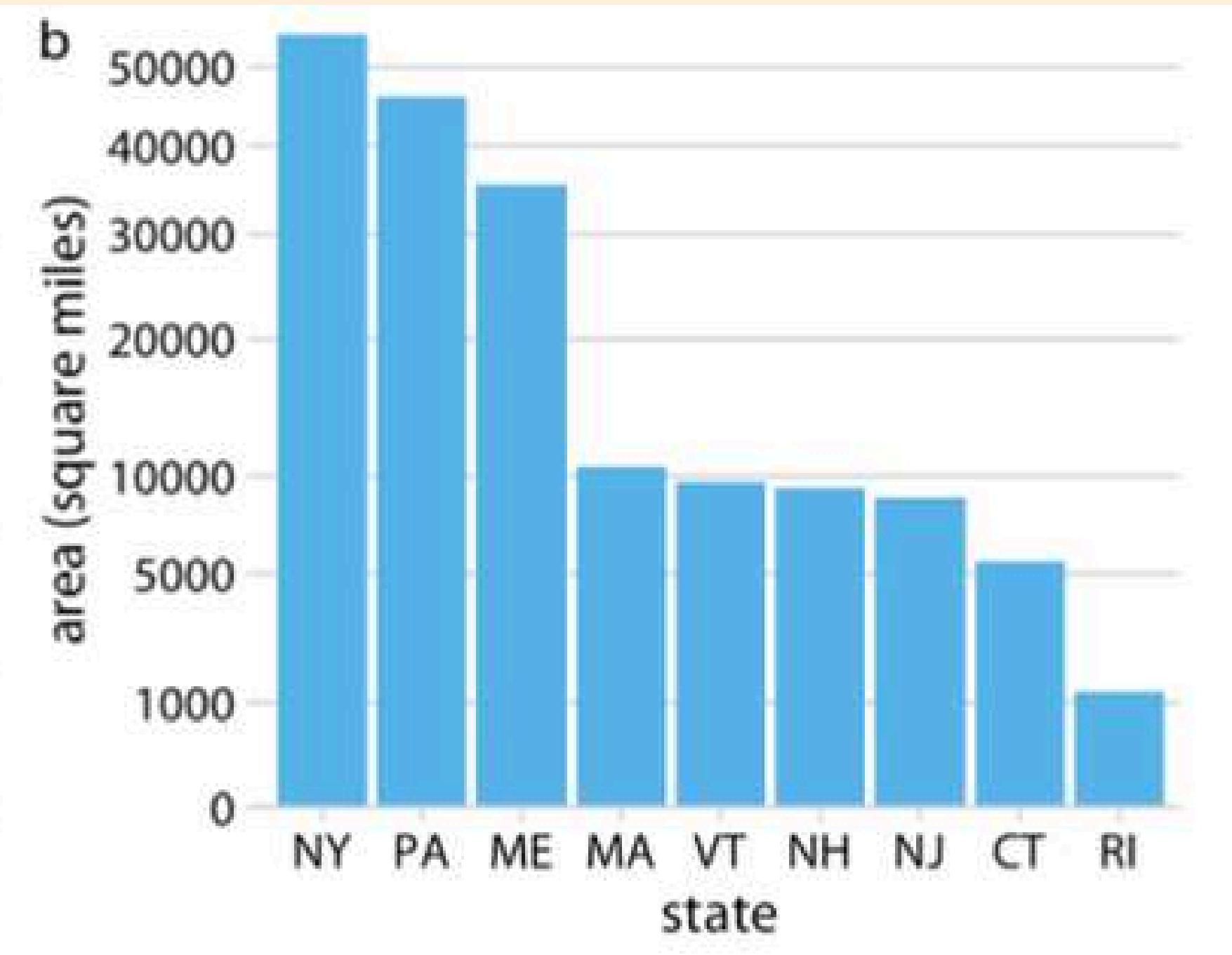
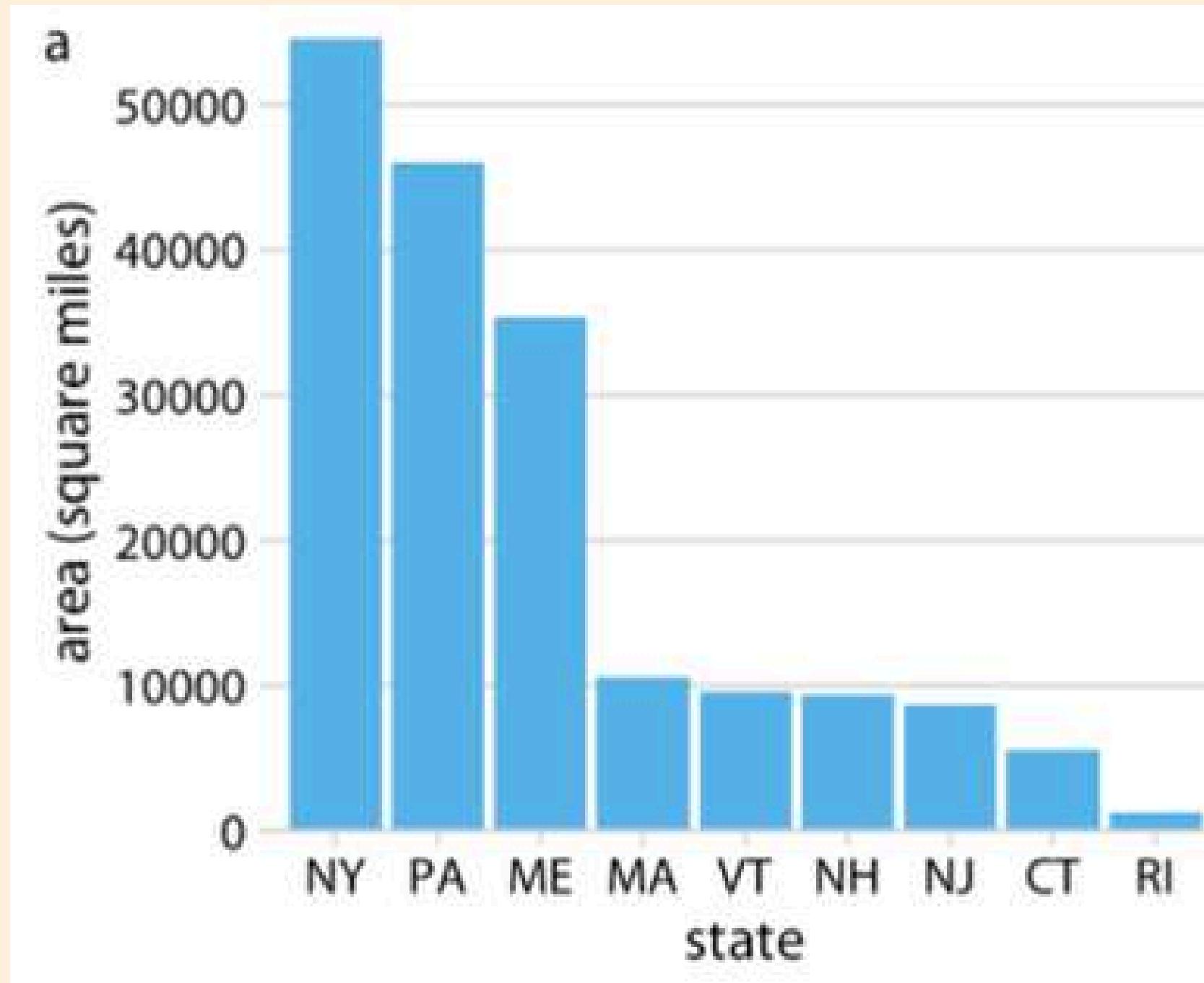


original data, linear scale

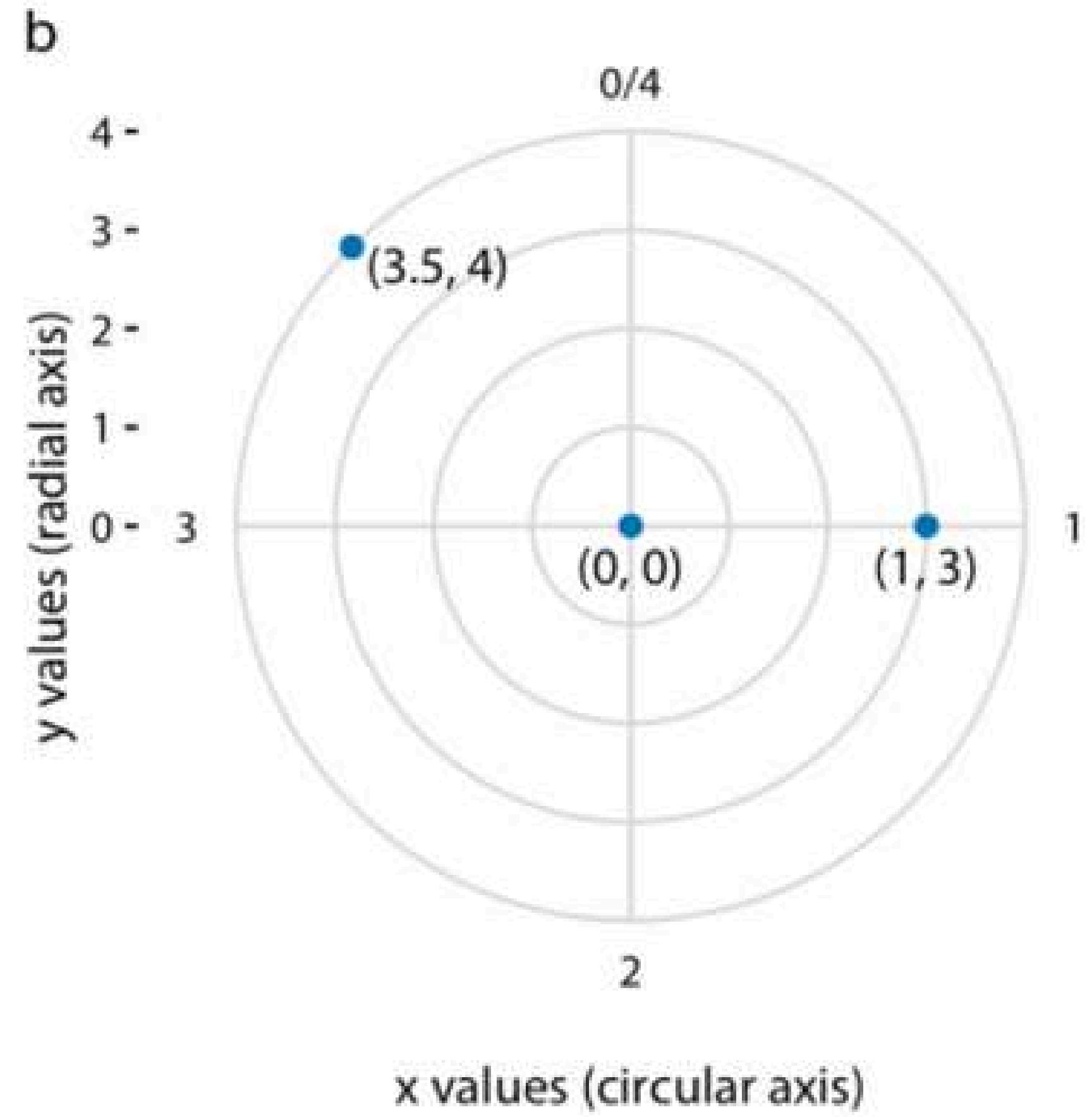
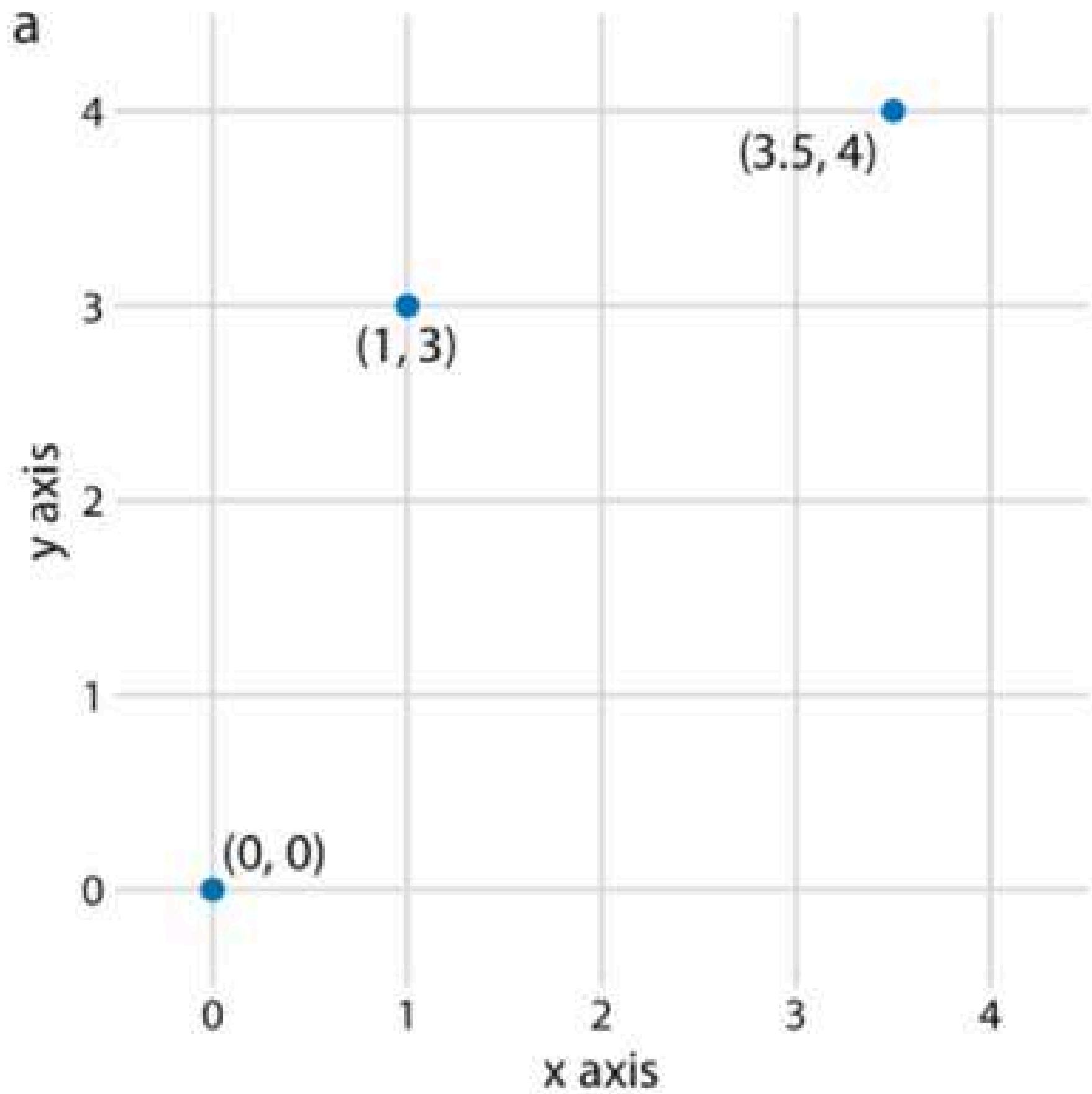


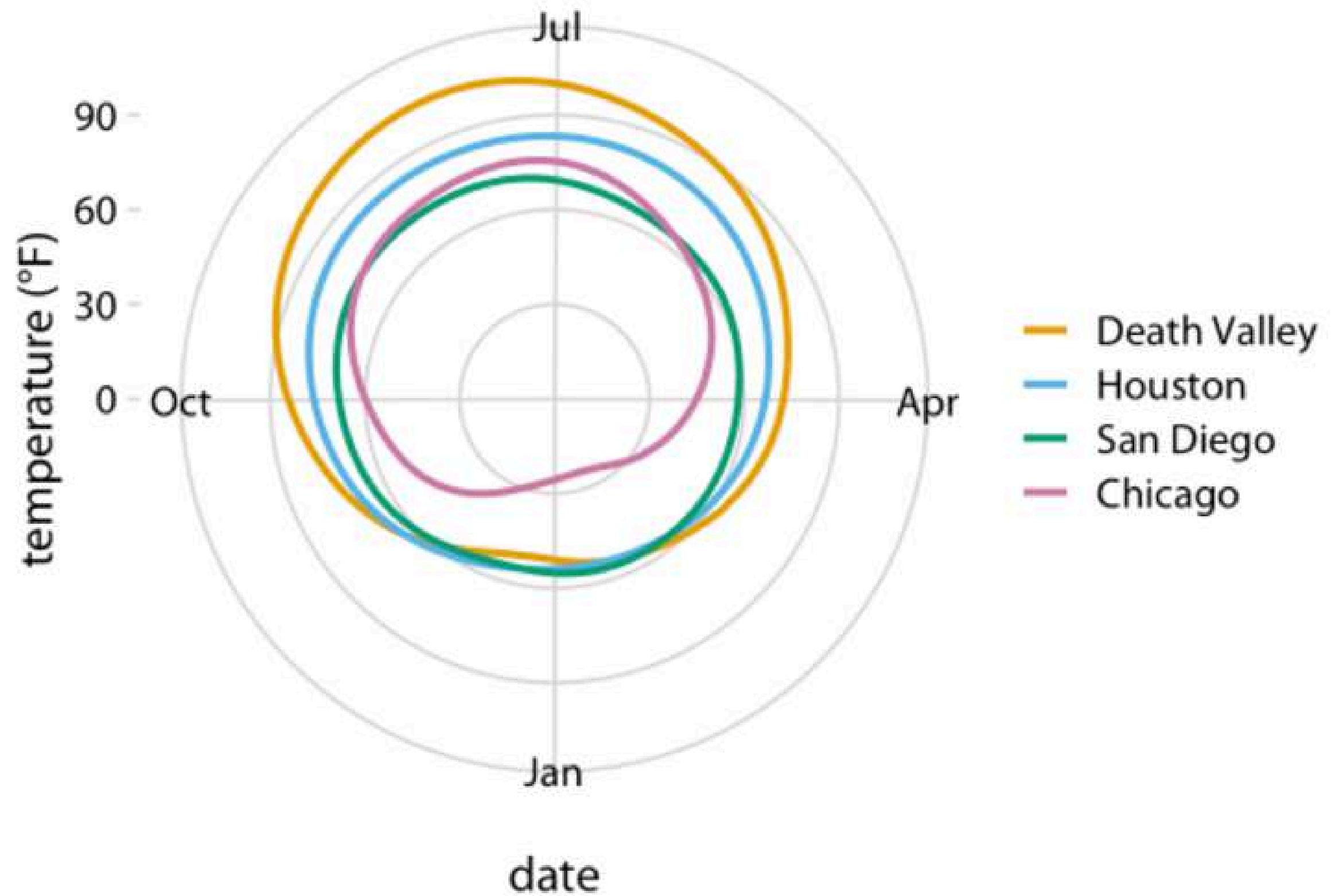
original data, square-root scale



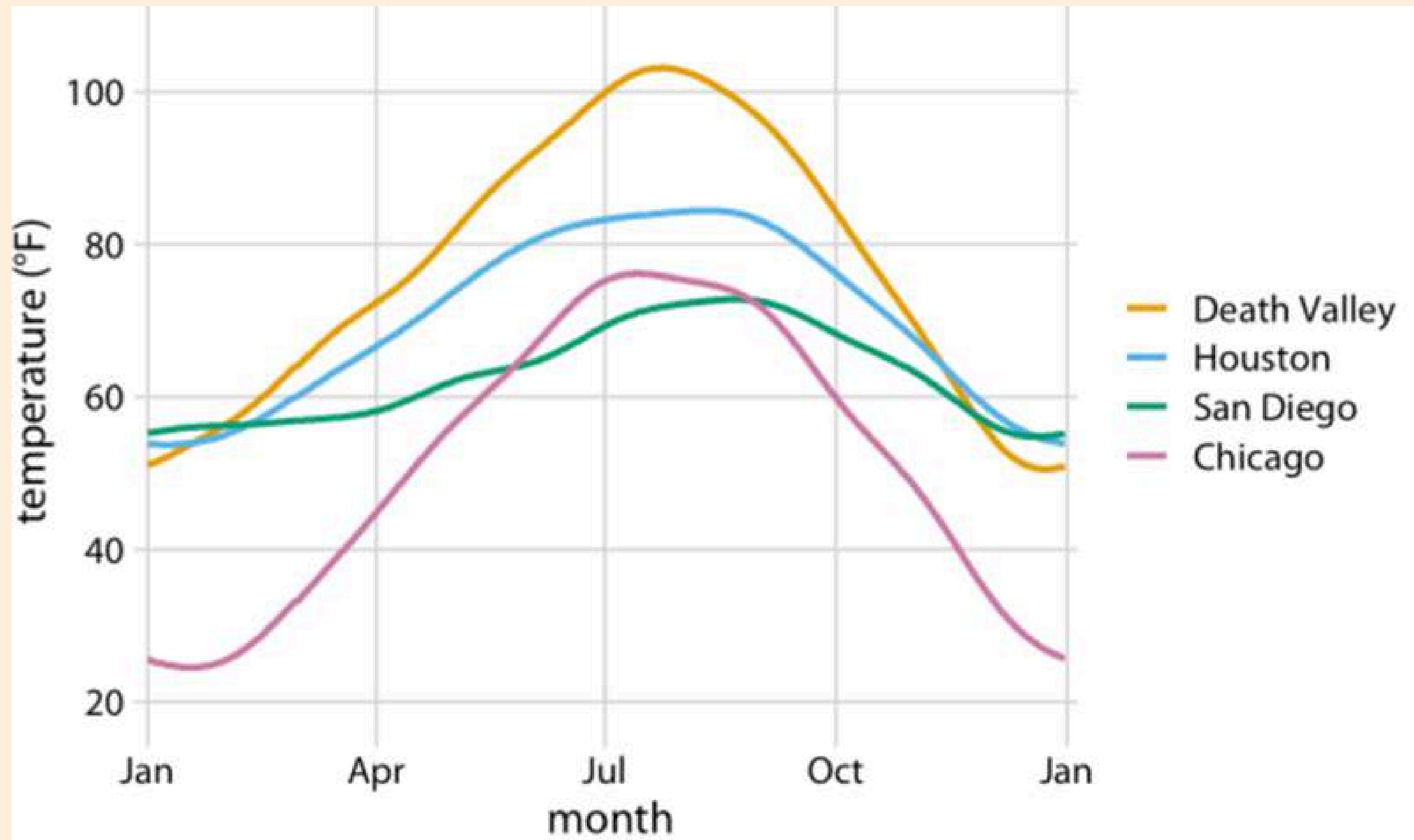


**Areas of northeastern US states. (a) Areas shown on a linear scale. (b) Areas shown on a square-root scale. Data source: Google**

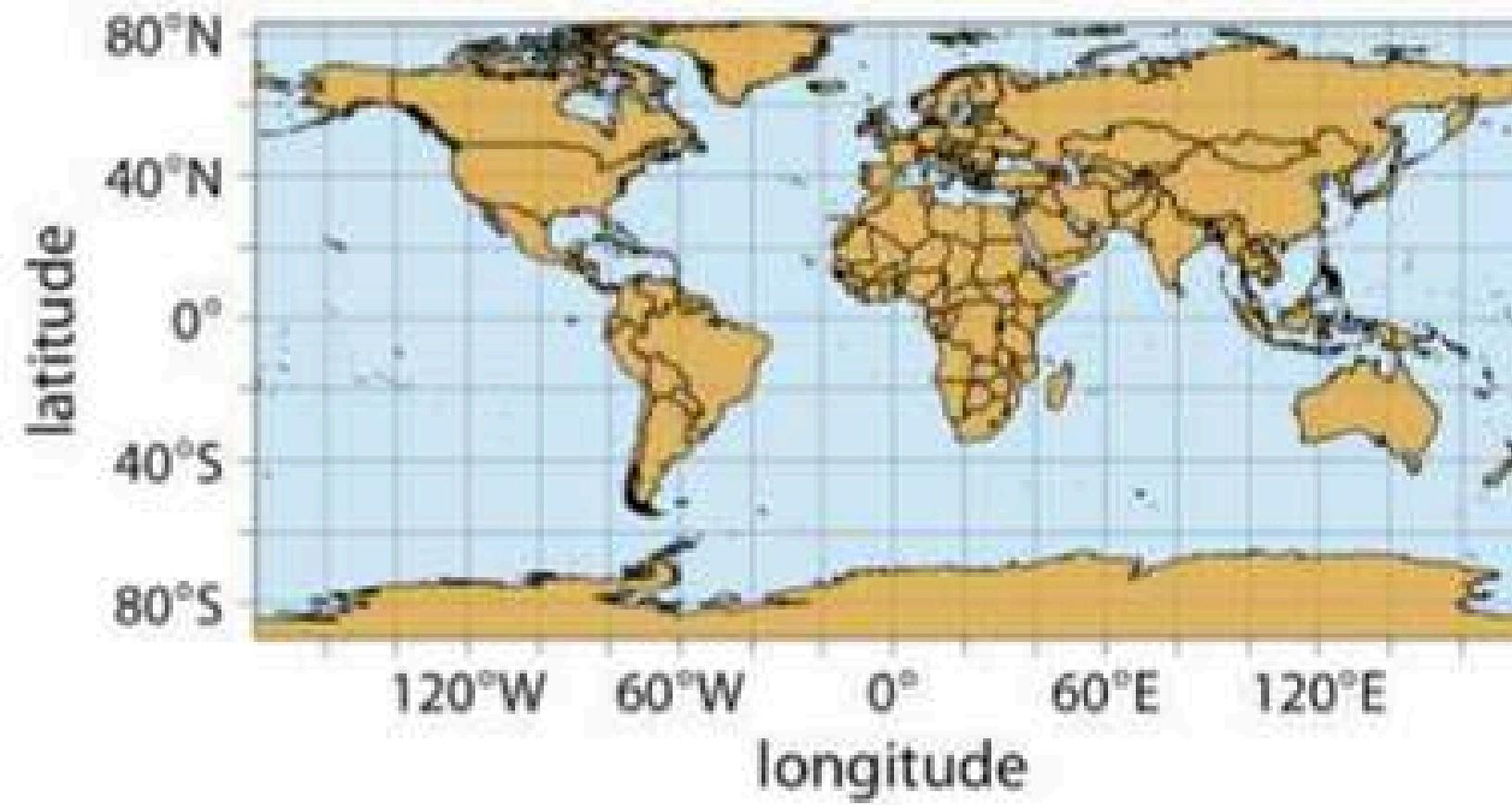




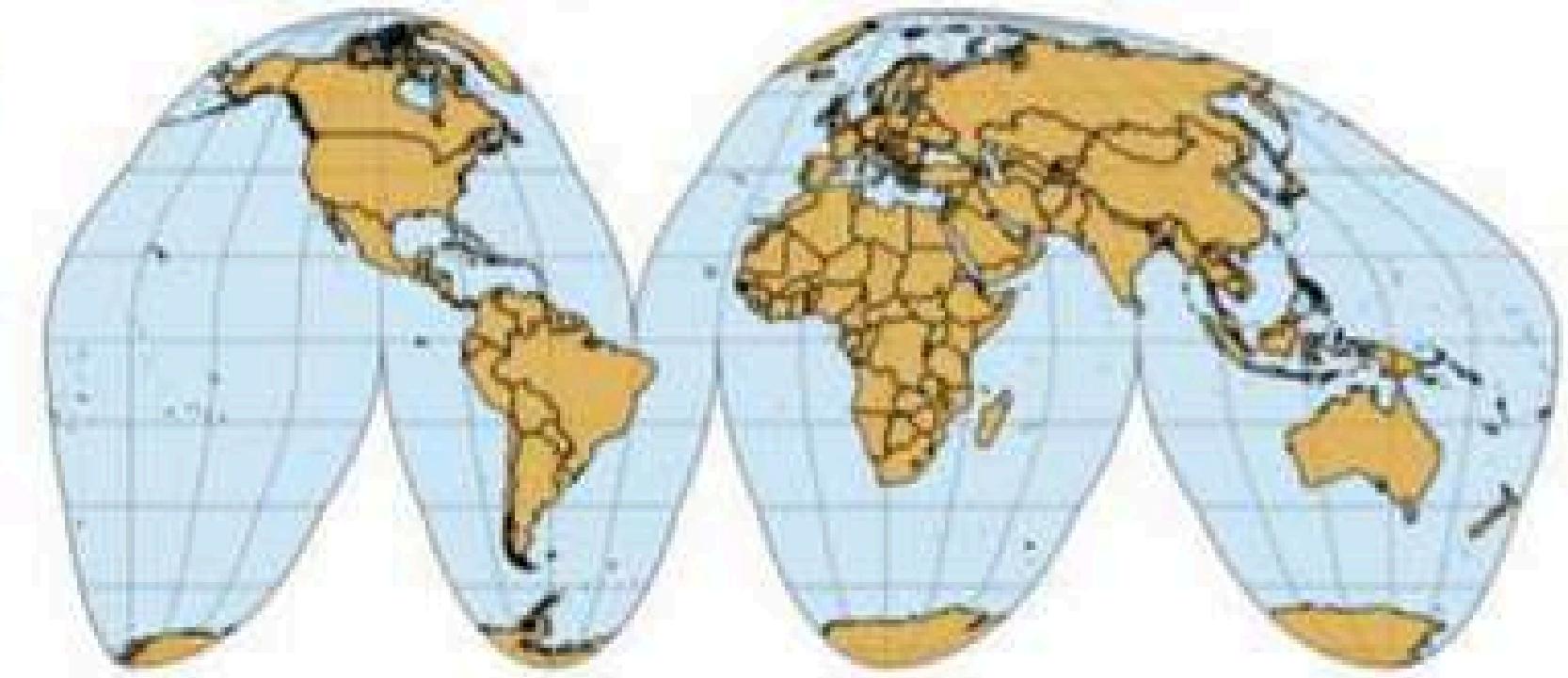
Daily temperature normals  
for four selected locations  
in the US, shown in  
polar coordinates.



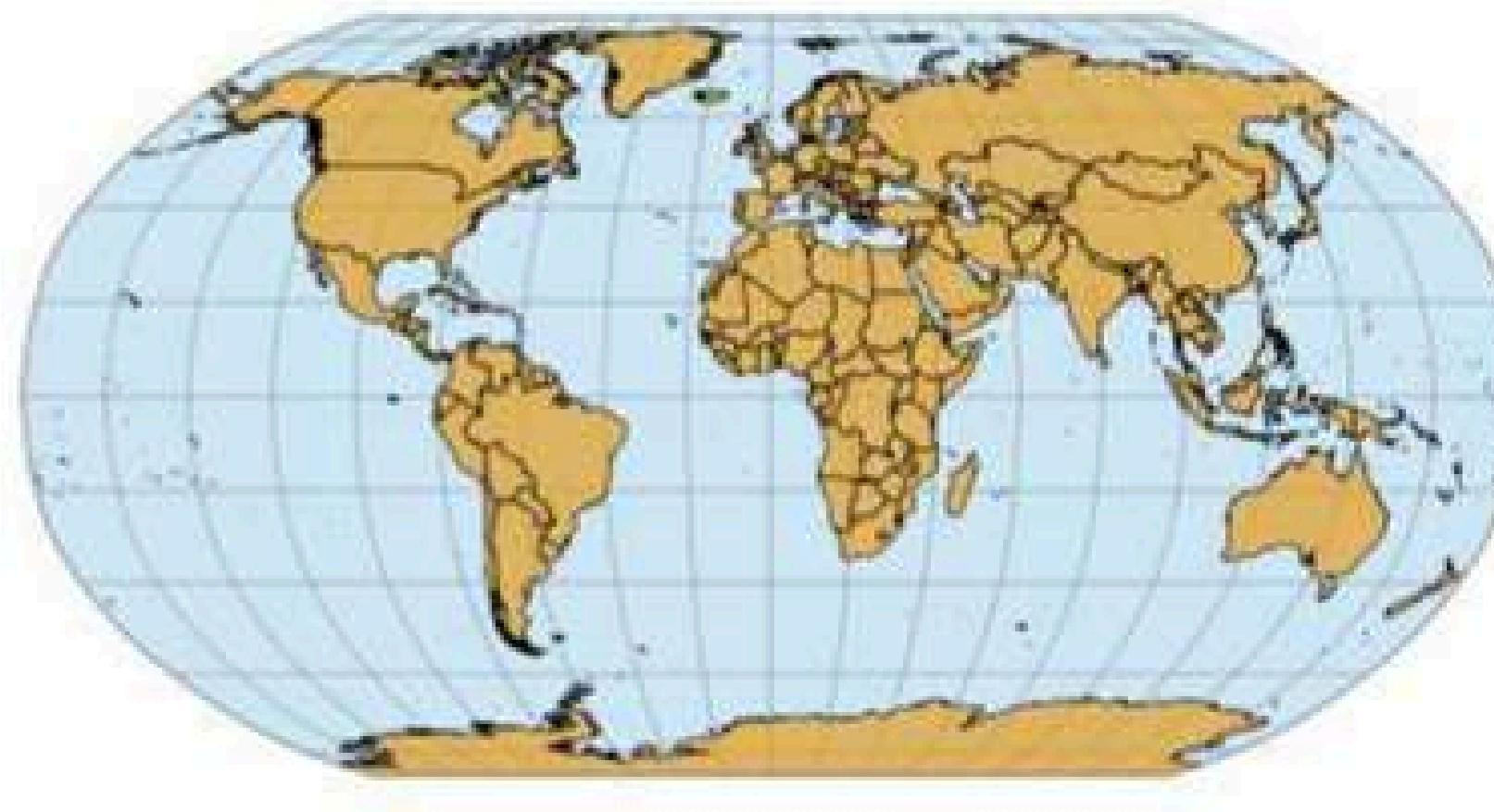
**Cartesian longitude and latitude**



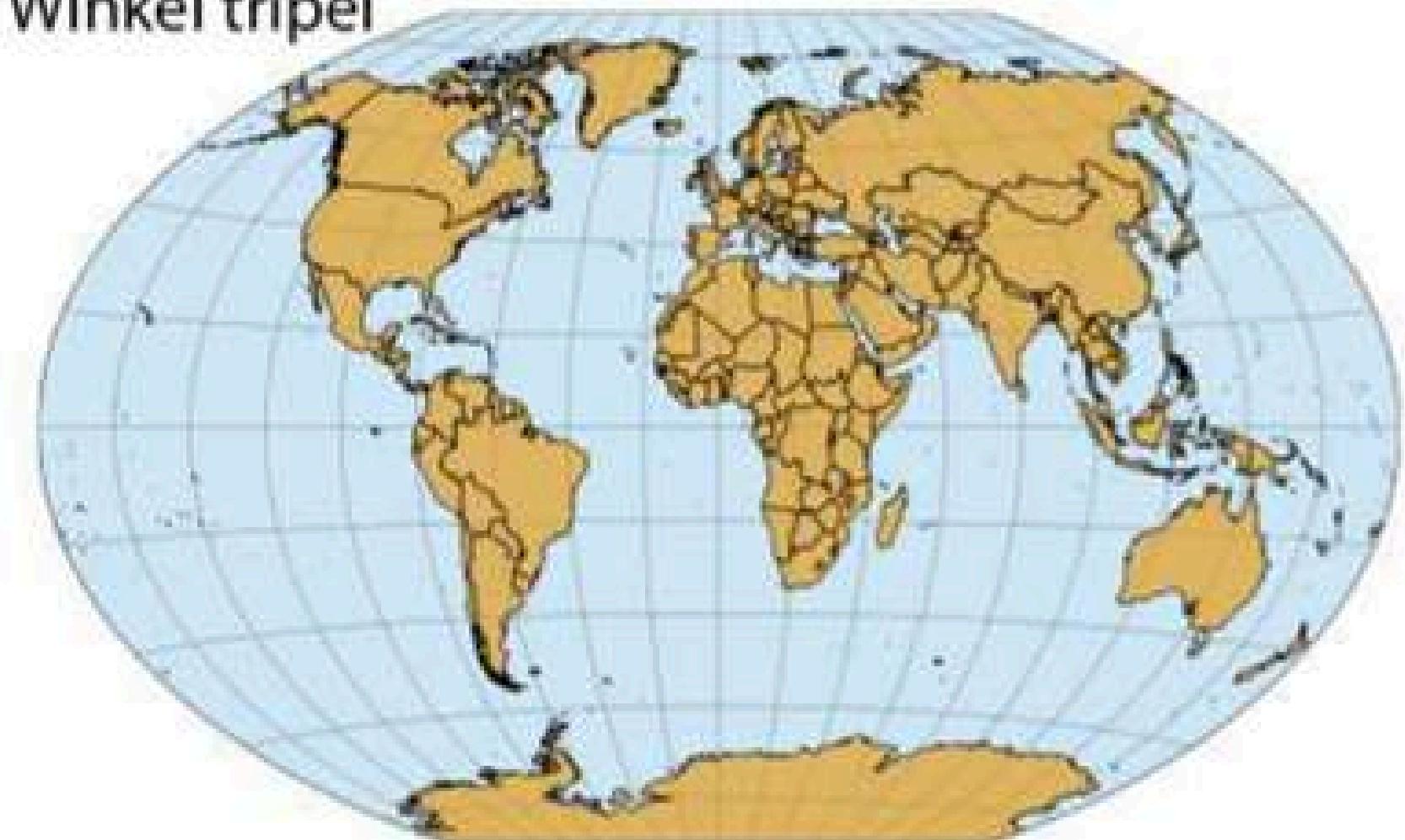
**Interrupted Goode homolosine**



**Robinson**



**Winkel tripel**



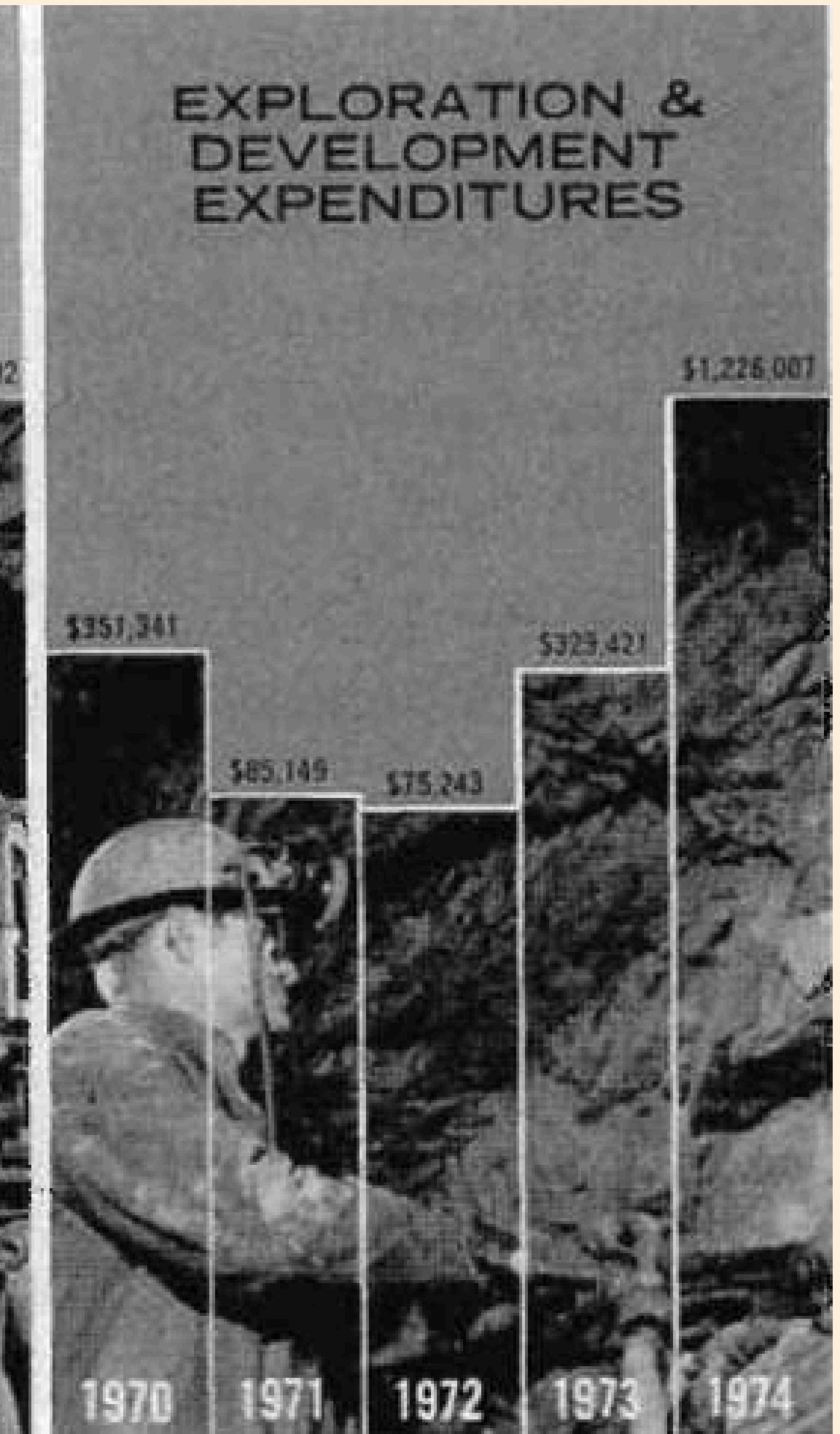
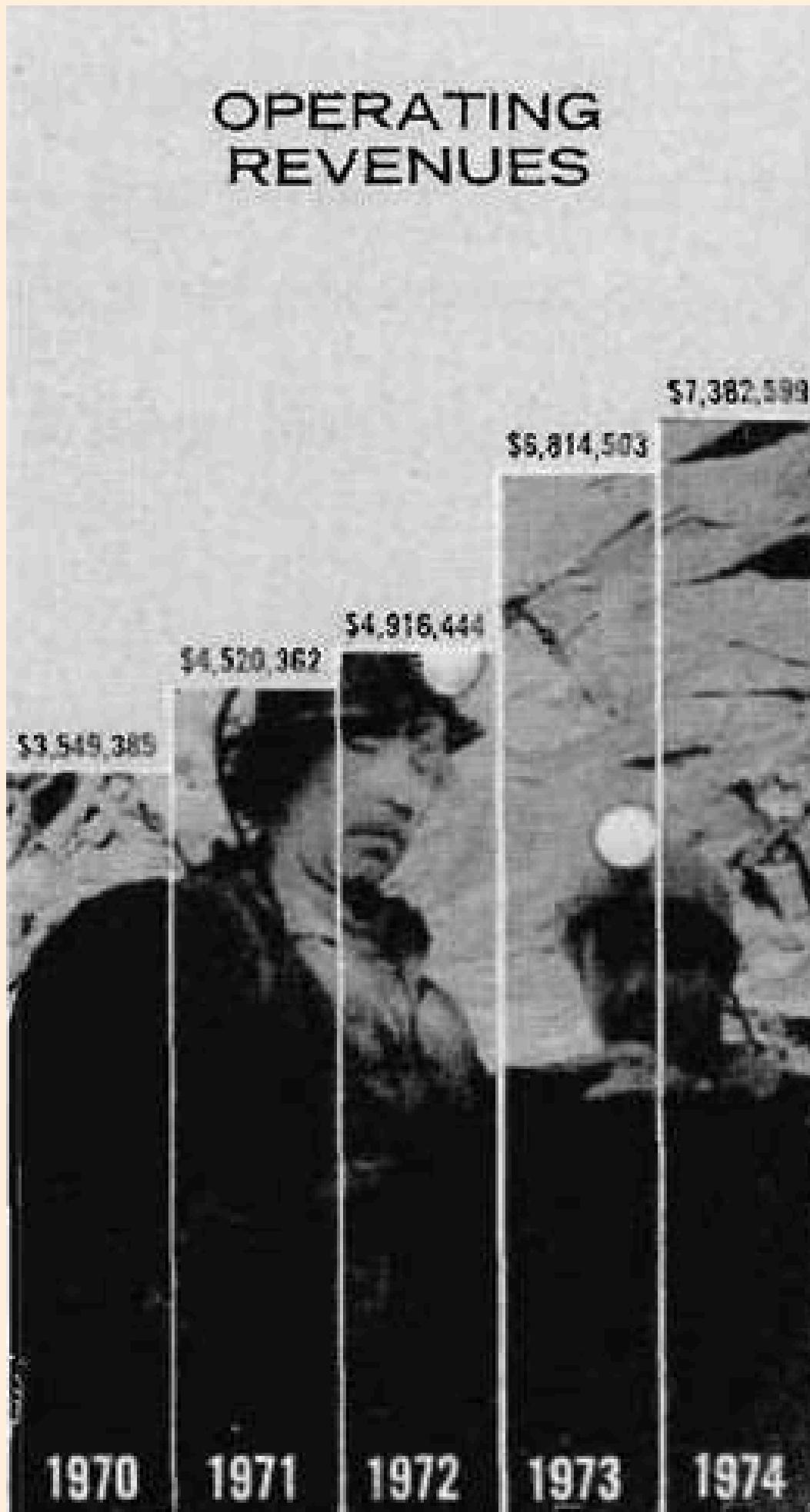
# Graphical Integrity

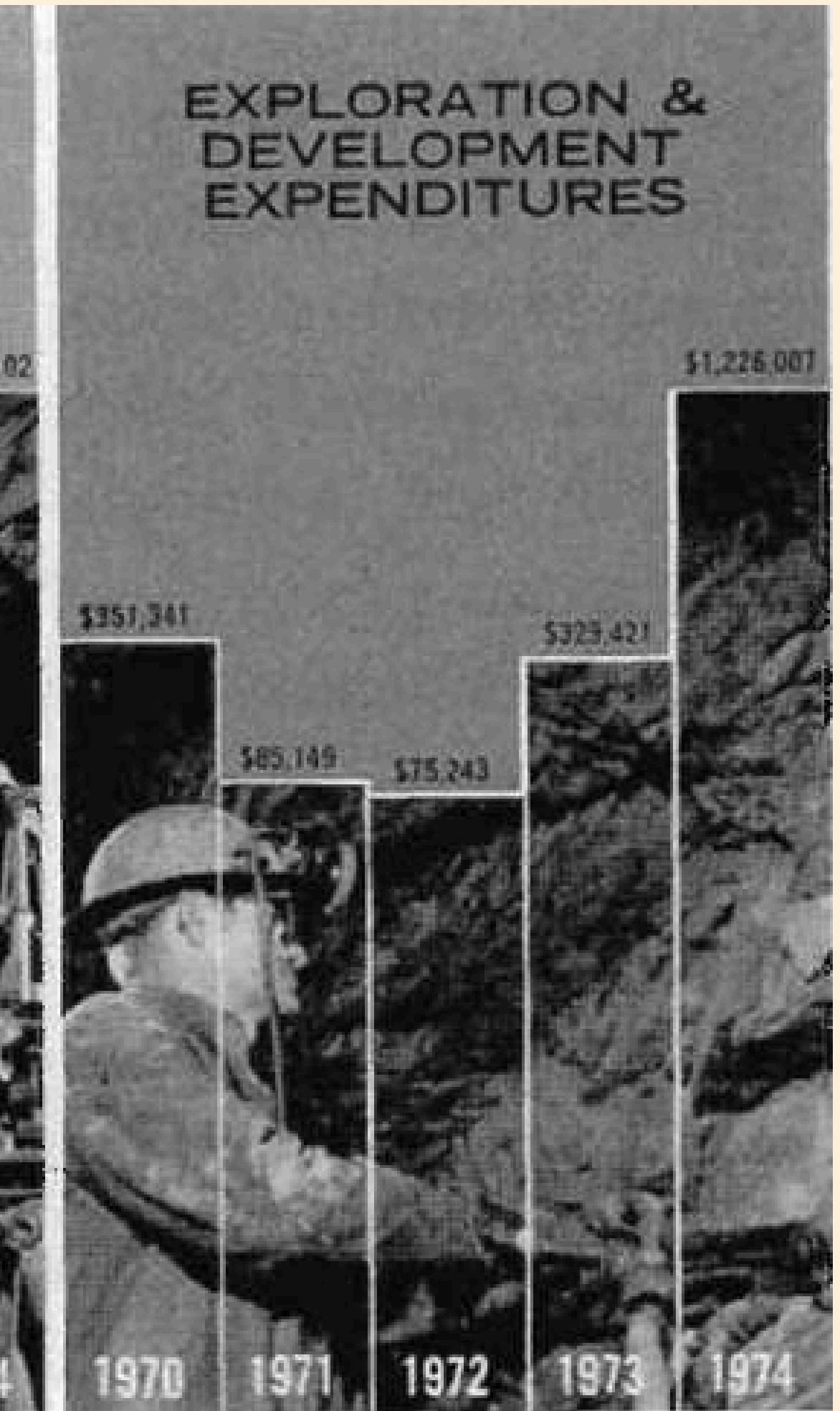
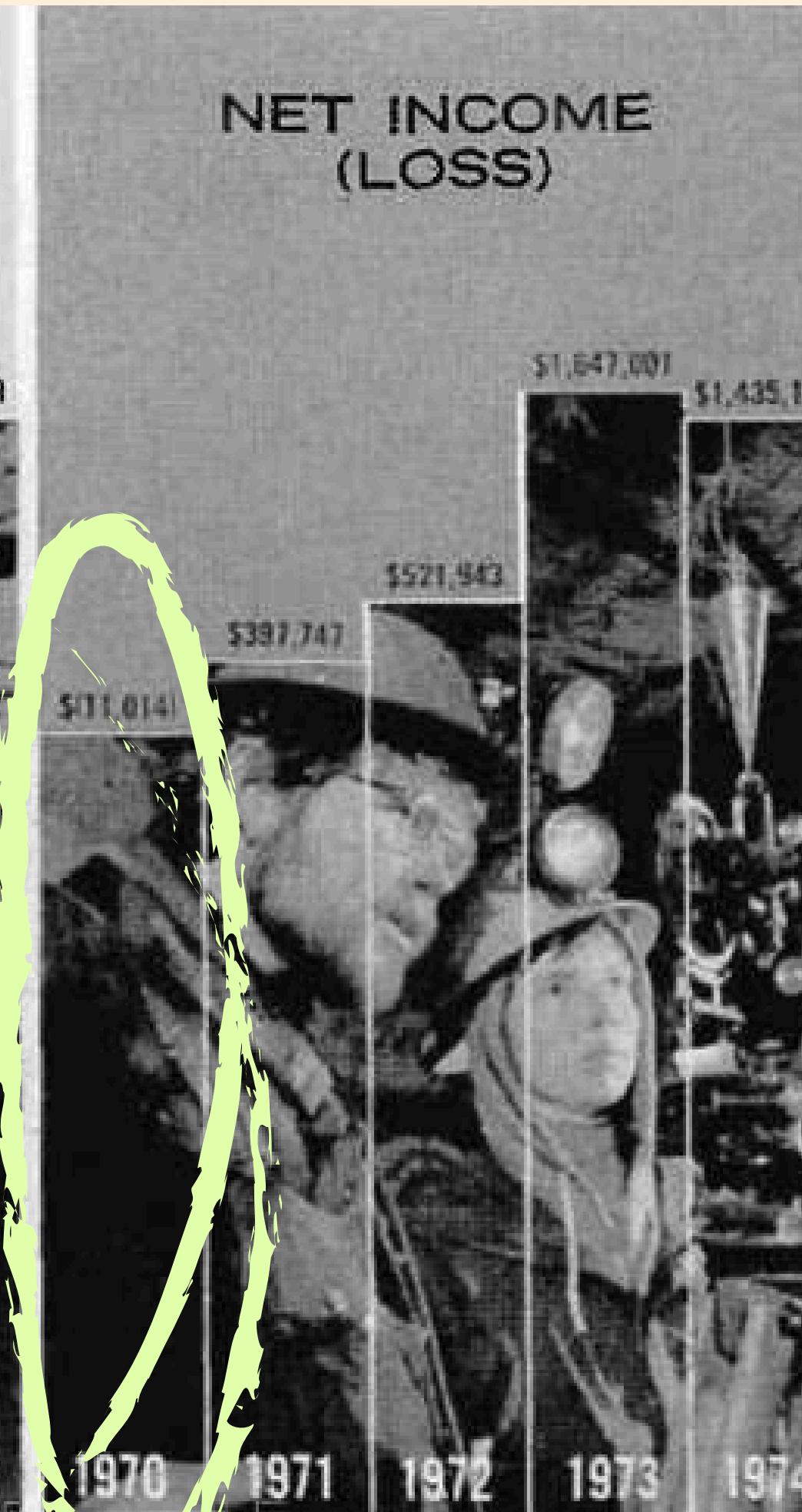
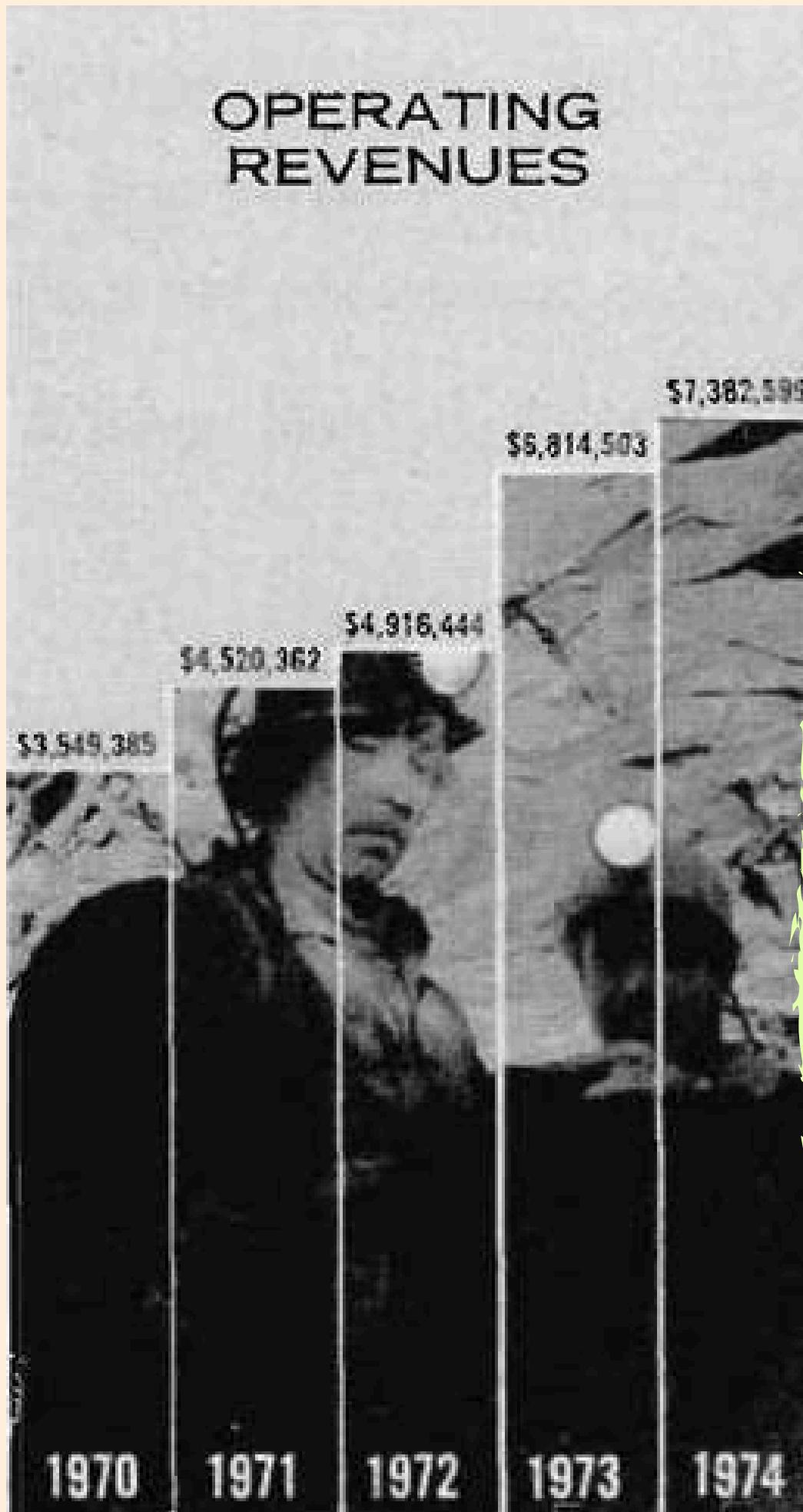


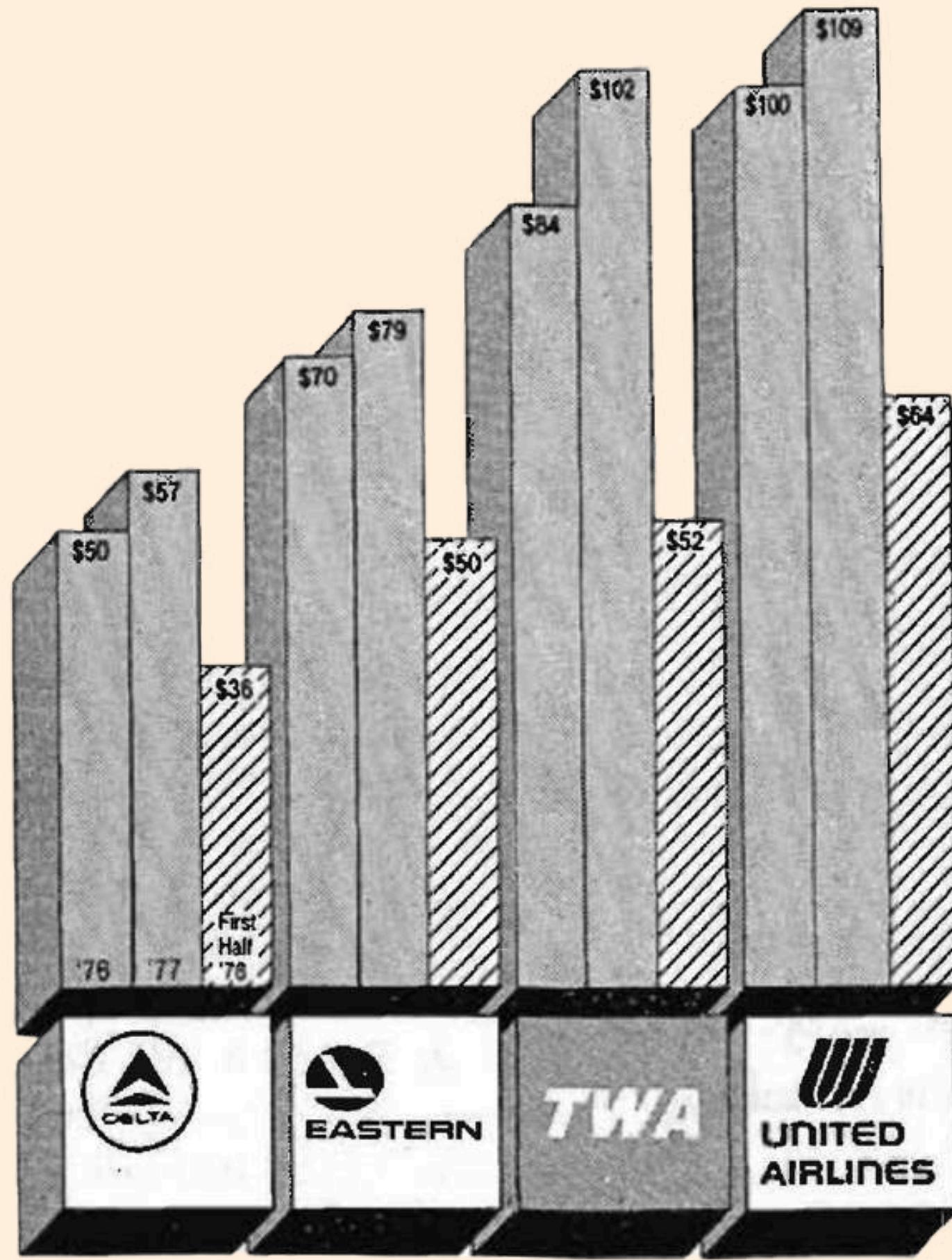
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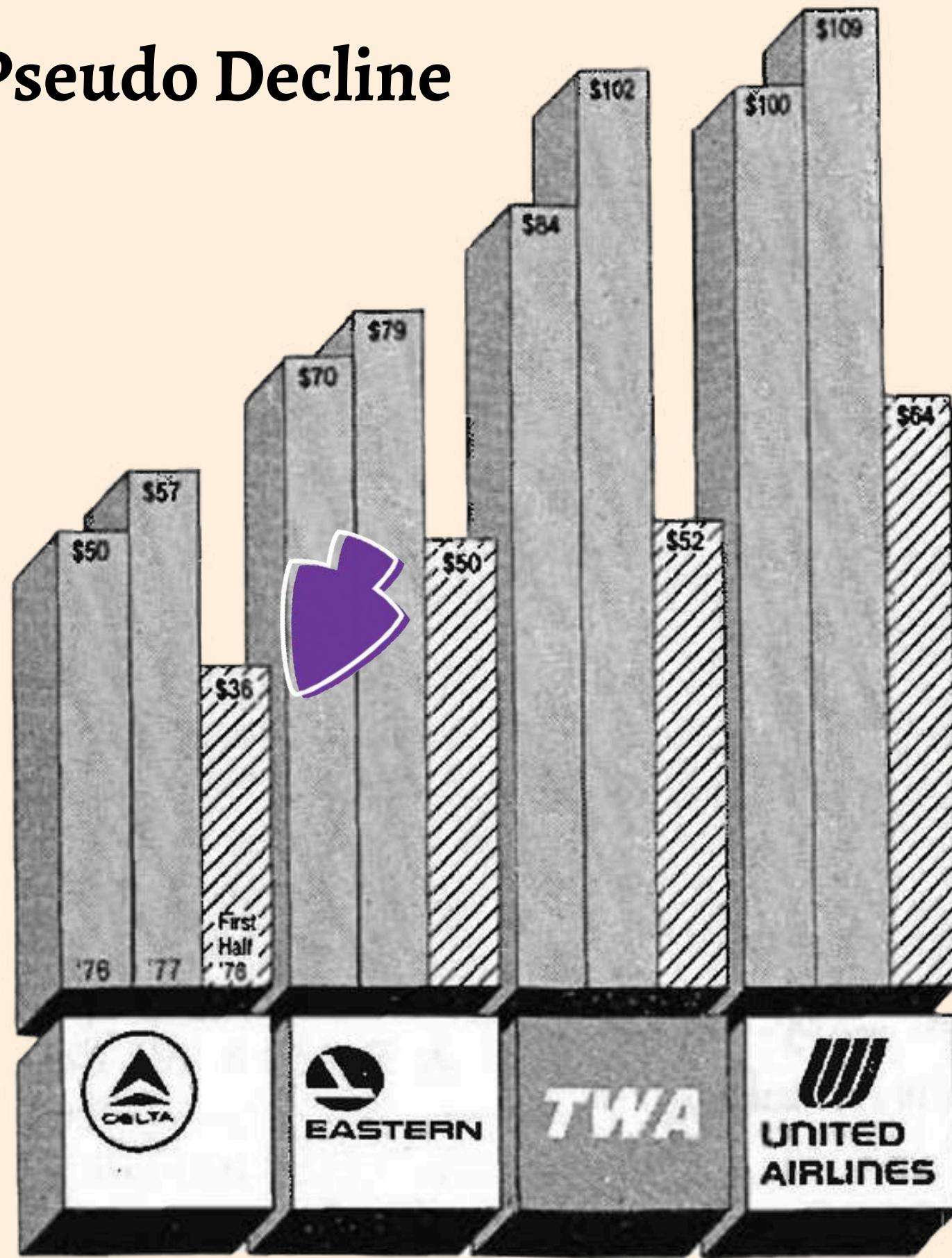






New York Times, August 8, 1978, p. D-1.

Pseudo Decline

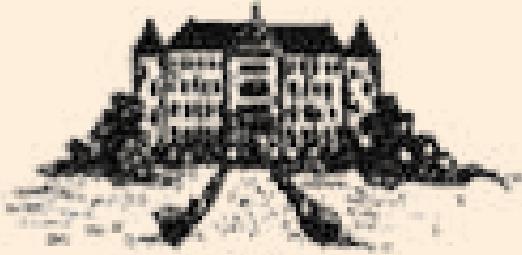


Six months of 1978 vs  
Full Year of 76 and 77

New York Times, August 8, 1978, p. D-1.

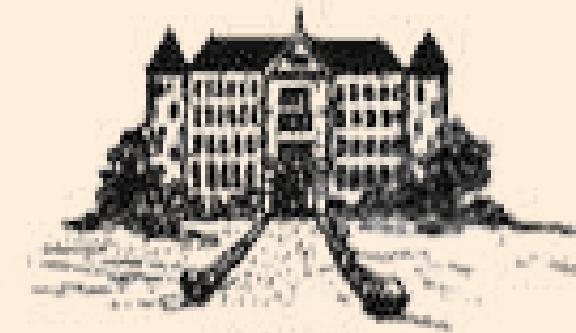
Comparative Annual Cost per Capita for care of Insane in  
Pittsburgh City Homes and Pennsylvania State Hospitals.

\$147



South Mountain

\$172



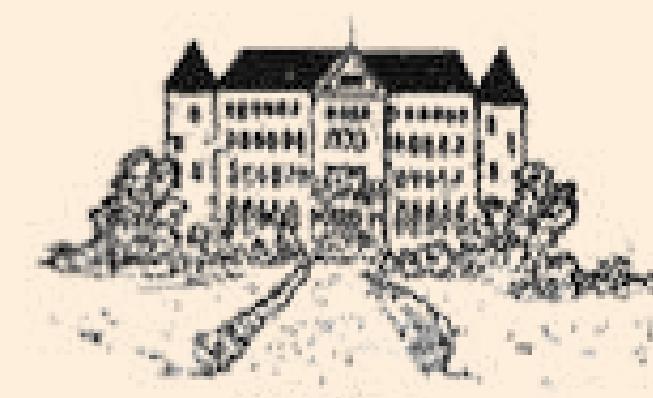
Pittsburgh

\$198



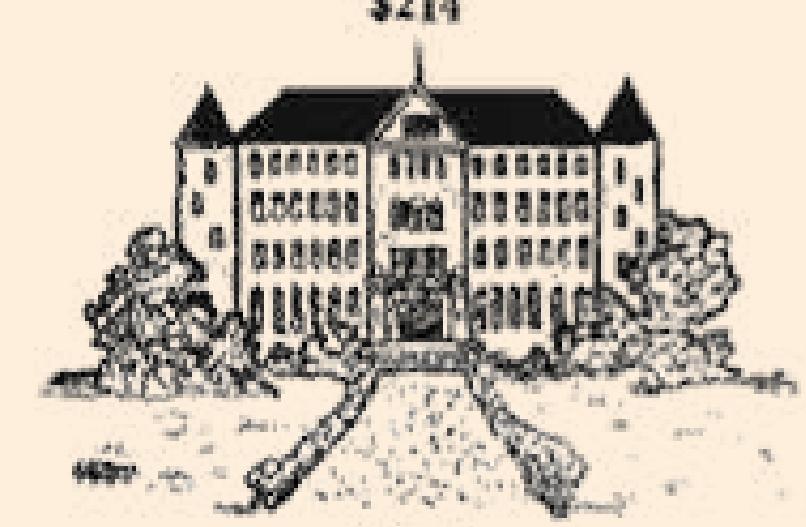
Harrisburg

\$213



Norristown

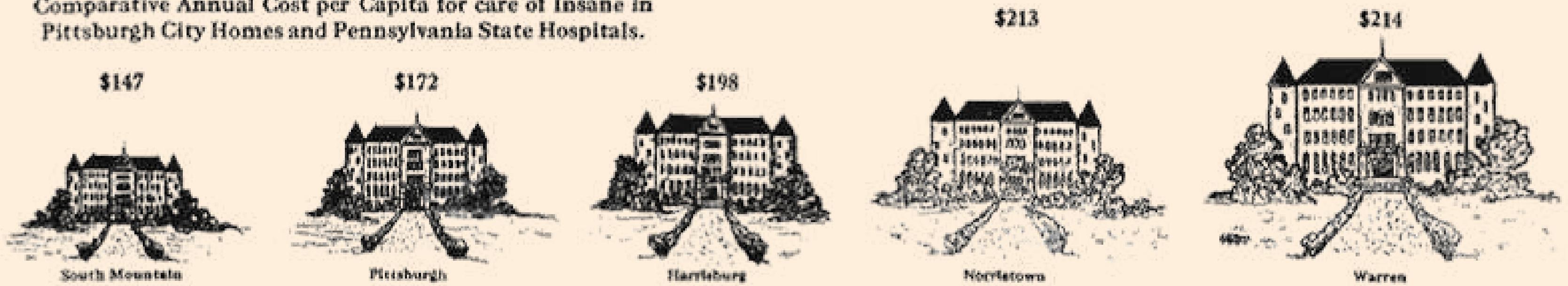
\$214



Warren

Pittsburgh Civic Commission, *Report on  
Expenditures of the Department of Charities*  
(Pittsburgh, 1911), p. 7.

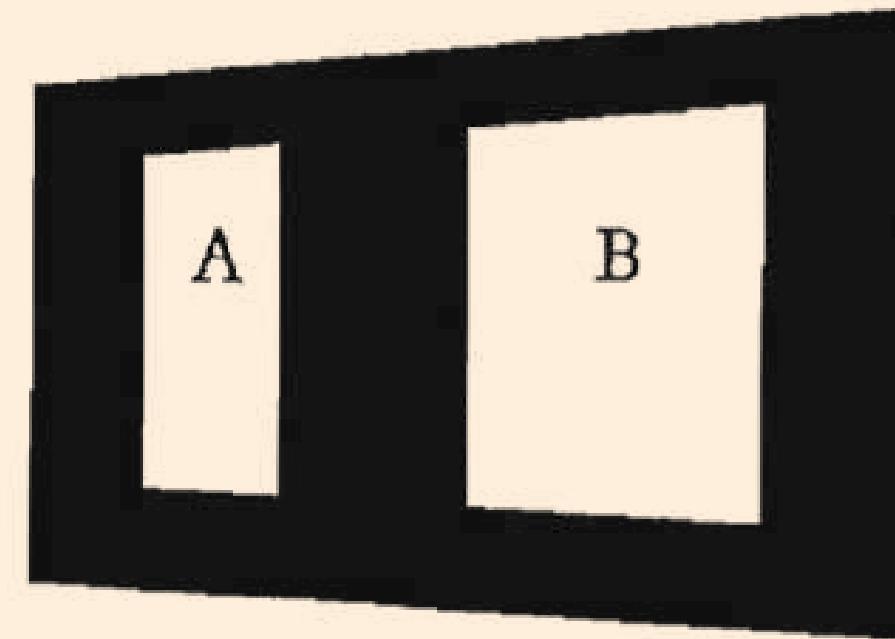
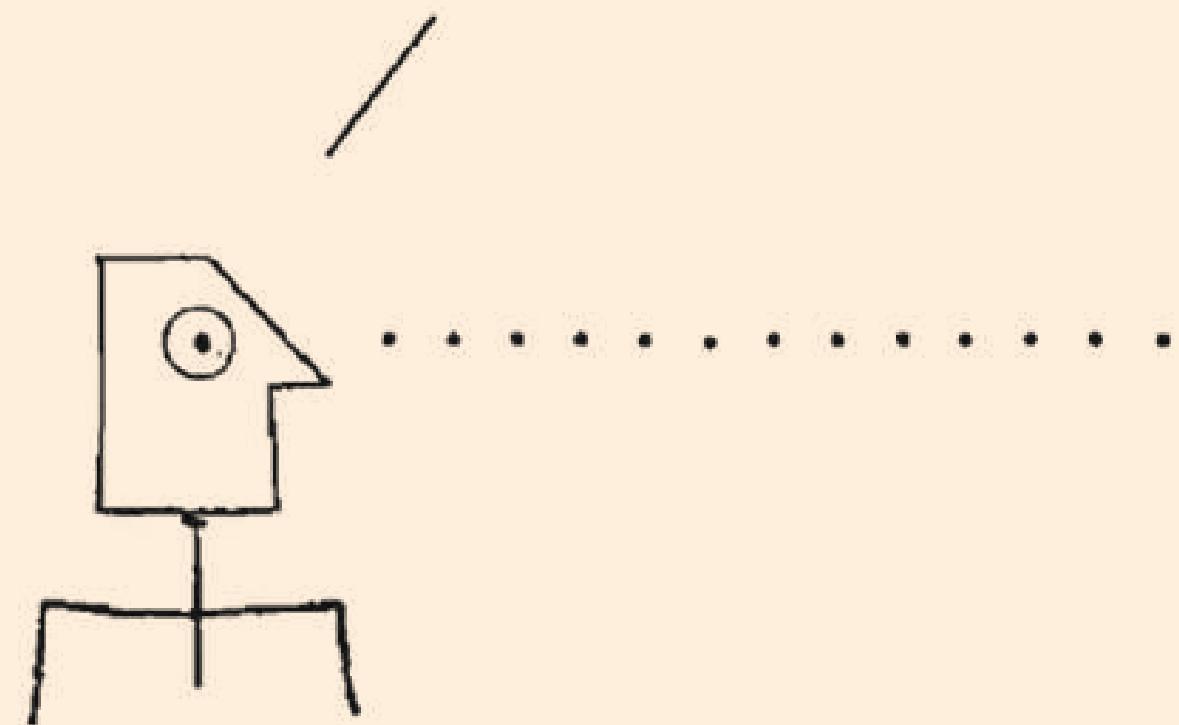
Comparative Annual Cost per Capita for care of Insane in  
Pittsburgh City Homes and Pennsylvania State Hospitals.



Pittsburgh Civic Commission, *Report on  
Expenditures of the Department of Charities*  
(Pittsburgh, 1911), p. 7.

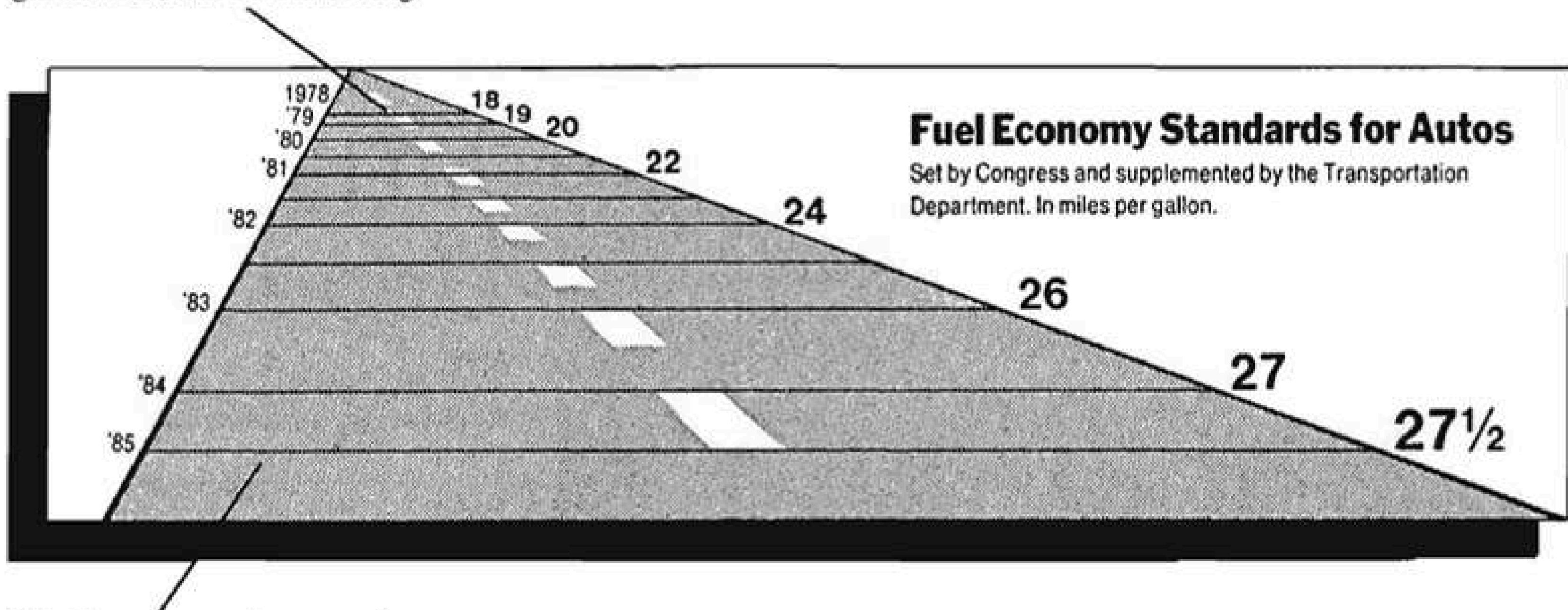
# Missing magnitude of numbers

**I think I see that area B  
is 3.14 times bigger than  
area A. Is that correct?**



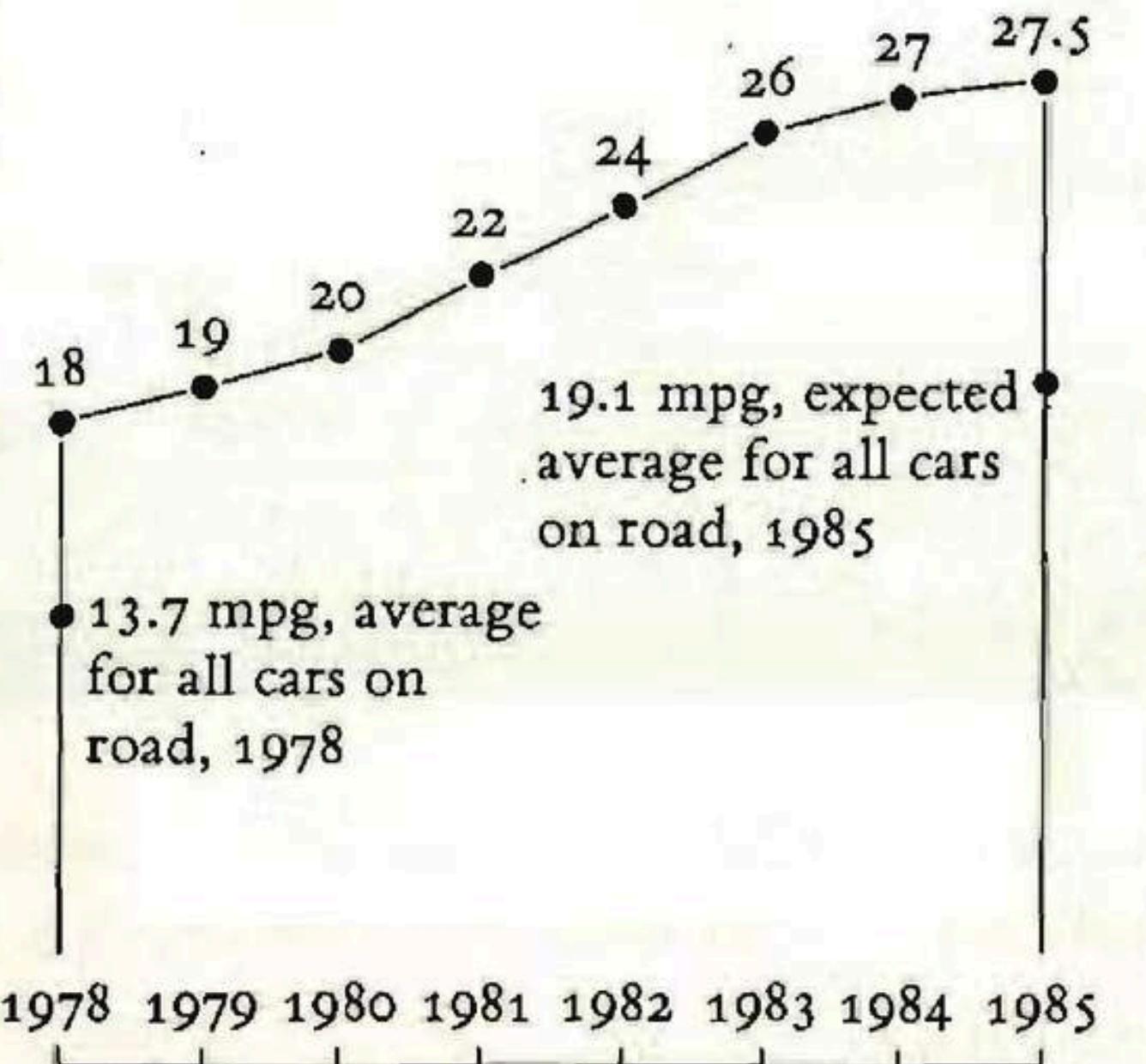


This line, representing 18 miles per gallon in 1978, is 0.6 inches long.

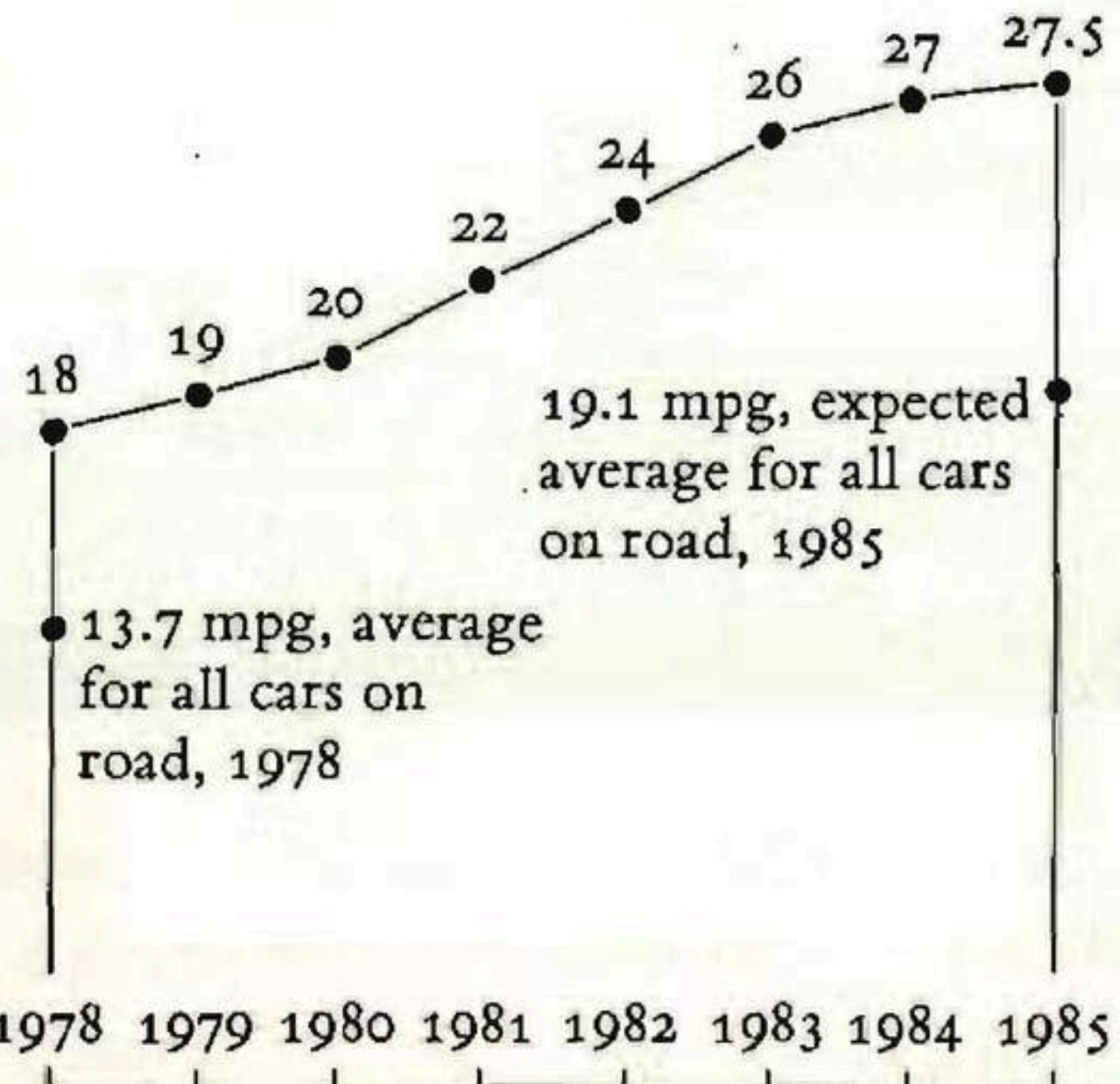


This line, representing 27.5 miles per gallon in 1985, is 5.3 inches long.

REQUIRED FUEL ECONOMY STANDARDS:  
NEW CARS BUILT FROM 1978 TO 1985

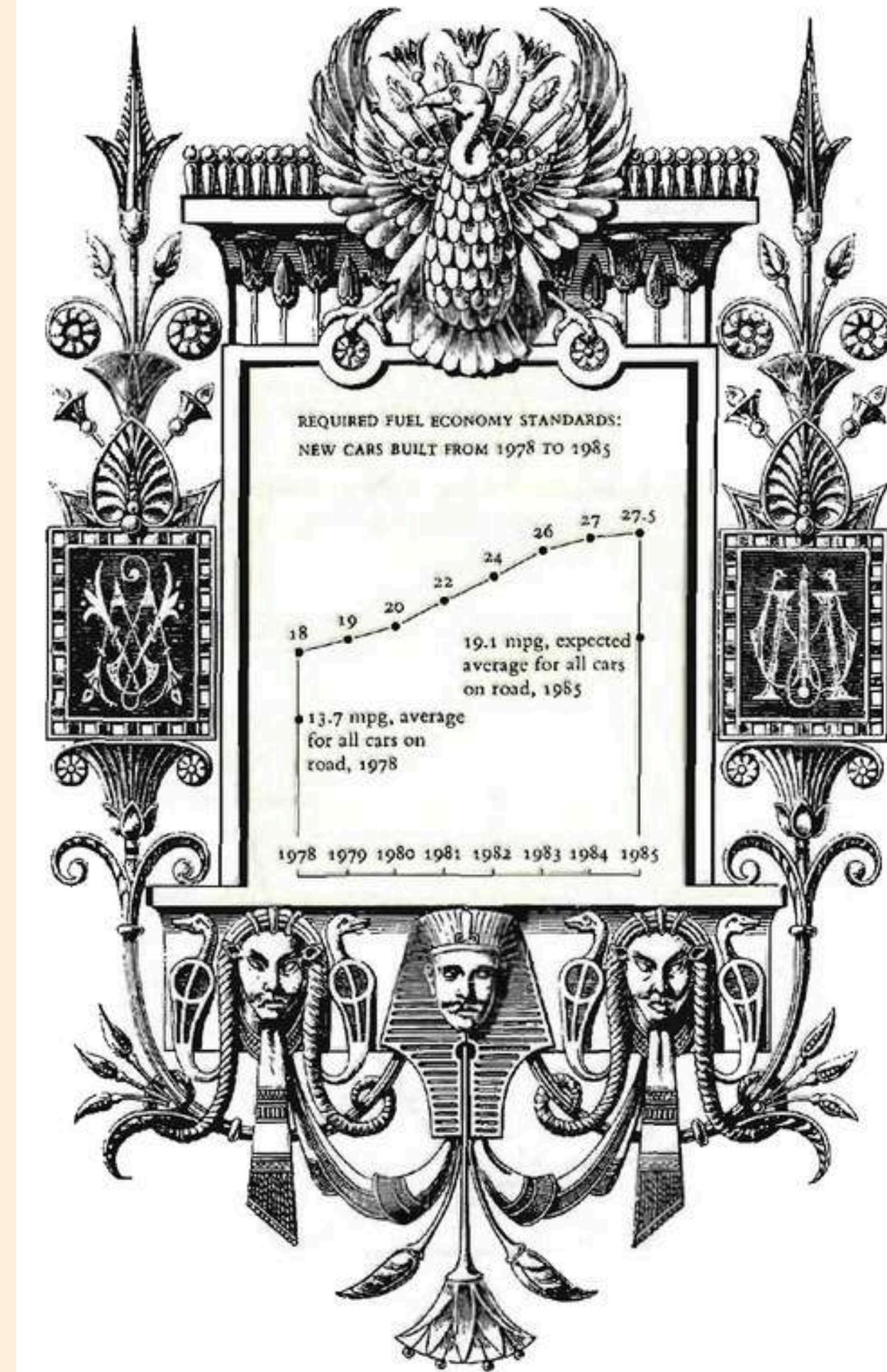


REQUIRED FUEL ECONOMY STANDARDS:  
NEW CARS BUILT FROM 1978 TO 1985



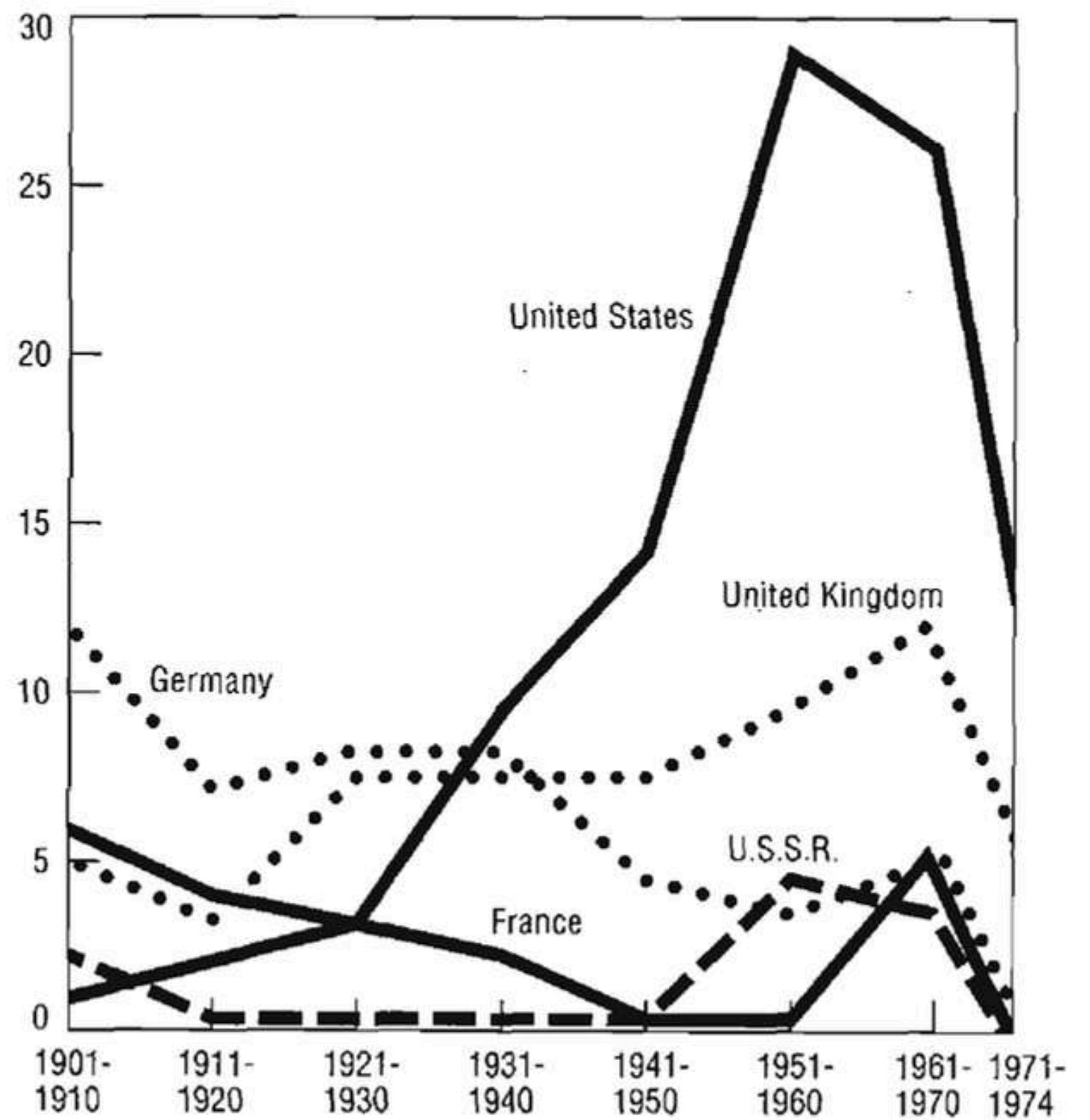
REQUIRED FUEL ECONOMY STANDARDS:  
NEW CARS BUILT FROM 1978 TO 1985

13.7 mpg, average for all cars on road, 1978  
19.1 mpg, expected average for all cars on road, 1985  
1978 1979 1980 1981 1982 1983 1984 1985

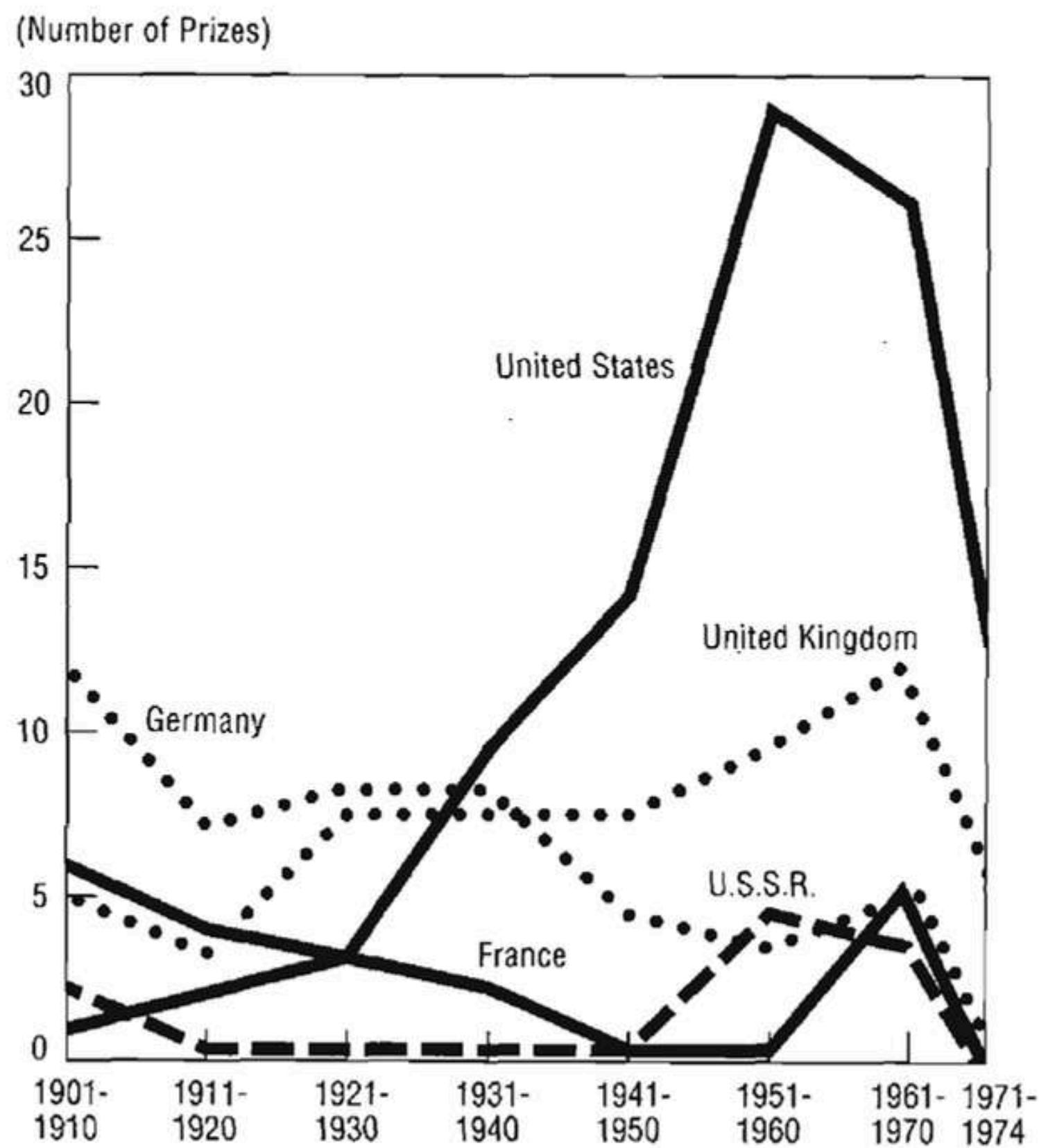


## Nobel Prizes Awarded in Science, for Selected Countries, 1901-1974

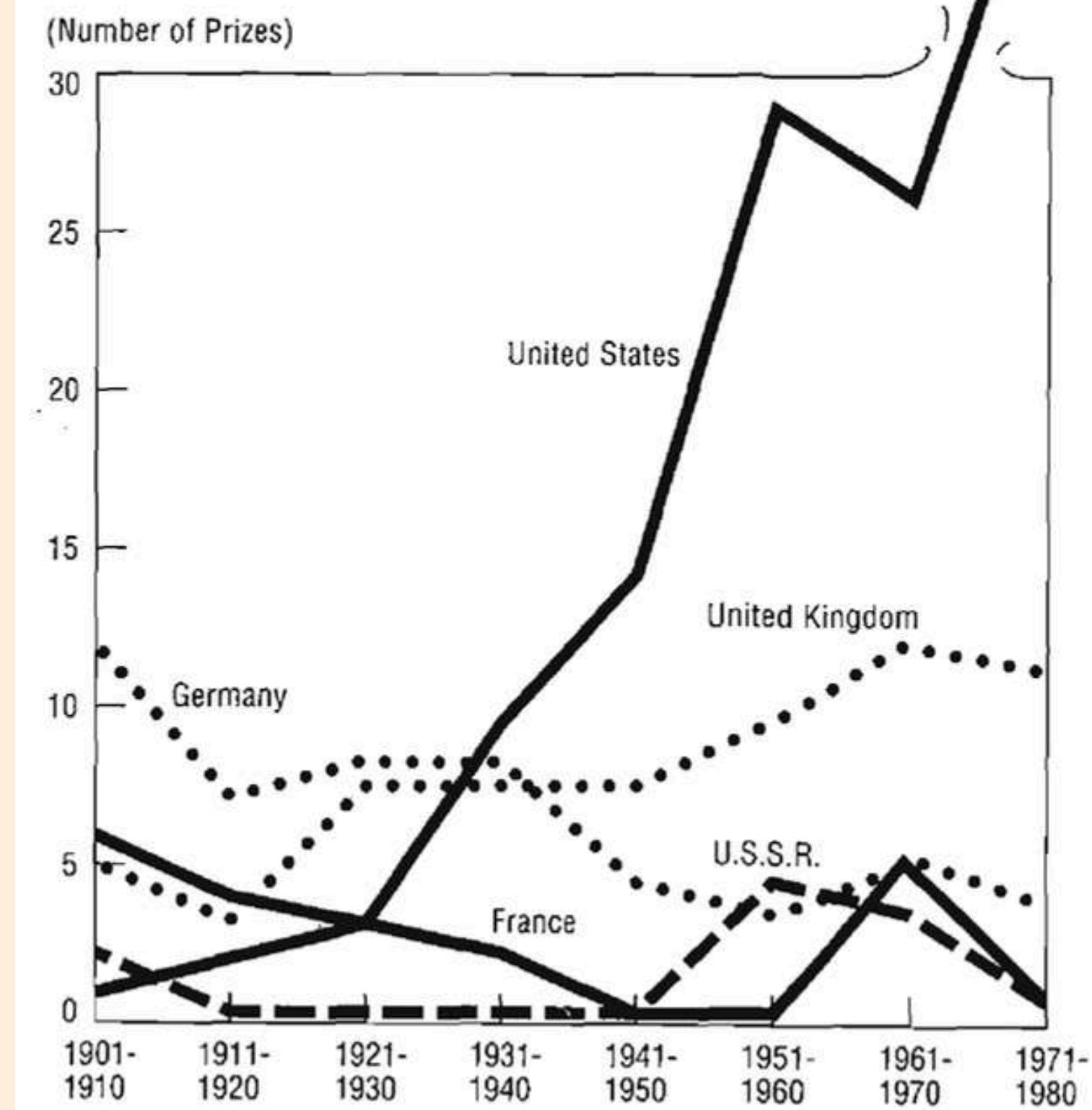
(Number of Prizes)



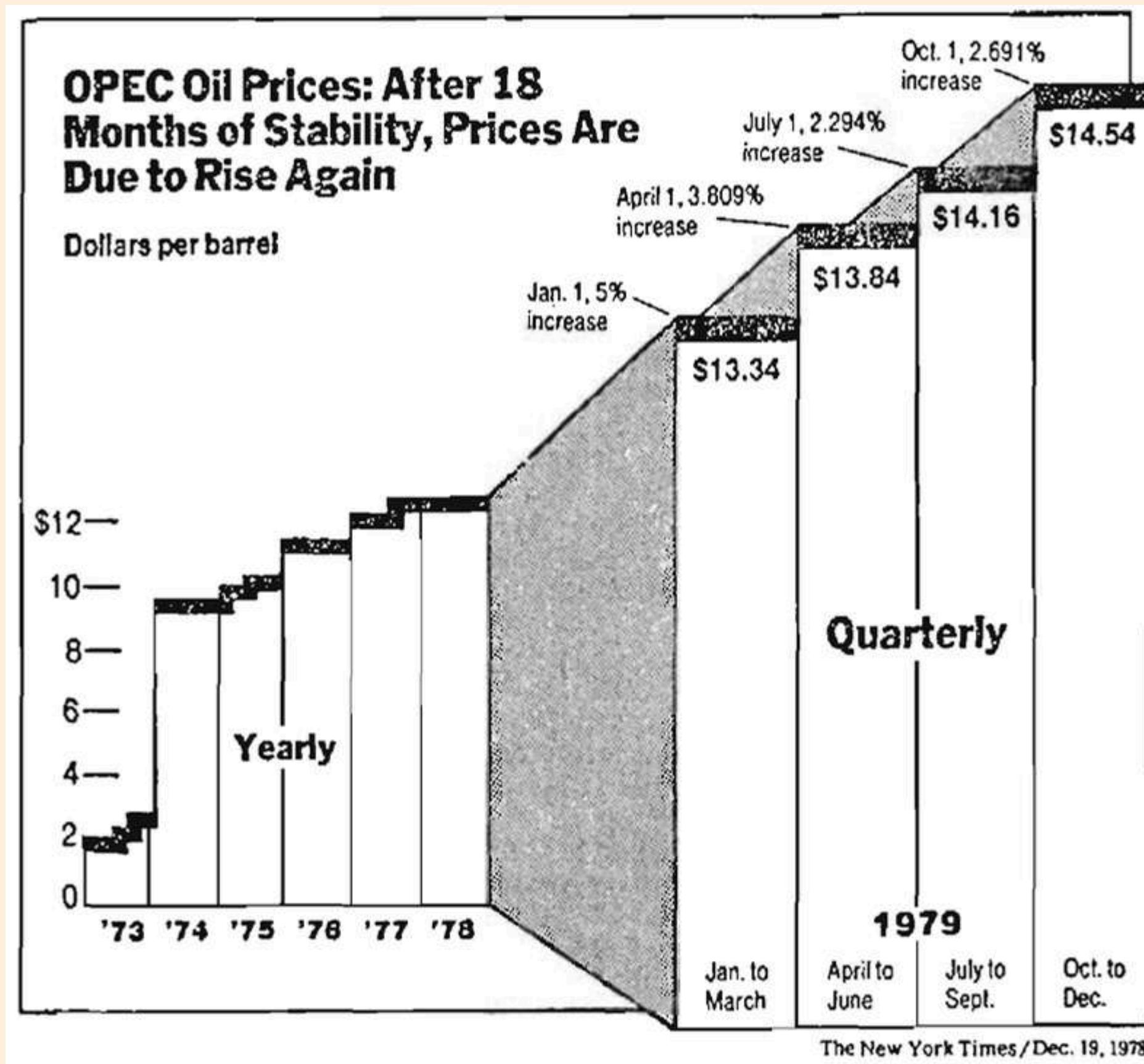
### Nobel Prizes Awarded in Science, for Selected Countries, 1901-1974



### Nobel Prizes Awarded in Science, for Selected Countries, 1901-1980

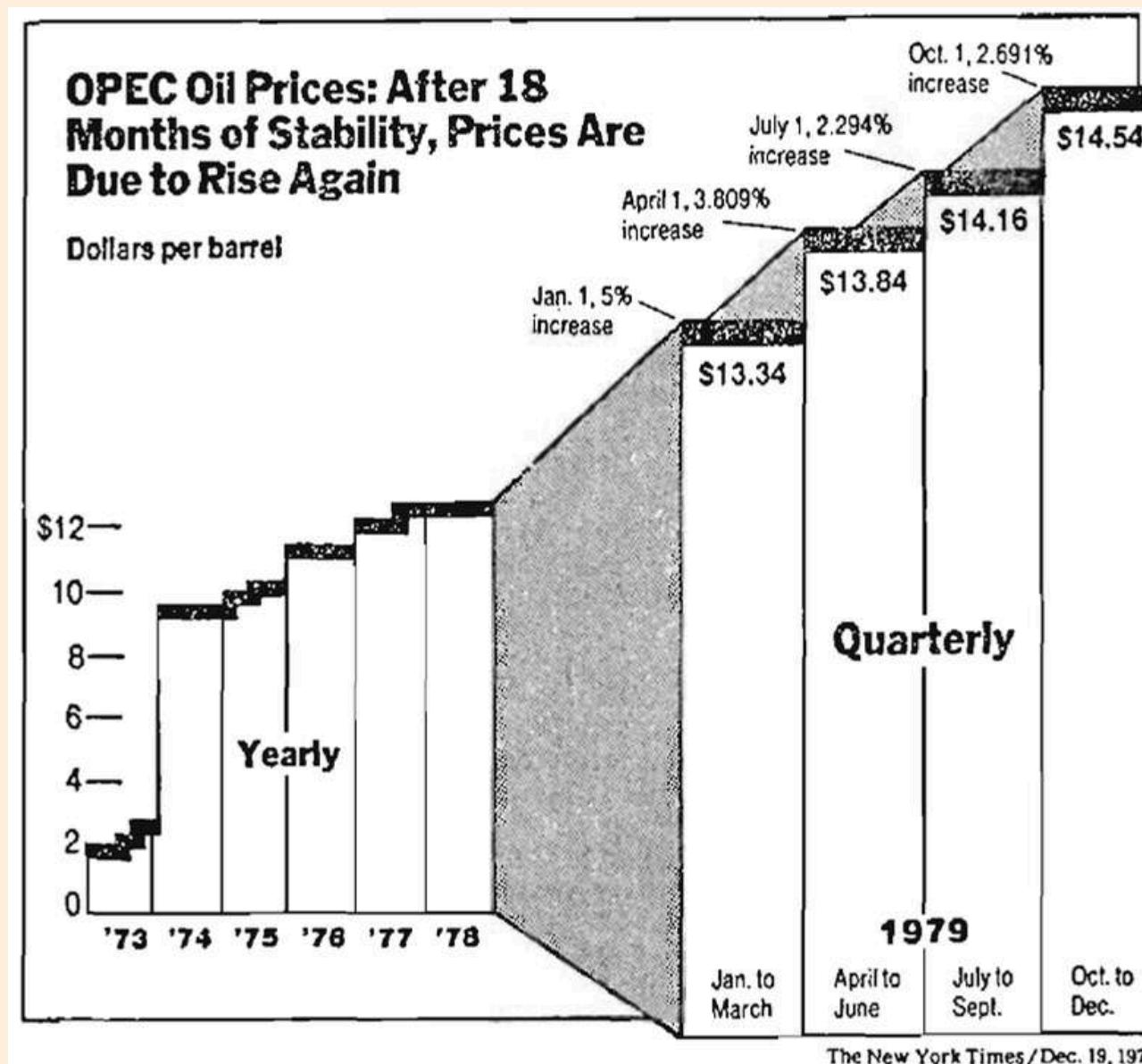


# Design Variation Corrupted this image



New York Times, December 19, 1978,  
p. D-7.

# Design Variation Corrupted this image



Five different vertical scales show the price:

During this time

1973–1978

January–March 1979

April–June 1979

July–September 1979

October–December 1979

one vertical inch equals

\$8.00

\$4.73

\$4.37

\$4.16

\$3.92

And two different horizontal scales show the passage of time:

During this time

1973–1978

1979

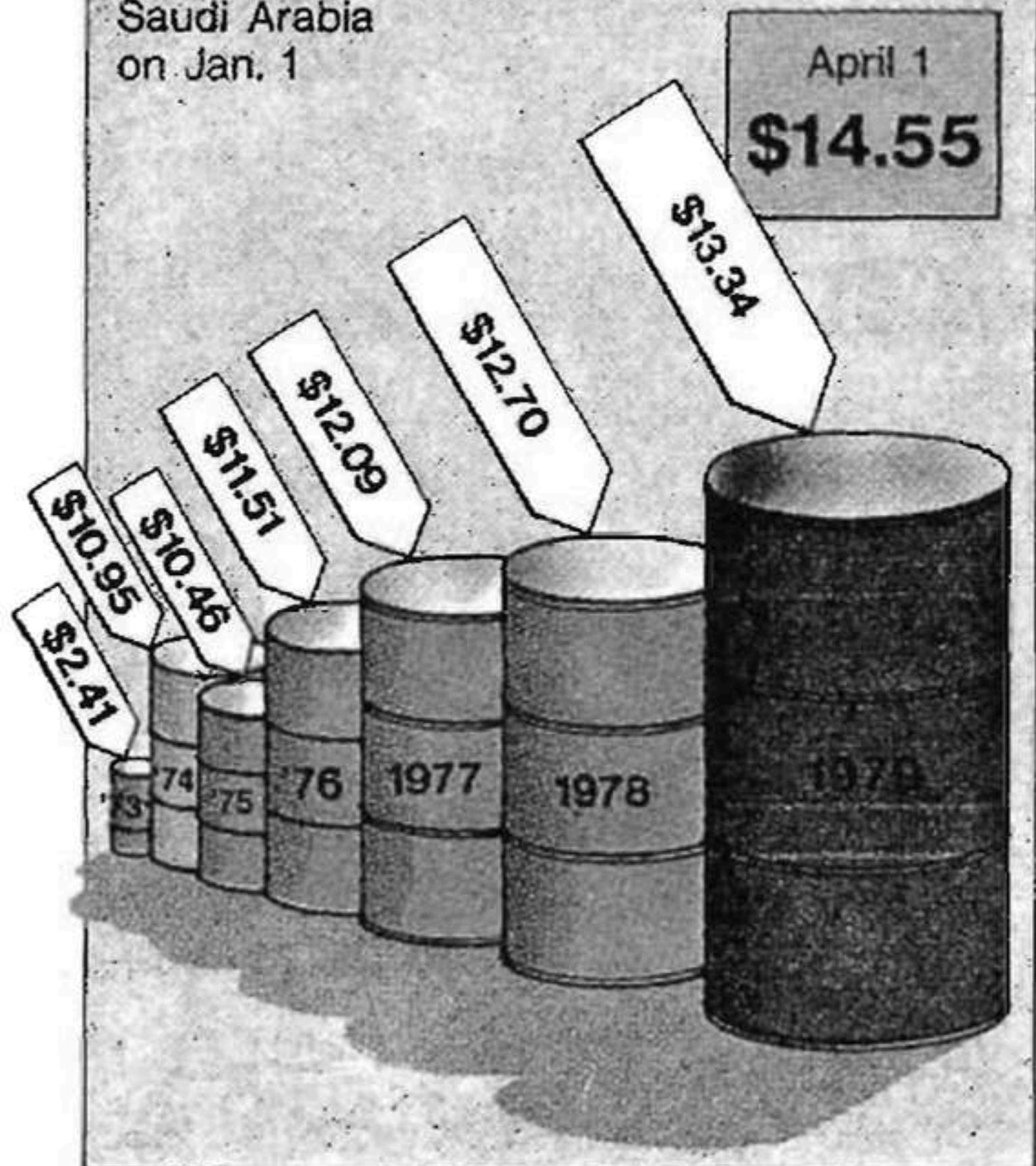
one horizontal inch equals

3.8 years

0.57 years

## IN THE BARREL...

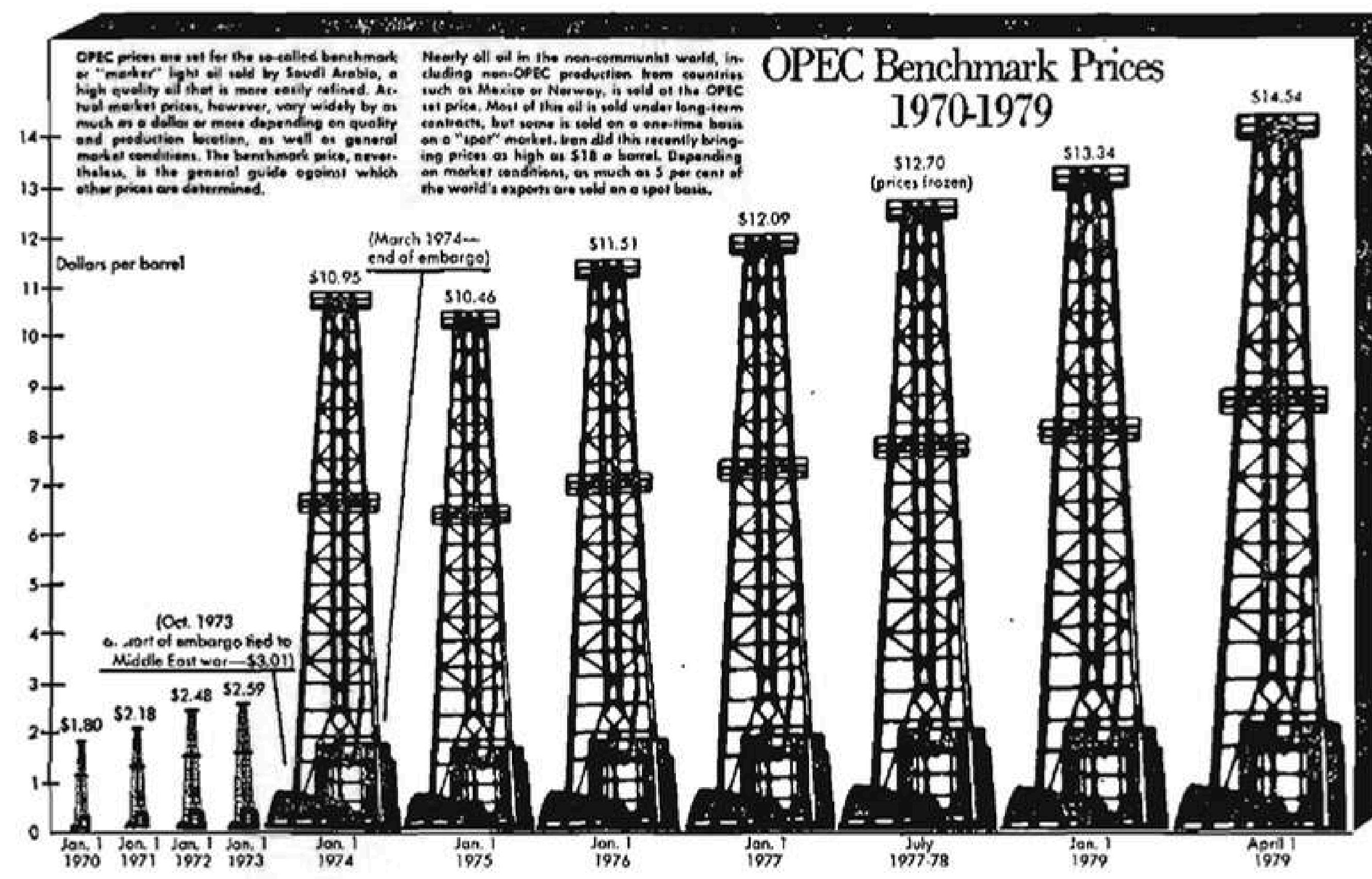
Price per bbl. of  
light crude, leaving  
Saudi Arabia  
on Jan. 1

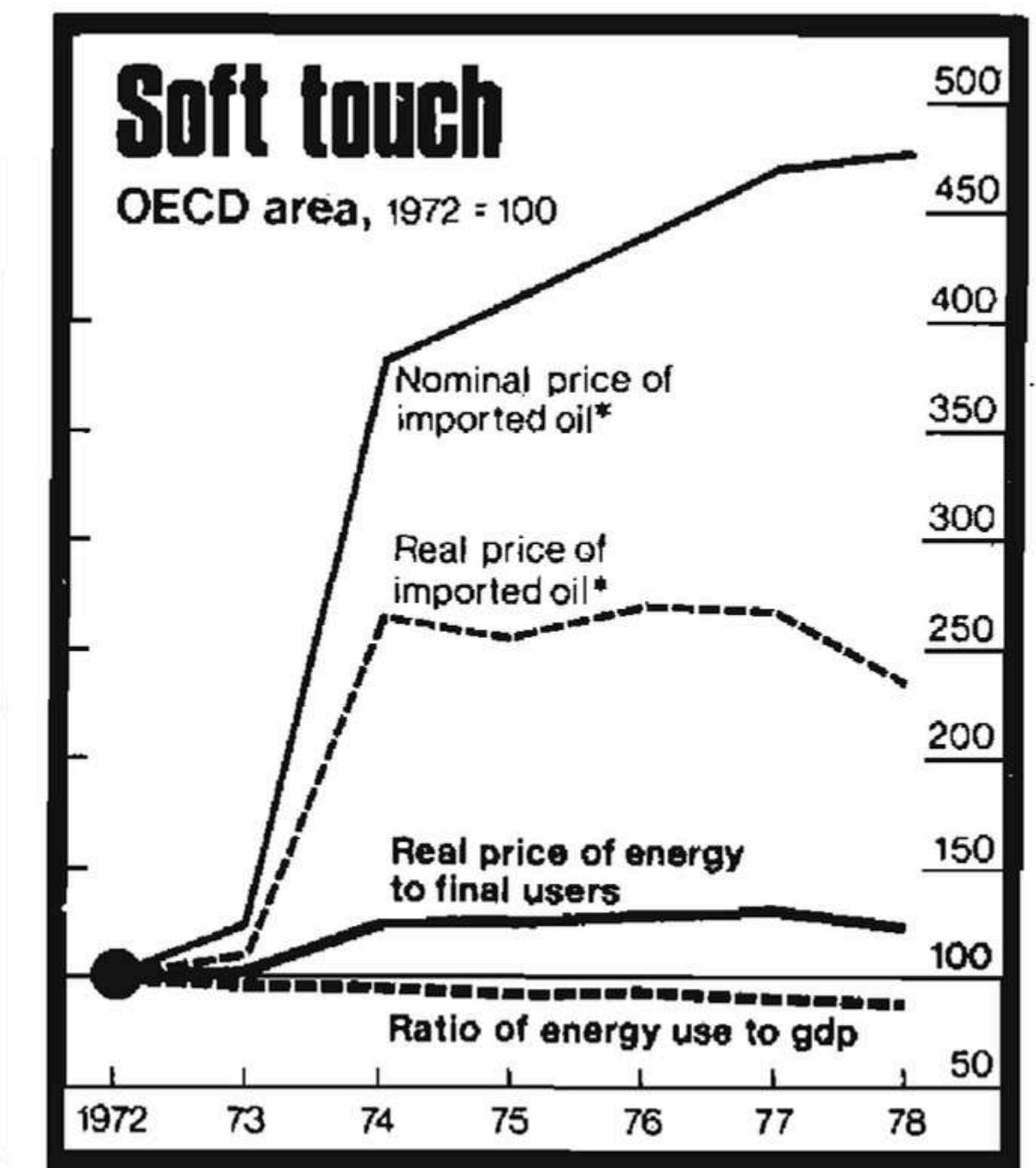
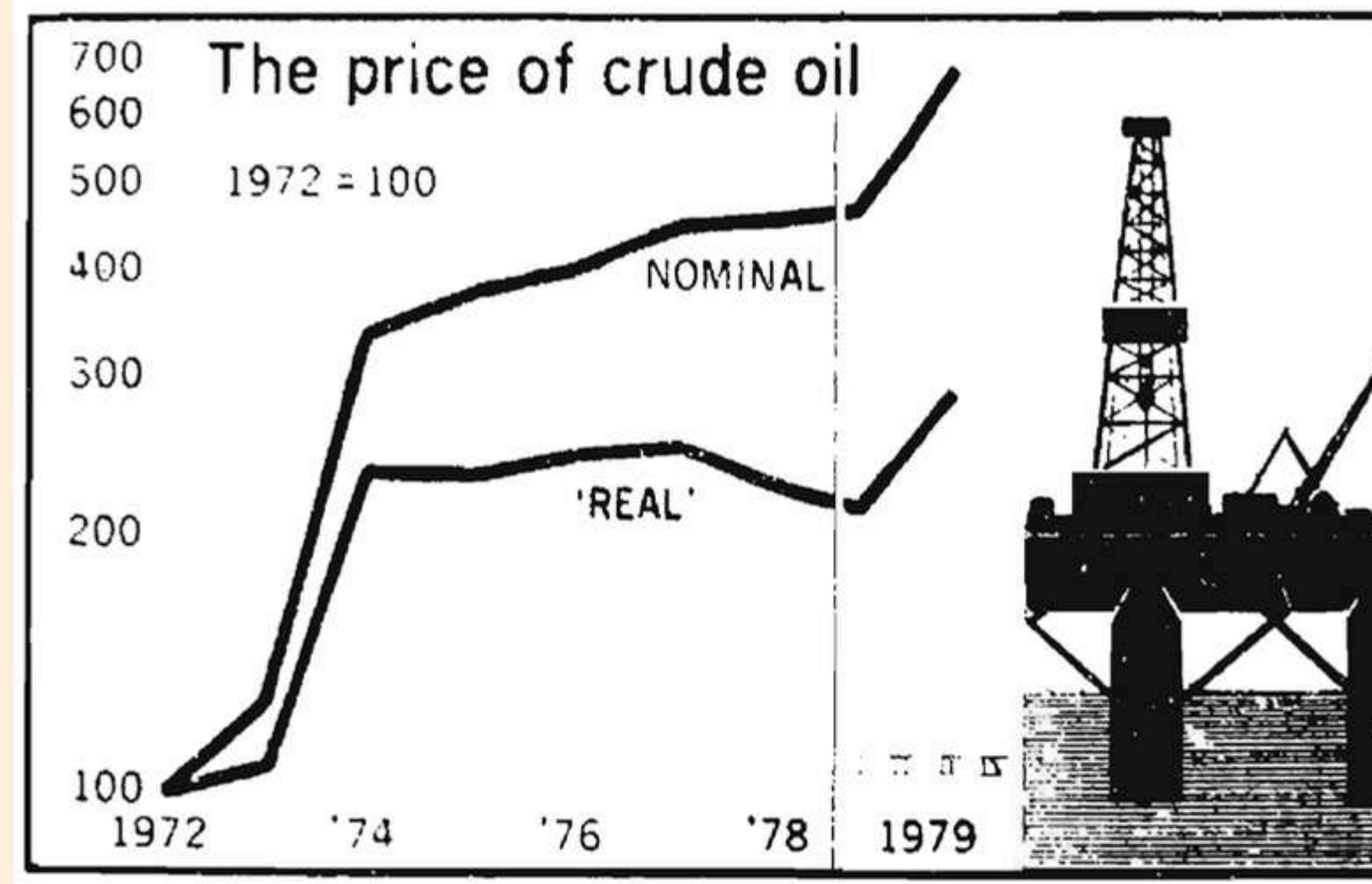


Lie Factor 9.4,  
454% vs 4280%

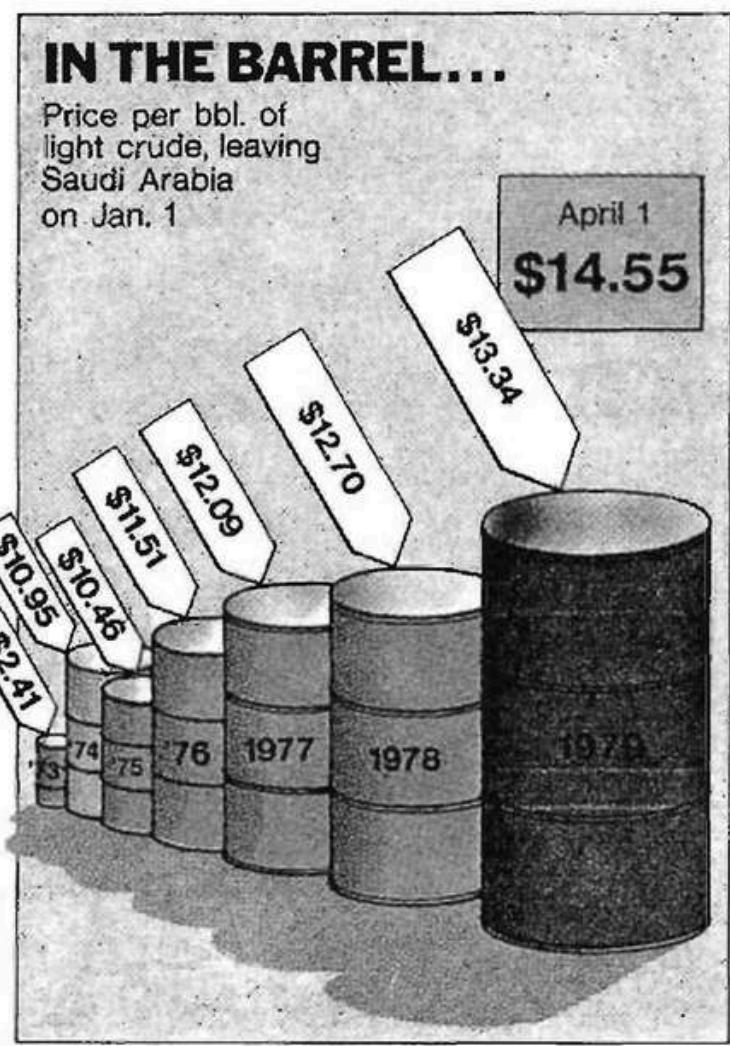
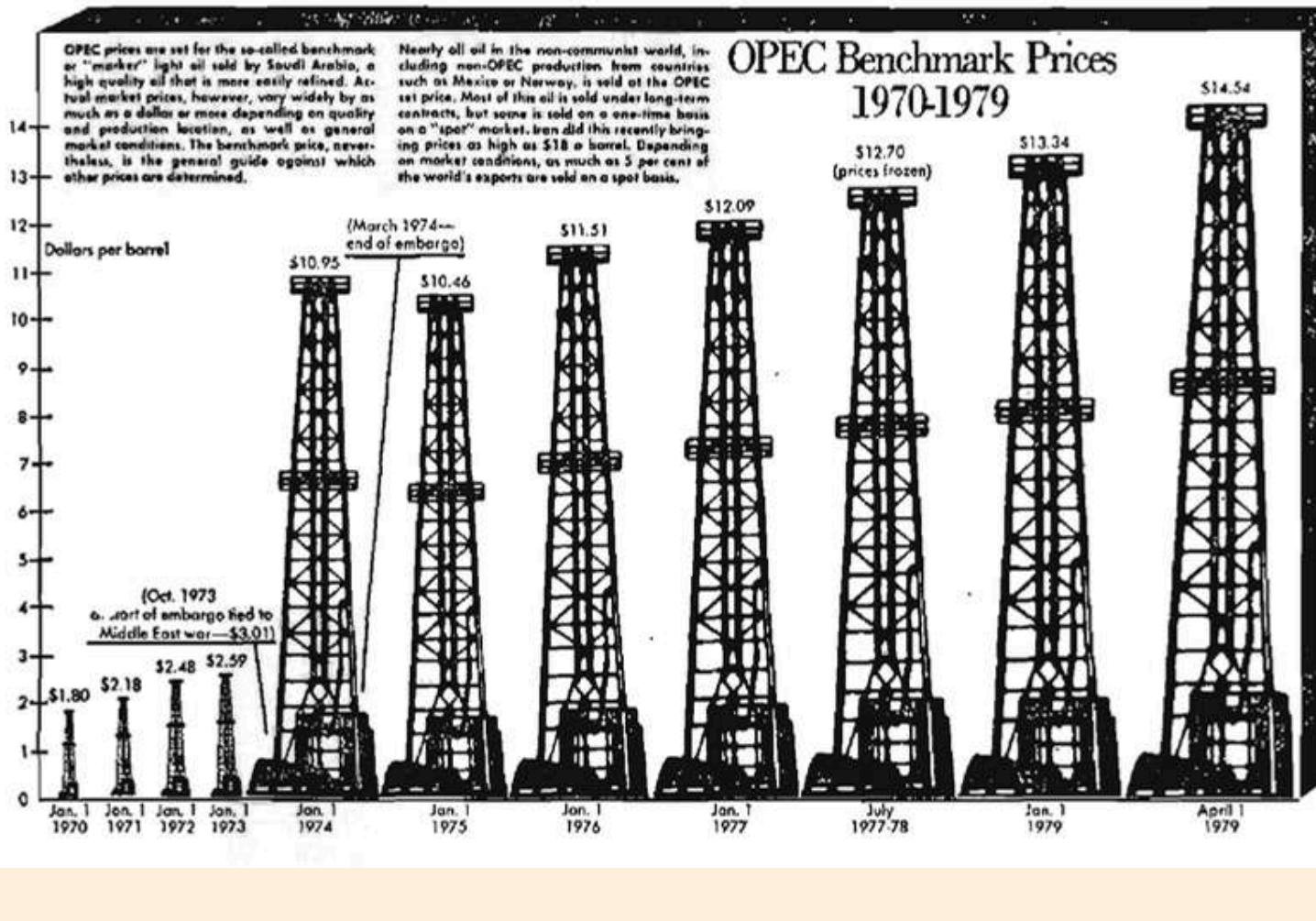
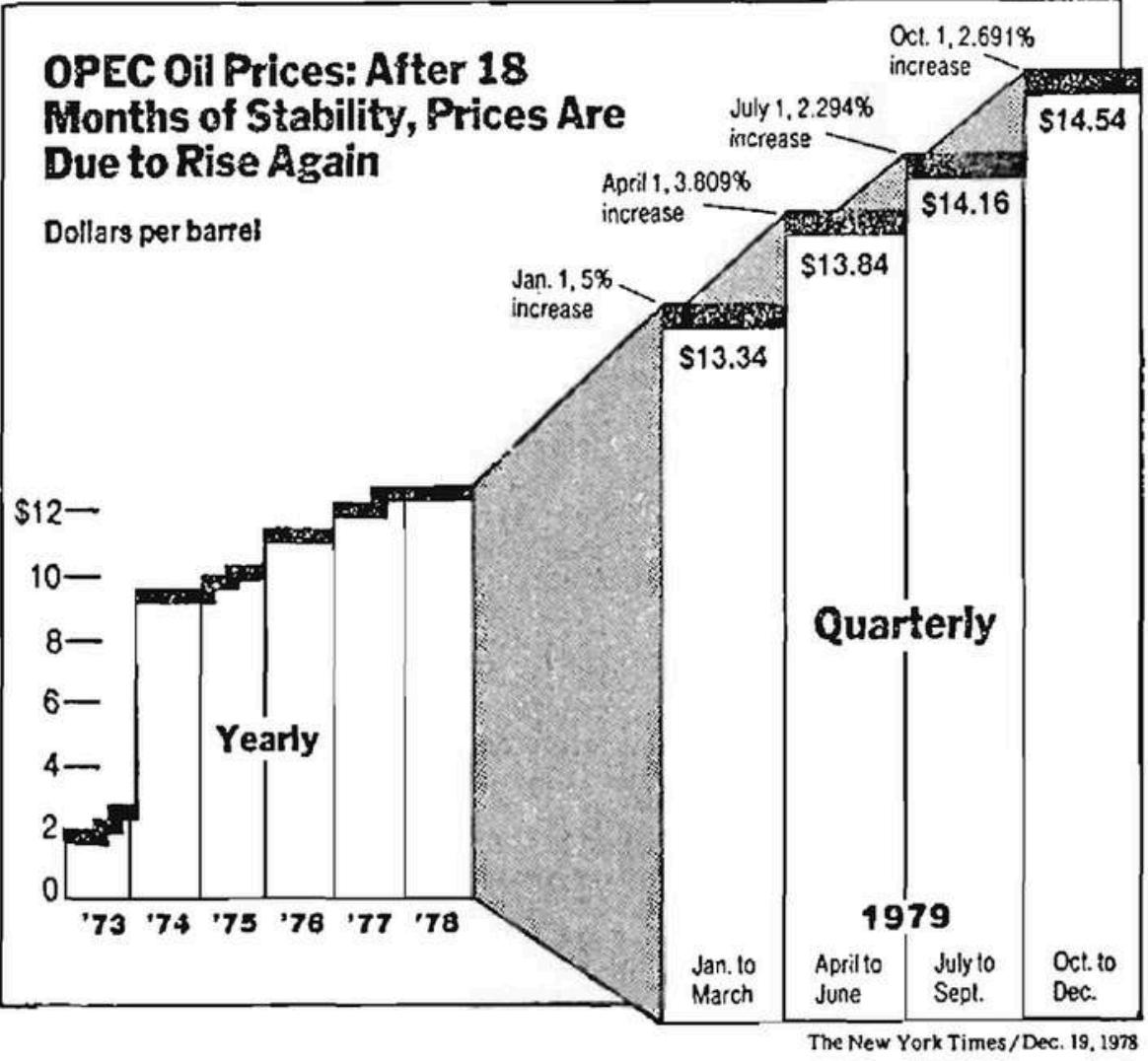
*Time*, April 9, 1979, p. 57.

# Lie Factor 9.5, 708% vs 6700%





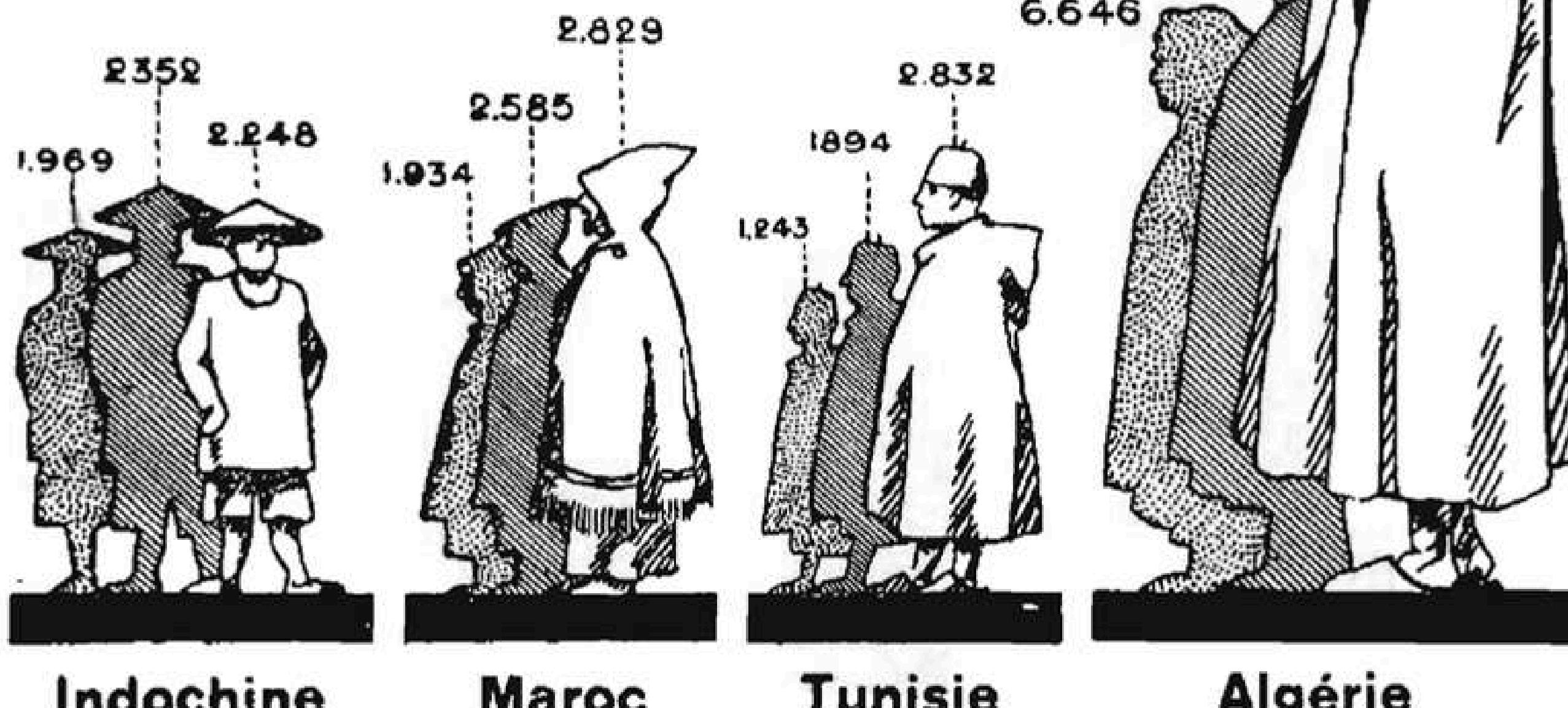
Actually the real price of oil had declined.



**"Busy with Decoration, the graphic had missed the news."**

-- E. Tufte

*Accroissement de nos  
exportations d'autos  
1927-1929*

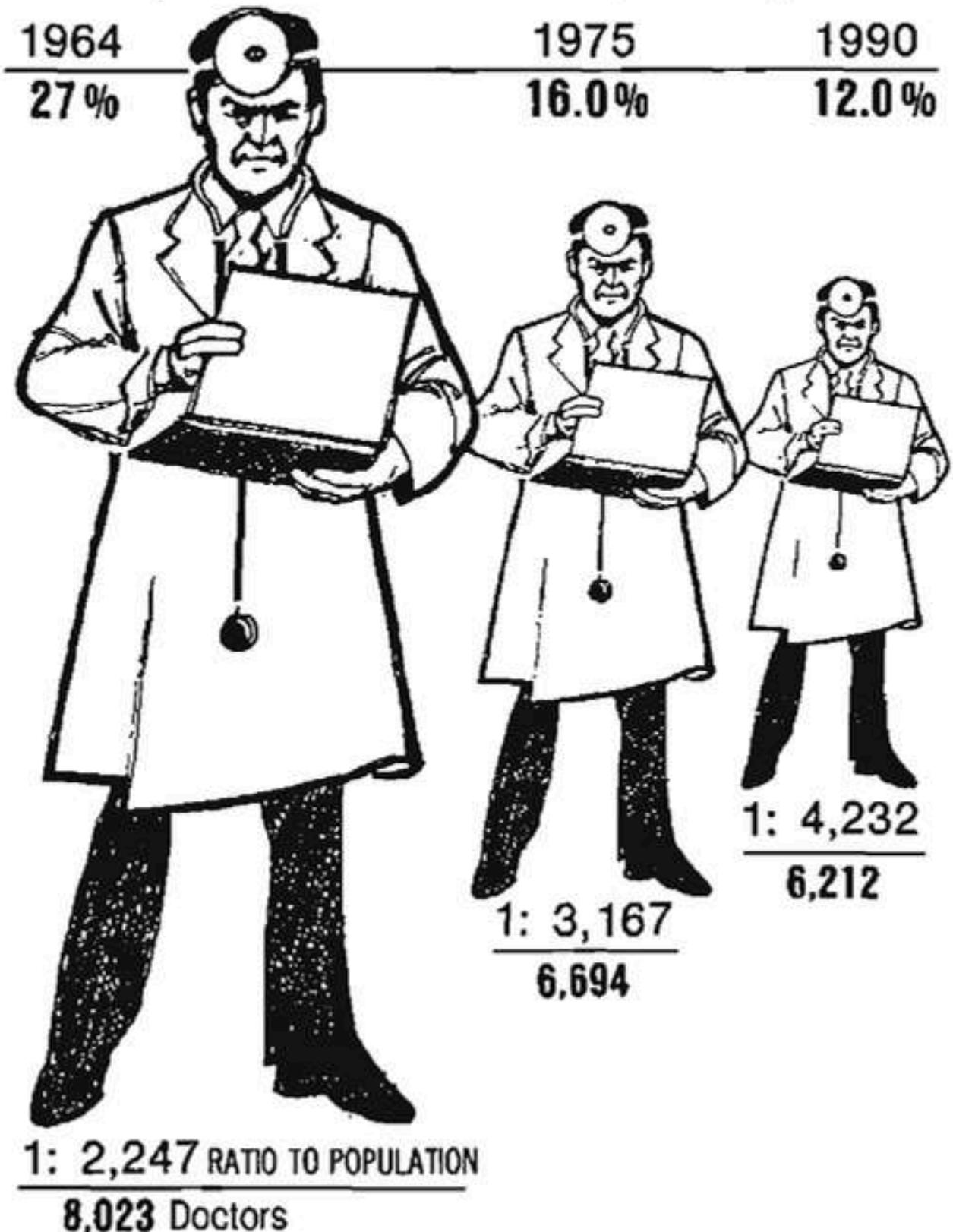


LF = 2.8

## THE SHRINKING FAMILY DOCTOR In California

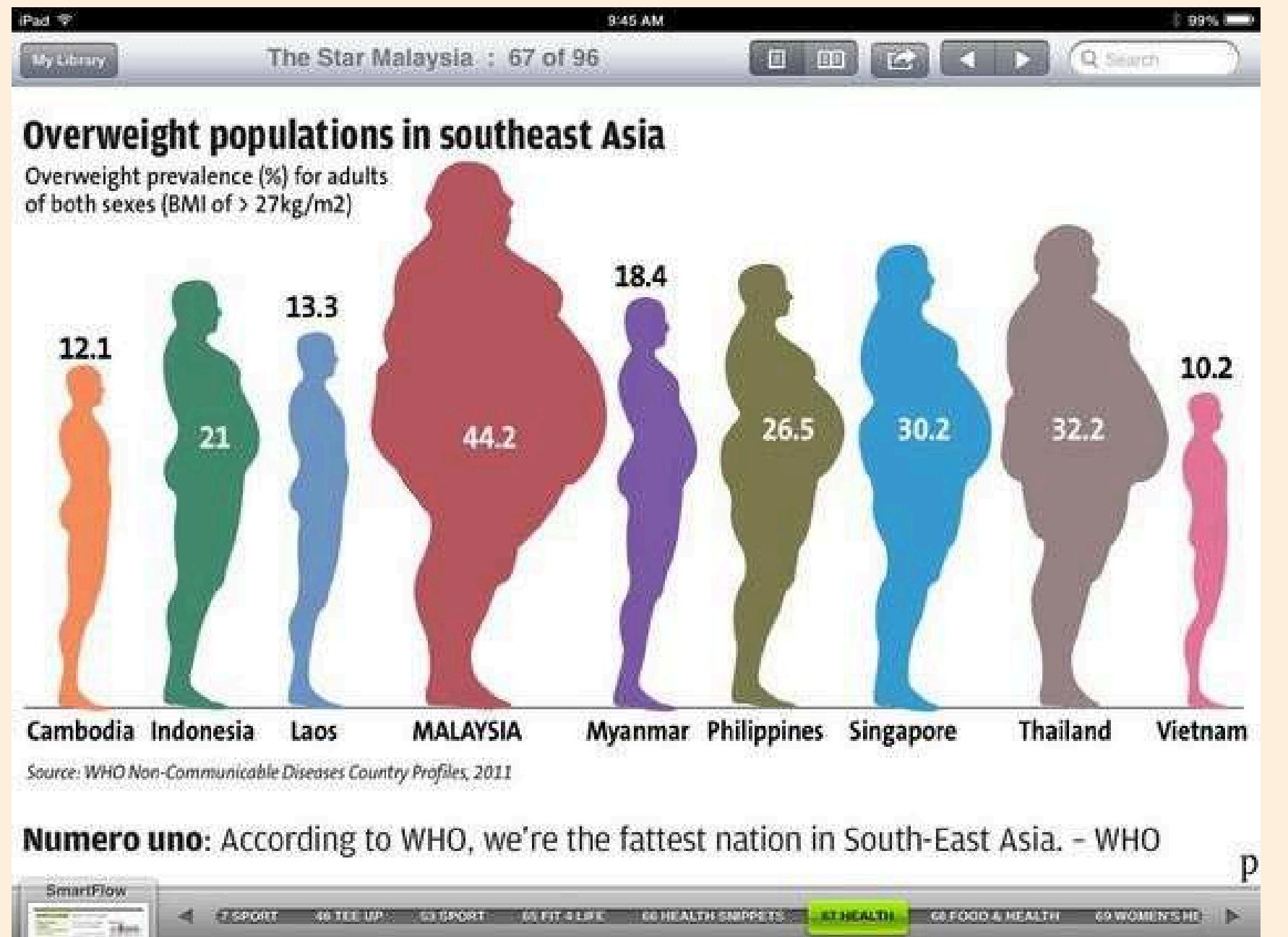
Percentage of Doctors Devoted Solely to Family Practice

| 1964 | 1975   | 1990   |
|------|--------|--------|
| 27 % | 16.0 % | 12.0 % |



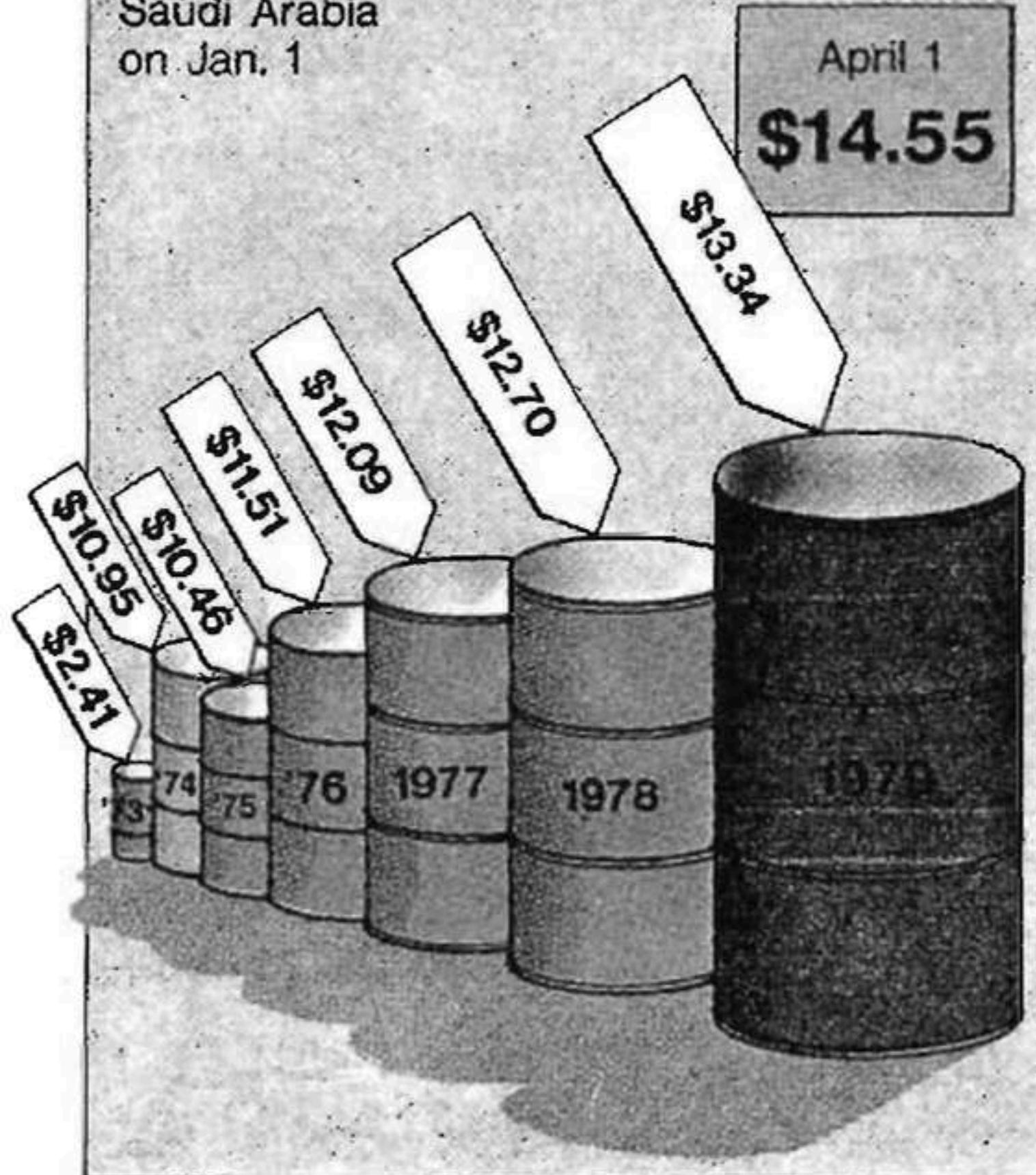
# Incorrect Horizontal Spacing as well

#2982



## IN THE BARREL...

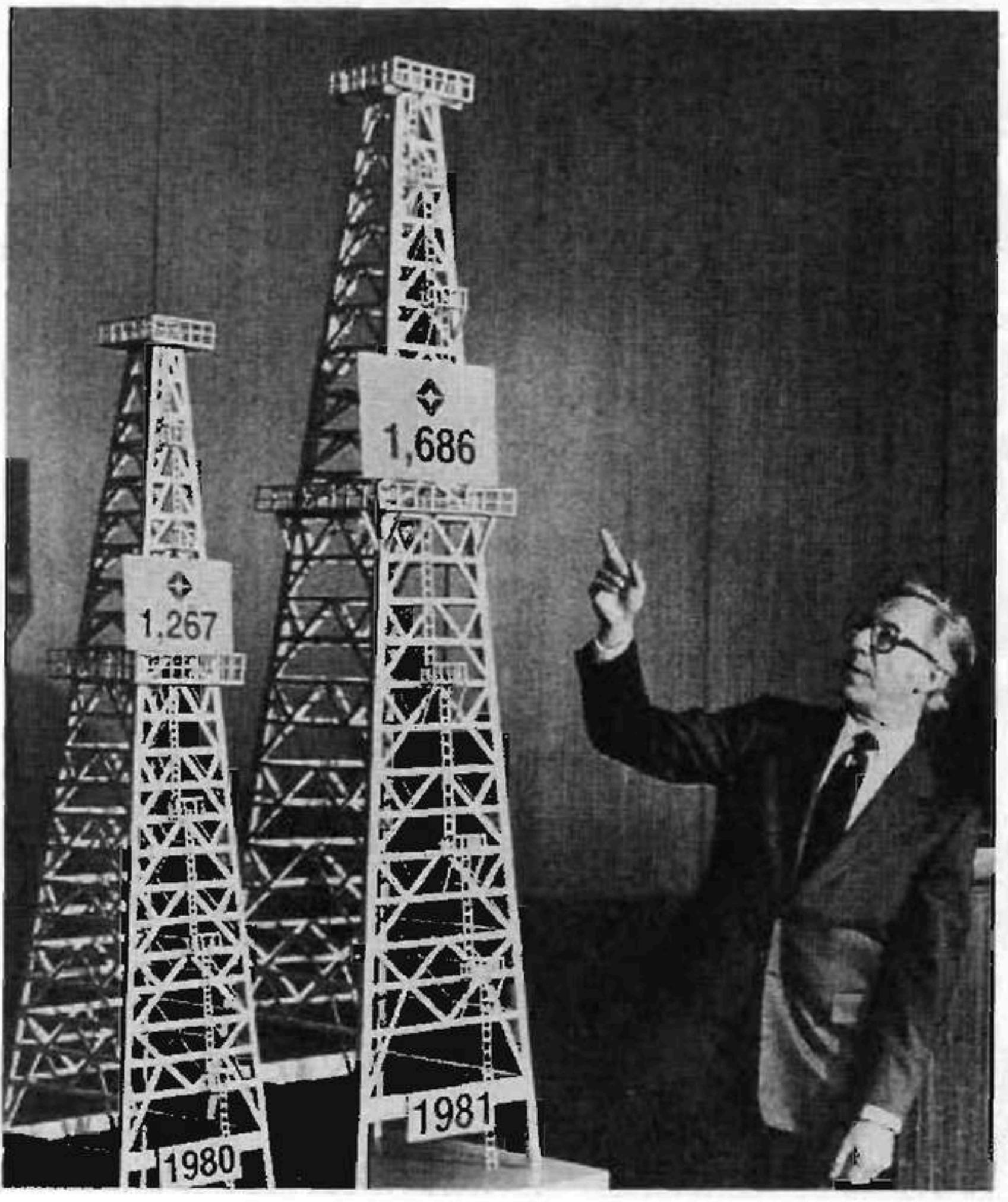
Price per bbl. of  
light crude, leaving  
Saudi Arabia  
on Jan. 1



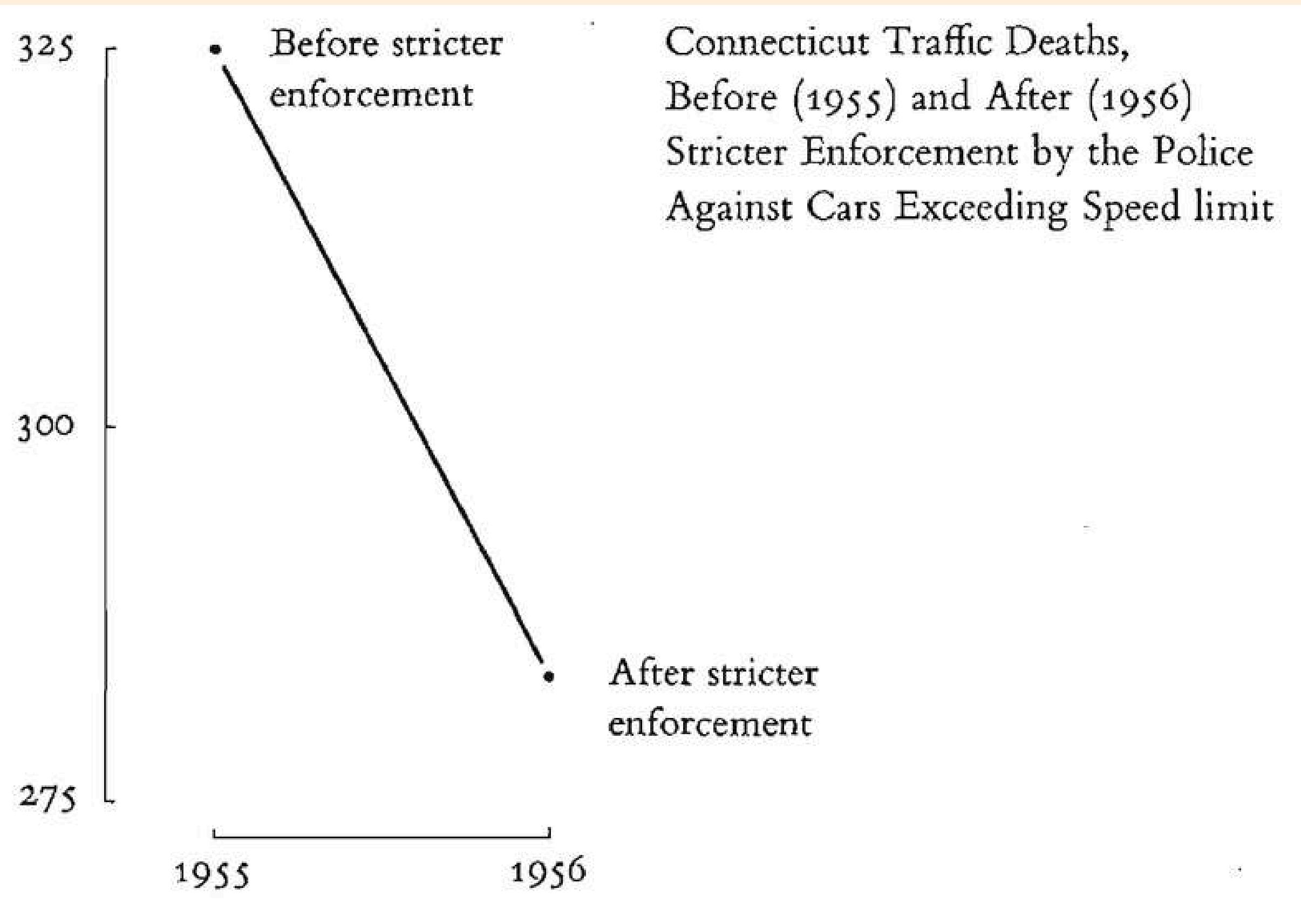
Lie Factor 9.4,  
454% vs 4280%

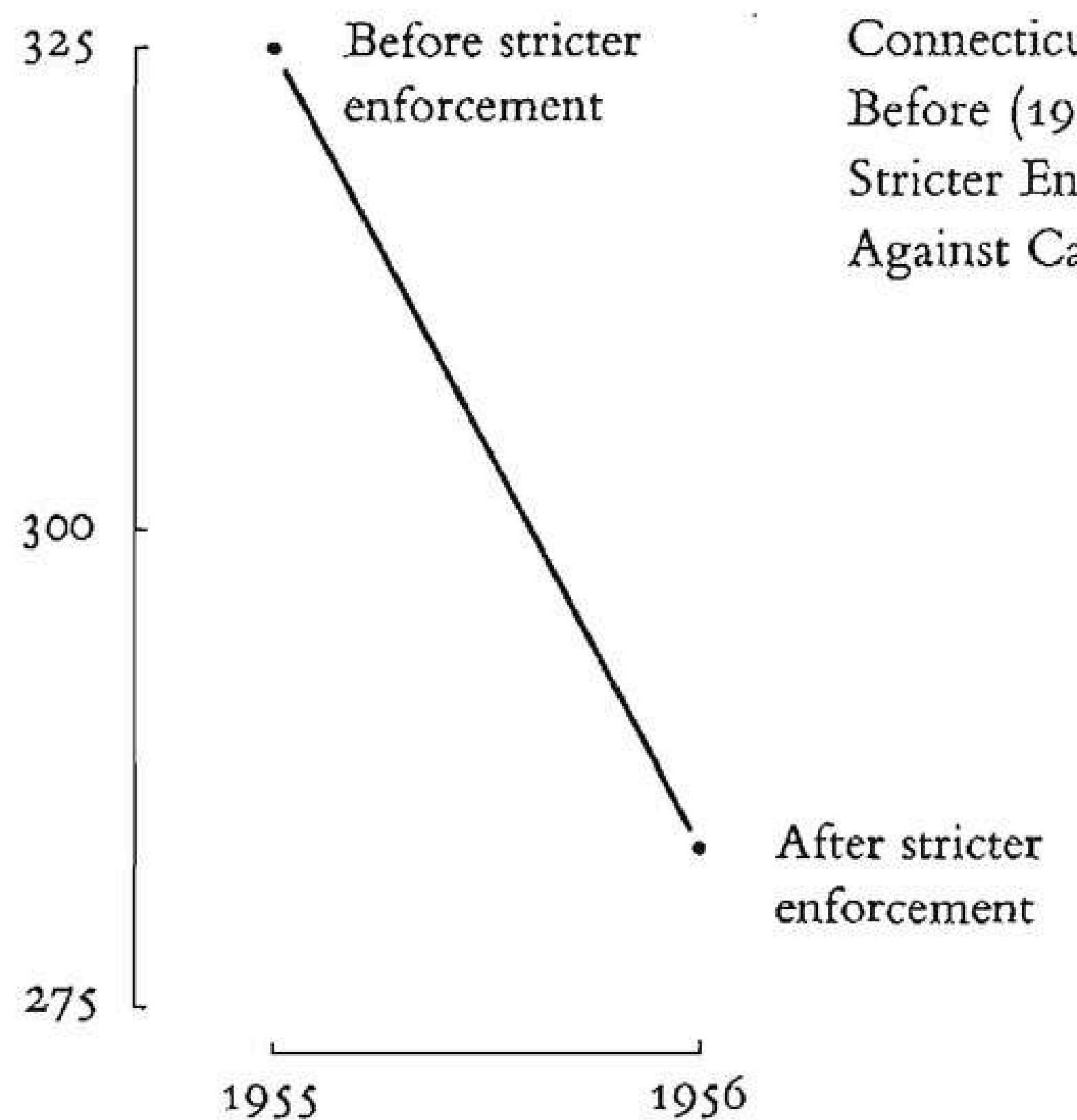
Lie Factor 59.4,  
considering volume

*Time*, April 9, 1979, p. 57.

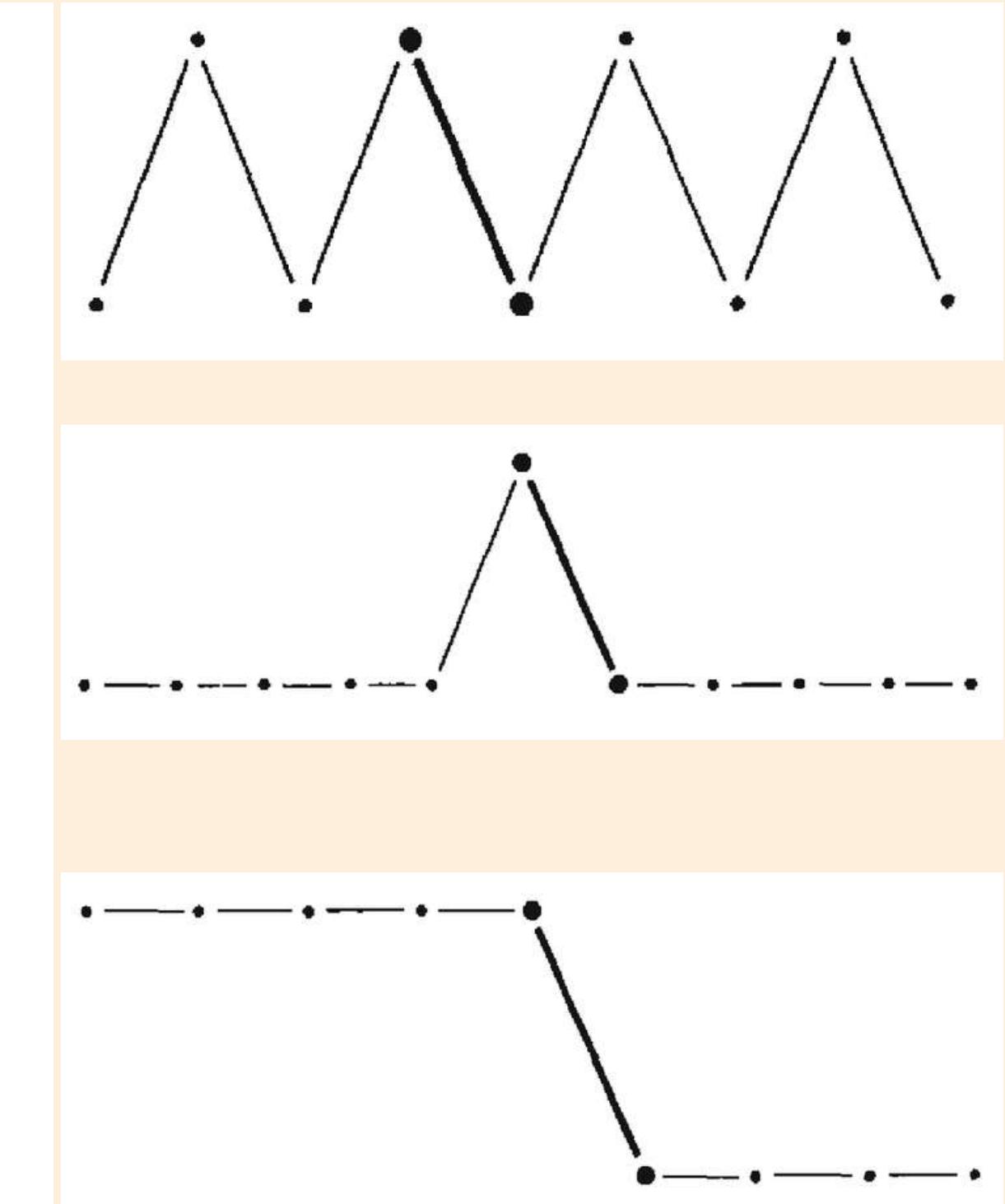


One dímensíonal data in  
three dímensíonal  
Graphic

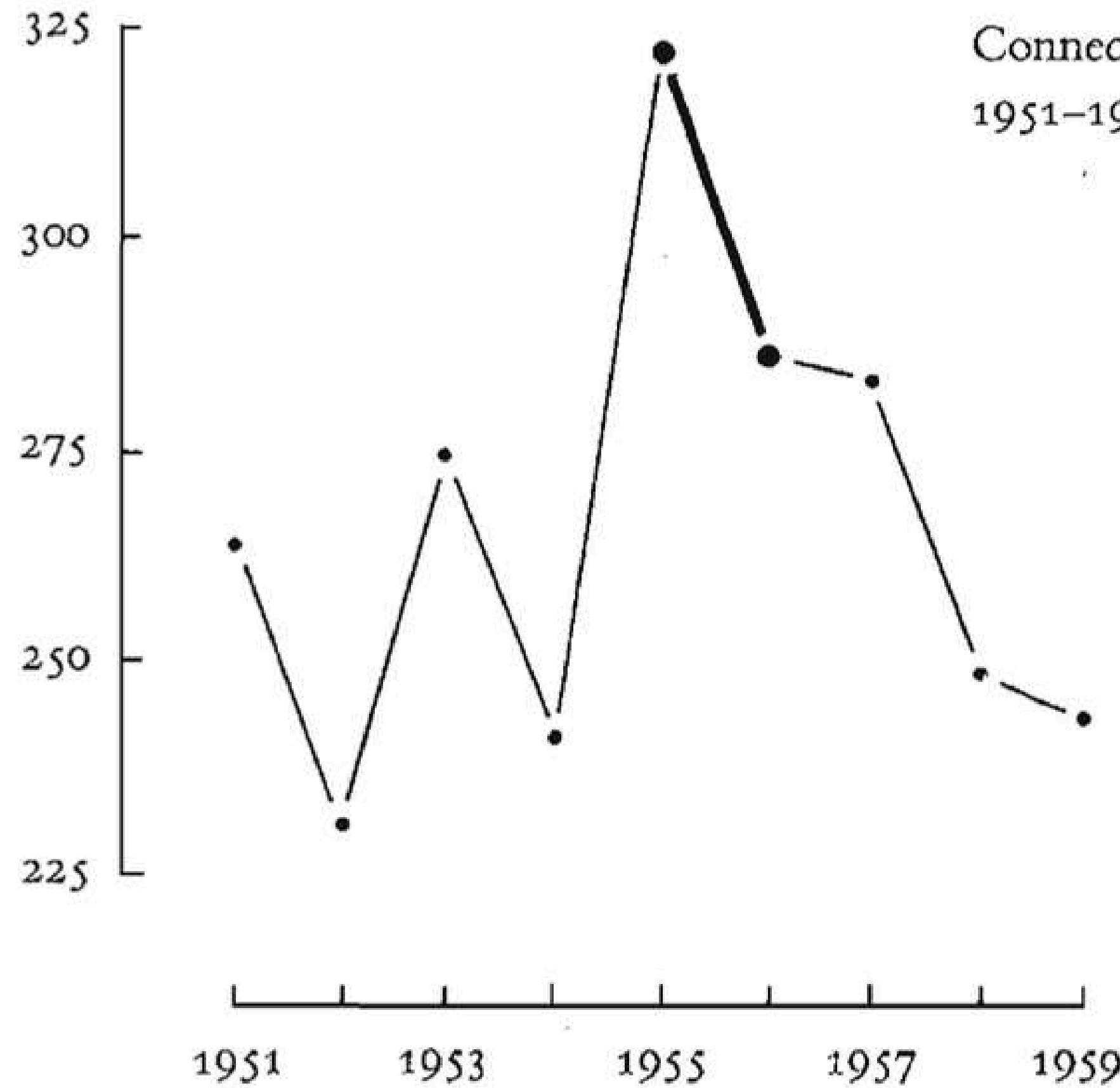




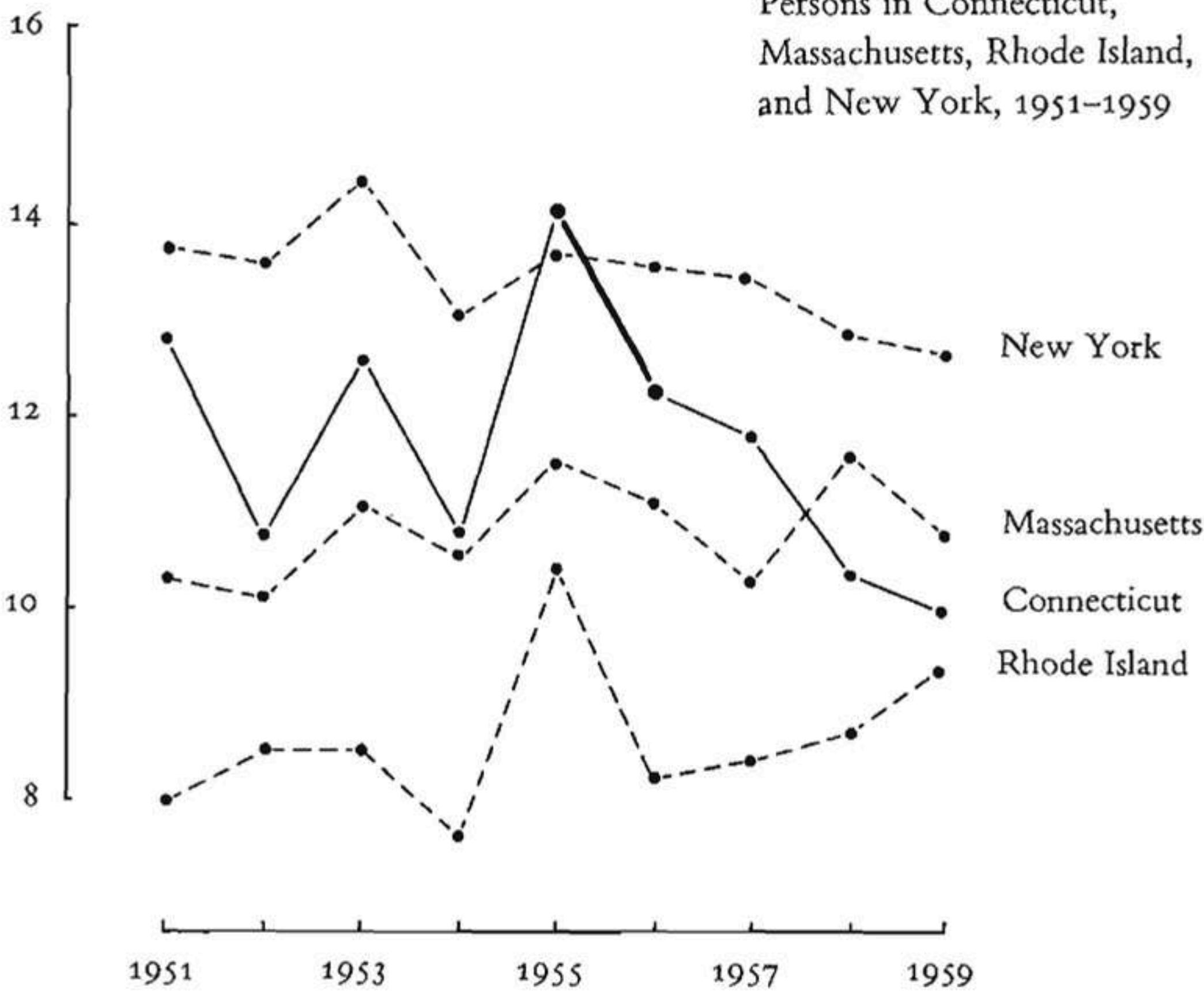
Connecticut Traffic Deaths,  
Before (1955) and After (1956)  
Stricter Enforcement by the Police  
Against Cars Exceeding Speed limit



Connecticut Traffic Deaths,  
1951–1959

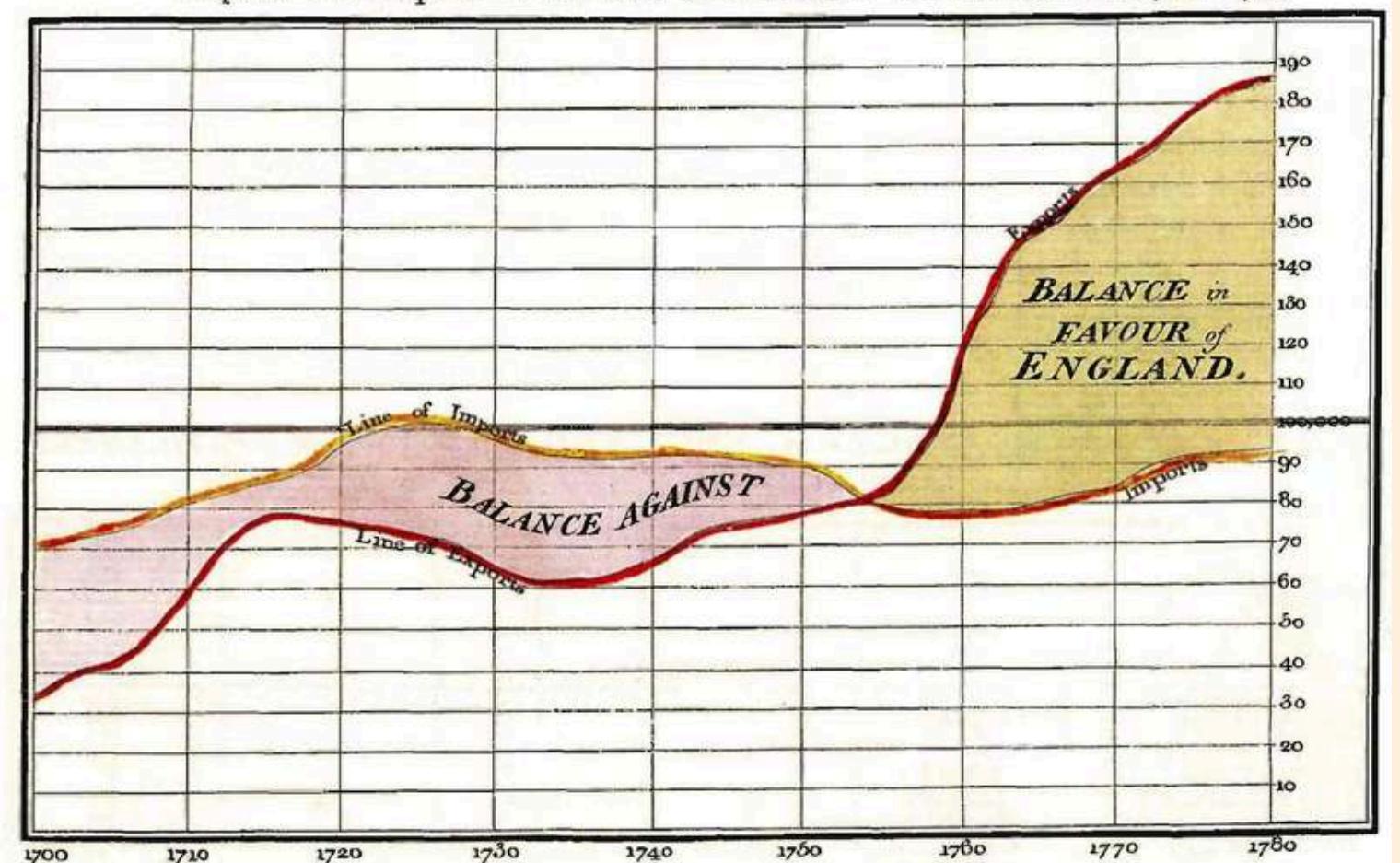


Traffic Deaths per 100,000  
Persons in Connecticut,  
Massachusetts, Rhode Island,  
and New York, 1951-1959



# Graphical integrity is more likely to result if these six principles are followed:

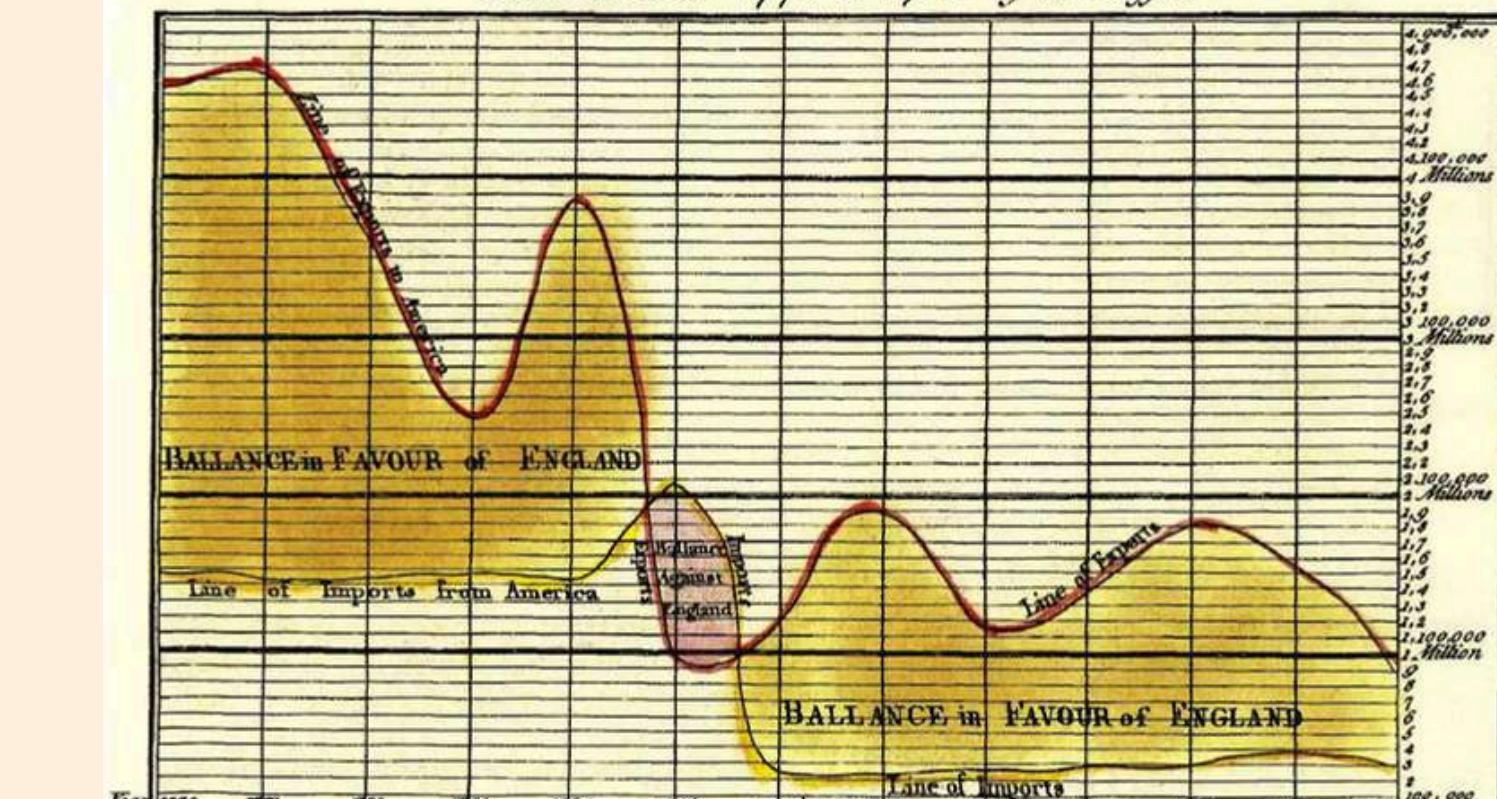
-  The representation of numbers, as physically measured on the surface of the graphic itself, should be directly proportional to the numerical quantities represented.
-  Clear, detailed, and thorough labeling should be used to defeat graphical distortion and ambiguity, Write out explanations of the data on the graphic itself. Label important events in the data.
-  Show data variation, not design variation.
-  In time-series displays of money, deflated and standardized units of monetary measurement are nearly always better than nominal units.
-  The number of information-carrying (variable) dimensions depicted should not exceed the number of dimensions in the data.
-  Graphics must not quote data out of context.



The Bottom line is divided into Years, the Right hand line into £10,000 each.  
Published at the Act direct, 1<sup>st</sup> May 1786, by W<sup>m</sup> Playfair  
Nude Sculpt 352, Strand, London.

# Data Ink and Graphical Redesign

CHART of IMPORTS and EXPORTS of ENGLAND to and from all NORTHAMERICA  
From the Year 1770 to 1782 by W. Playfair

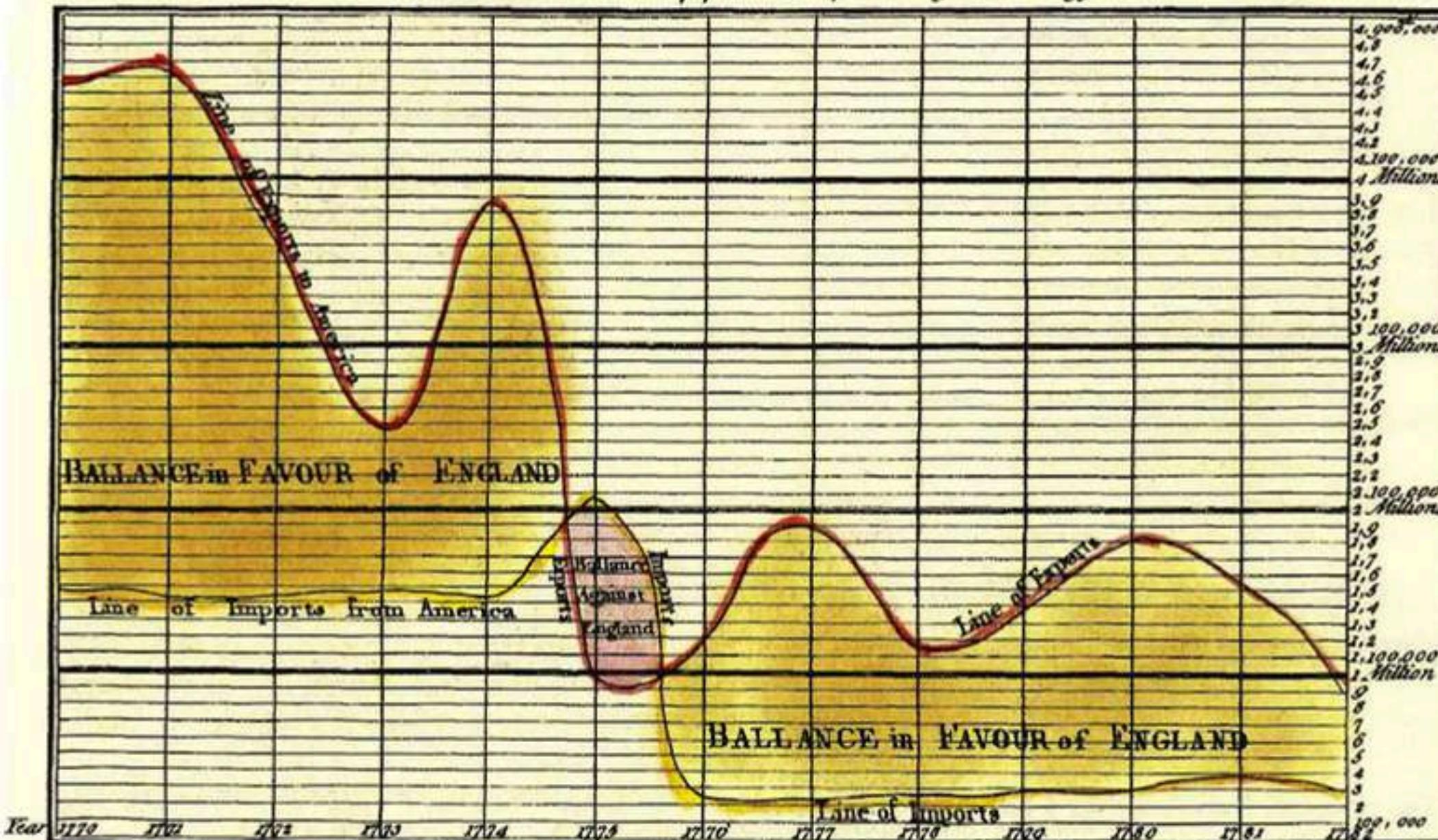


The Bottom Line is divided into Years the right-hand Line into HUNDRED THOUSAND POUNDS

J. André Sculp<sup>r</sup>

Published as the Act directs 20<sup>th</sup> Aug<sup>o</sup>. 1785.

*CHART of IMPORTS and EXPORTS of ENGLAND to and from all NORTHAMERICA  
From the Year 1770 to 1782 by W. Playfair*

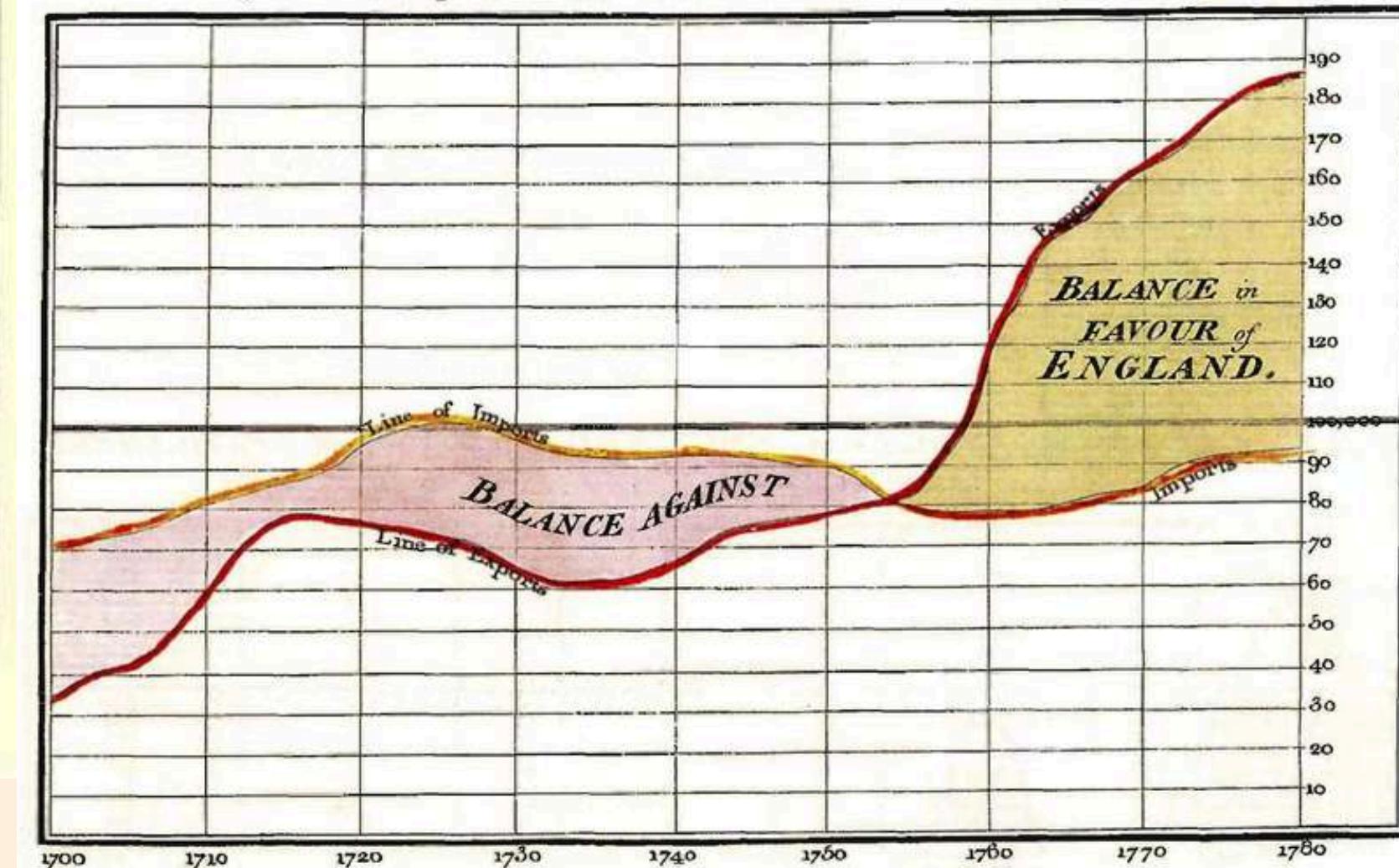


The Bottom Line is divided into Years the right-hand Line into HUNDRED THOUSAND POUNDS

J. Andre Sculp.

Published at the Act directe 20<sup>th</sup> Aug<sup>o</sup> 1785.

Exports and Imports to and from DENMARK & NORWAY from 1700 to 1780



The Bottom line is divided into Years, the Right hand line into £10,000 each.

Published at the Act directe, 1<sup>st</sup> May 1786, by W<sup>m</sup> Playfair

No. 352, Strand, London.

LF - LM

RF - RM

LM - LO

RM - RO

LT - LM

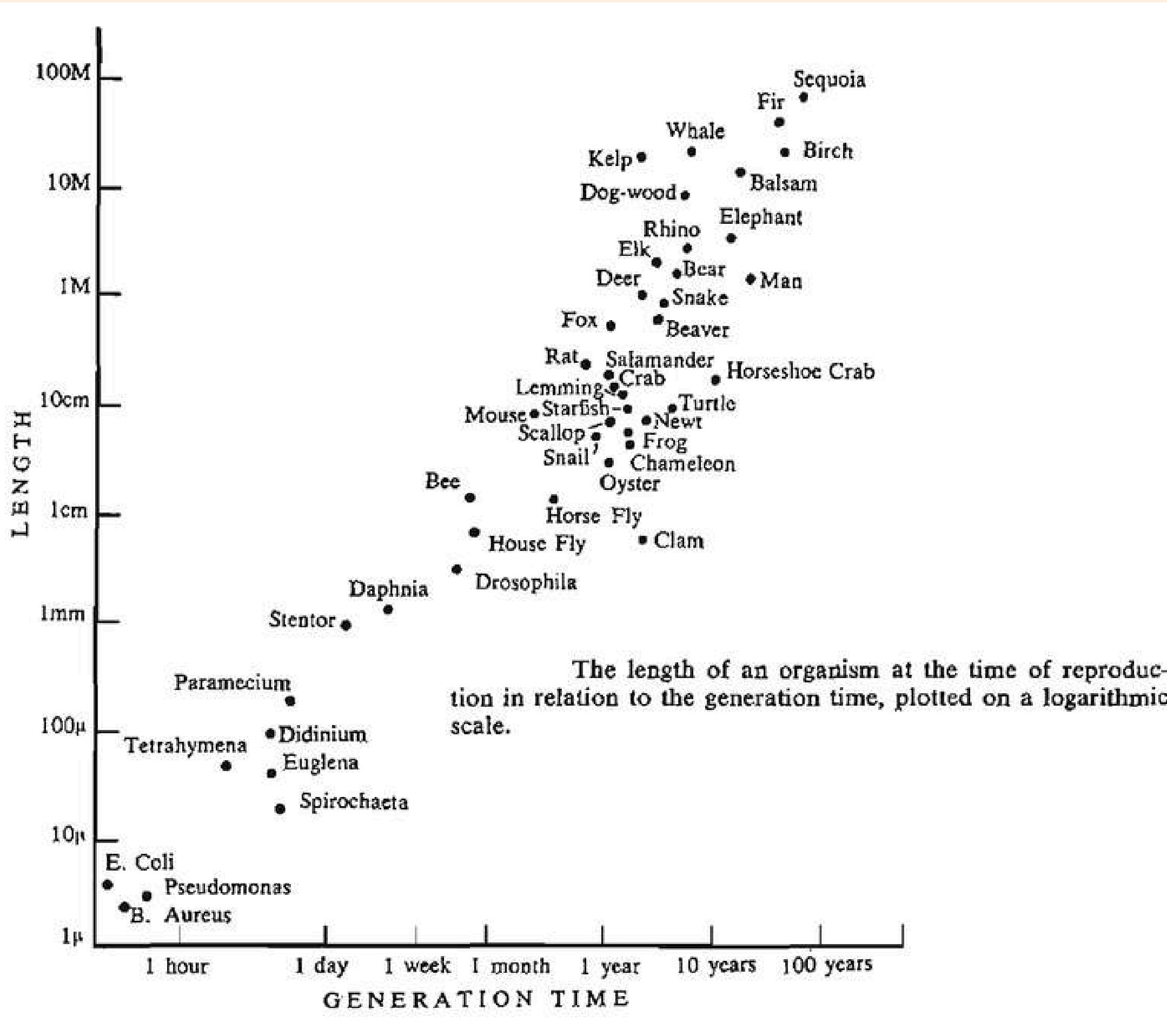
RT - RM

LT - LO

RT - RO

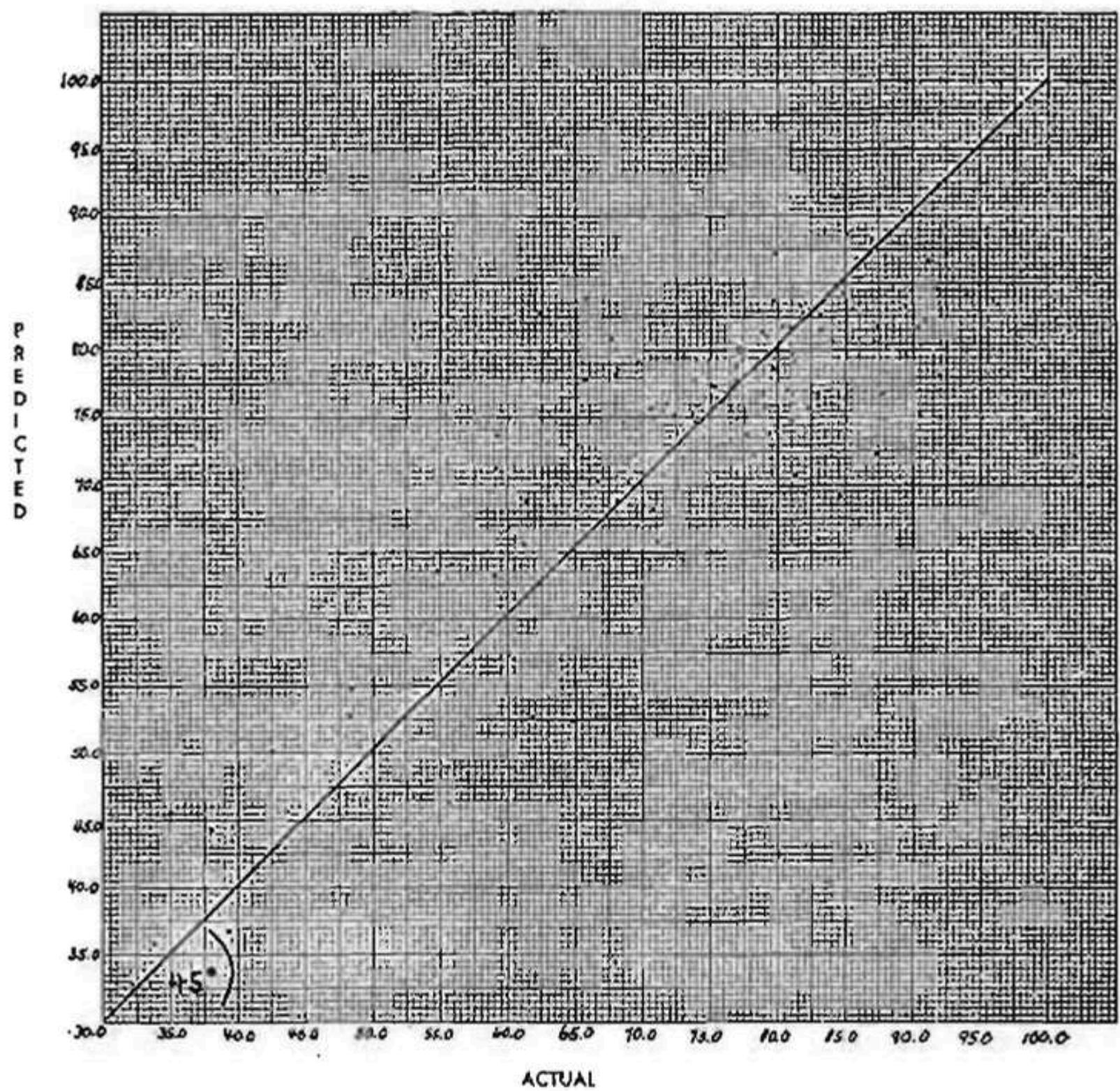
M7

**Every bit of ink  
is data ink**

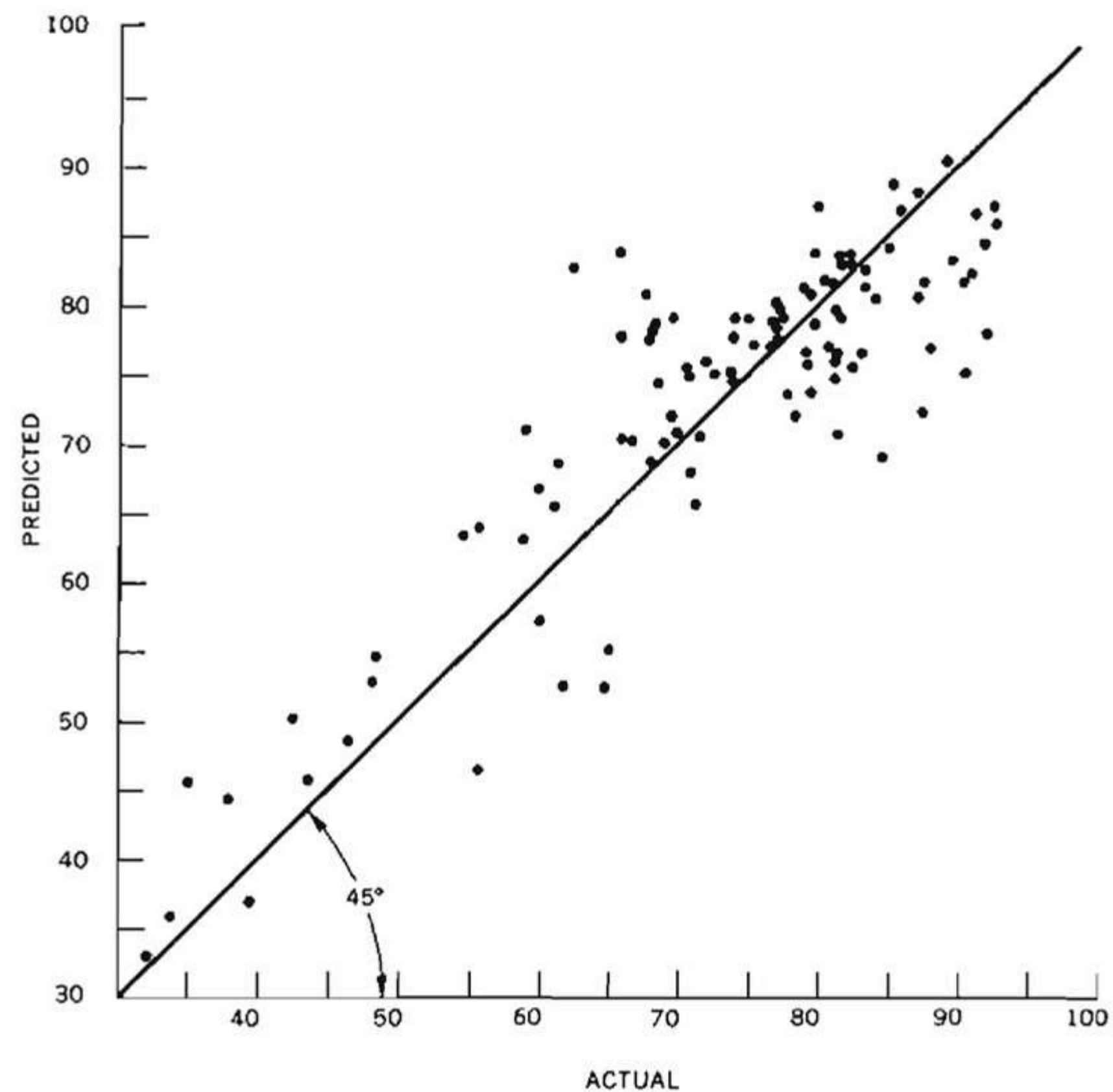
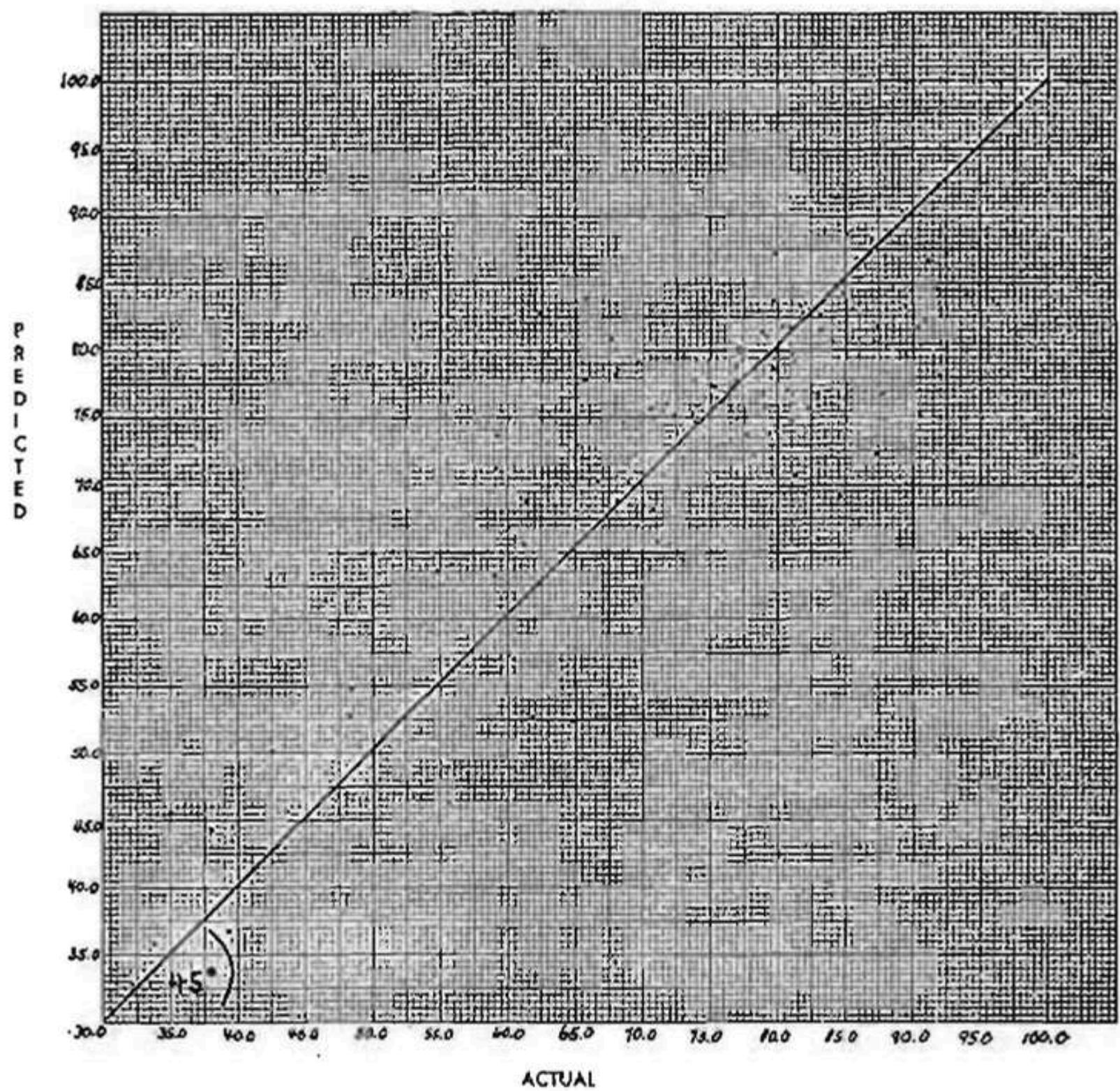


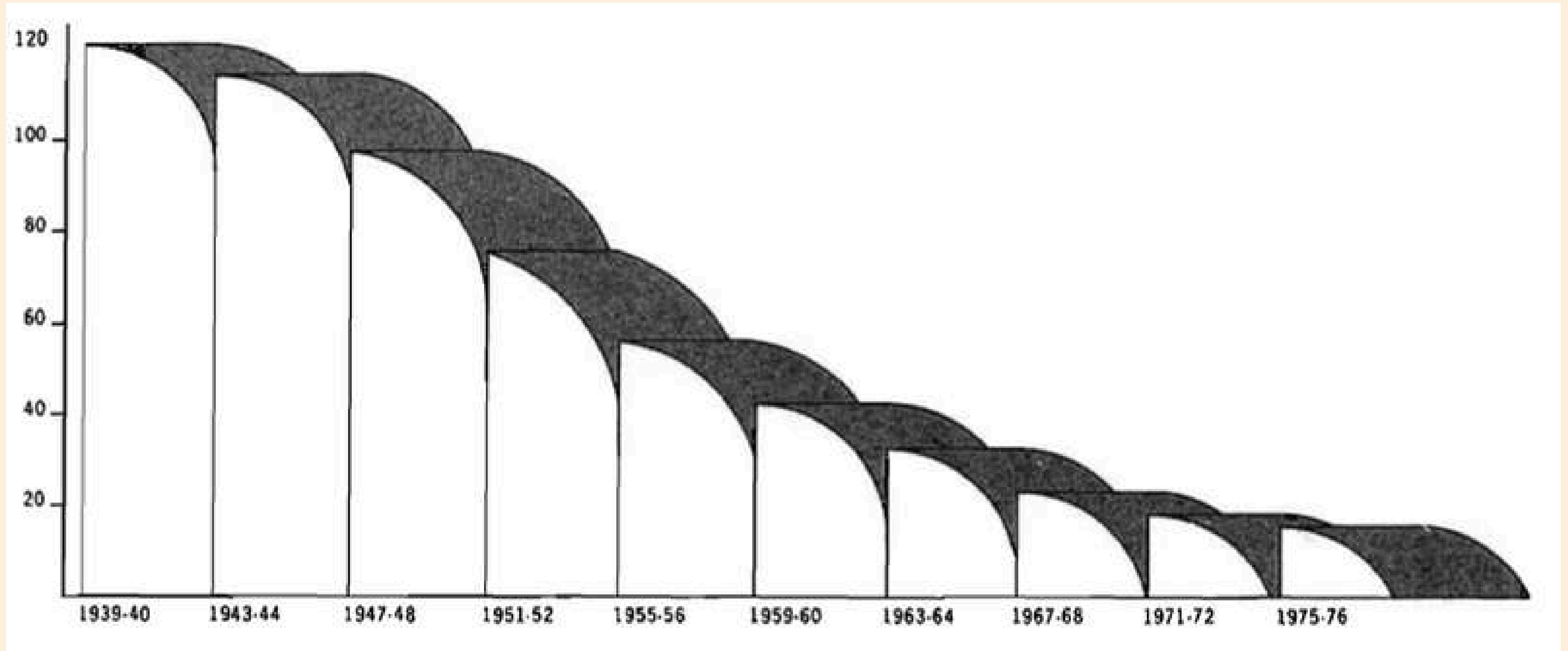
Only 10-20% is non data ink

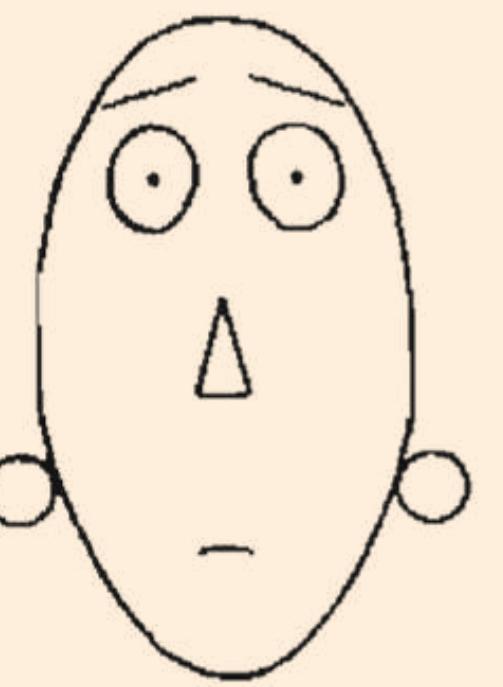
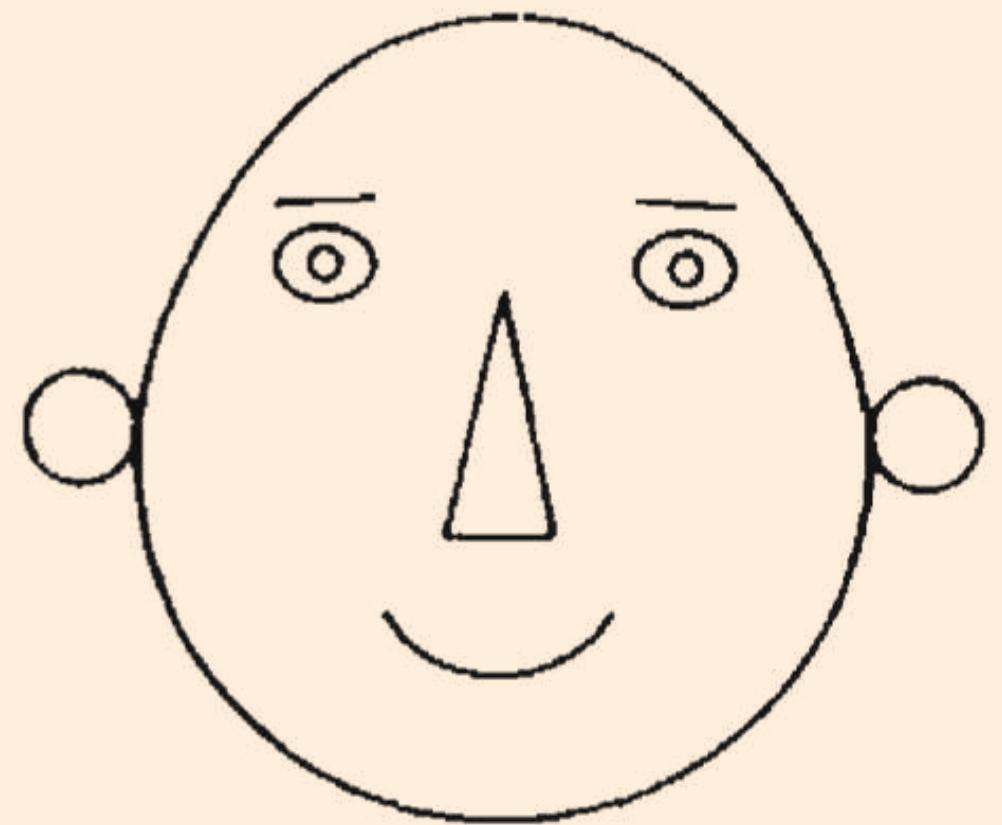
Relationship of Actual Rates of Registration to Predicted Rates  
(104 cities 1960).

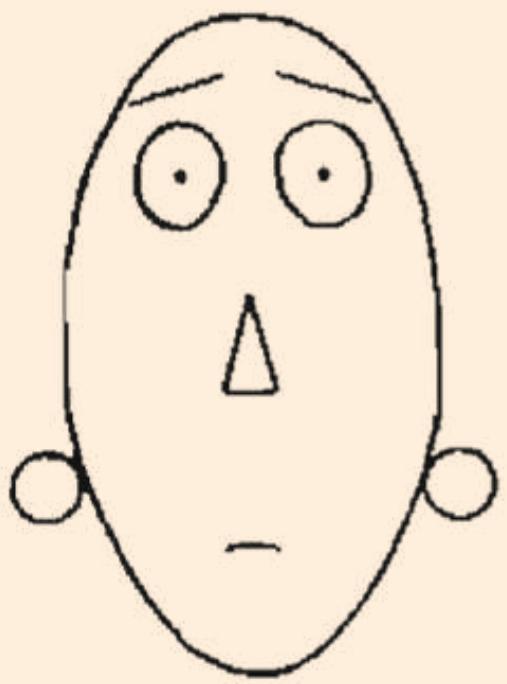
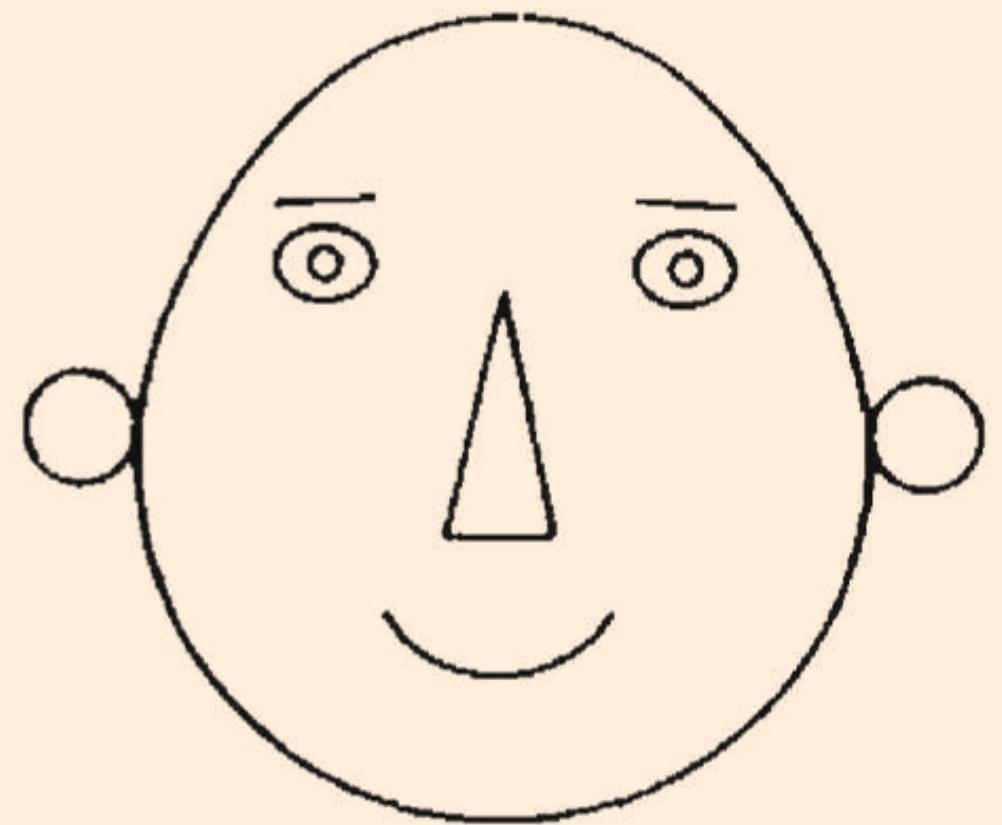


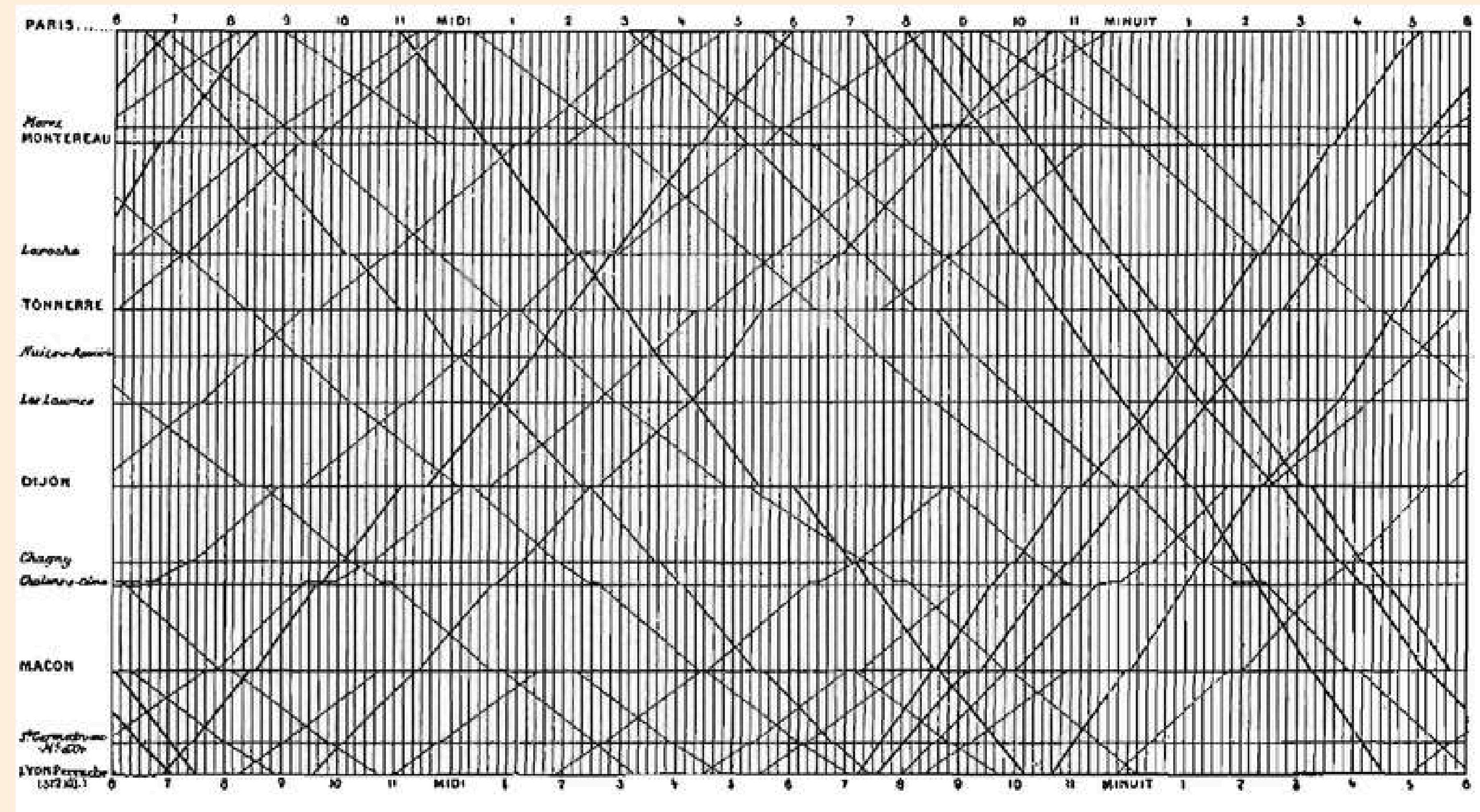
Relationship of Actual Rates of Registration to Predicted Rates  
(104 cities 1960).

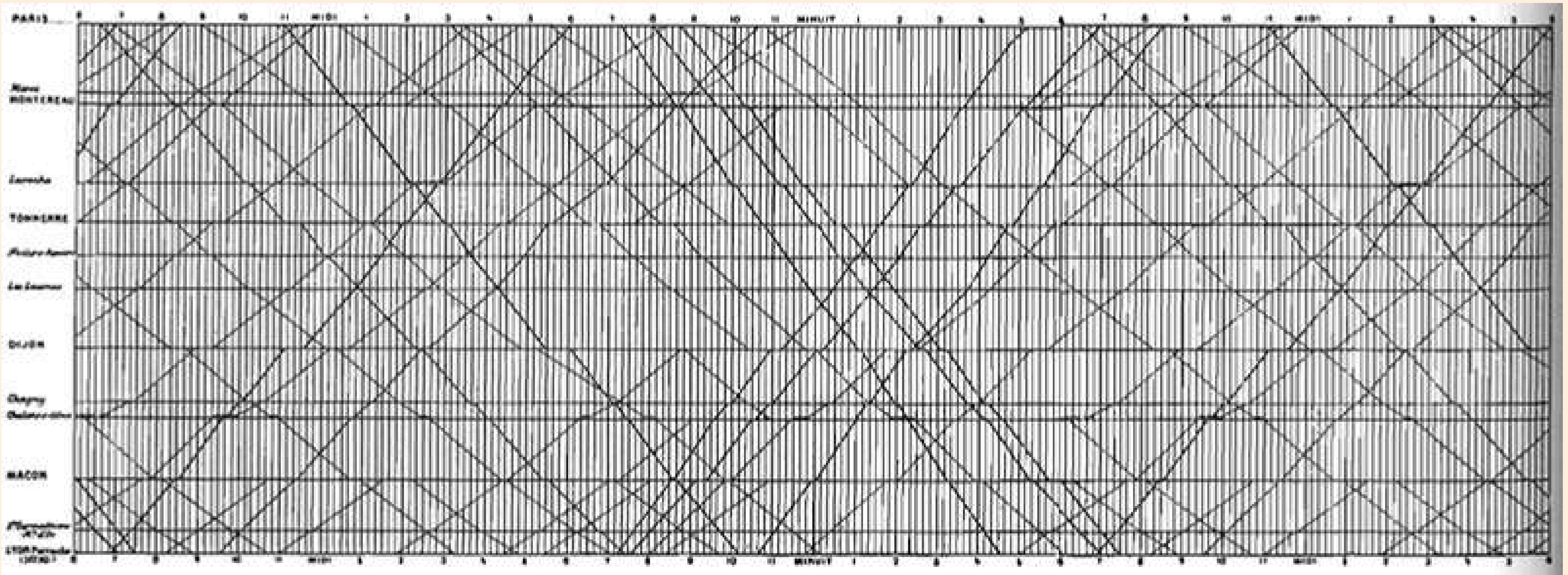


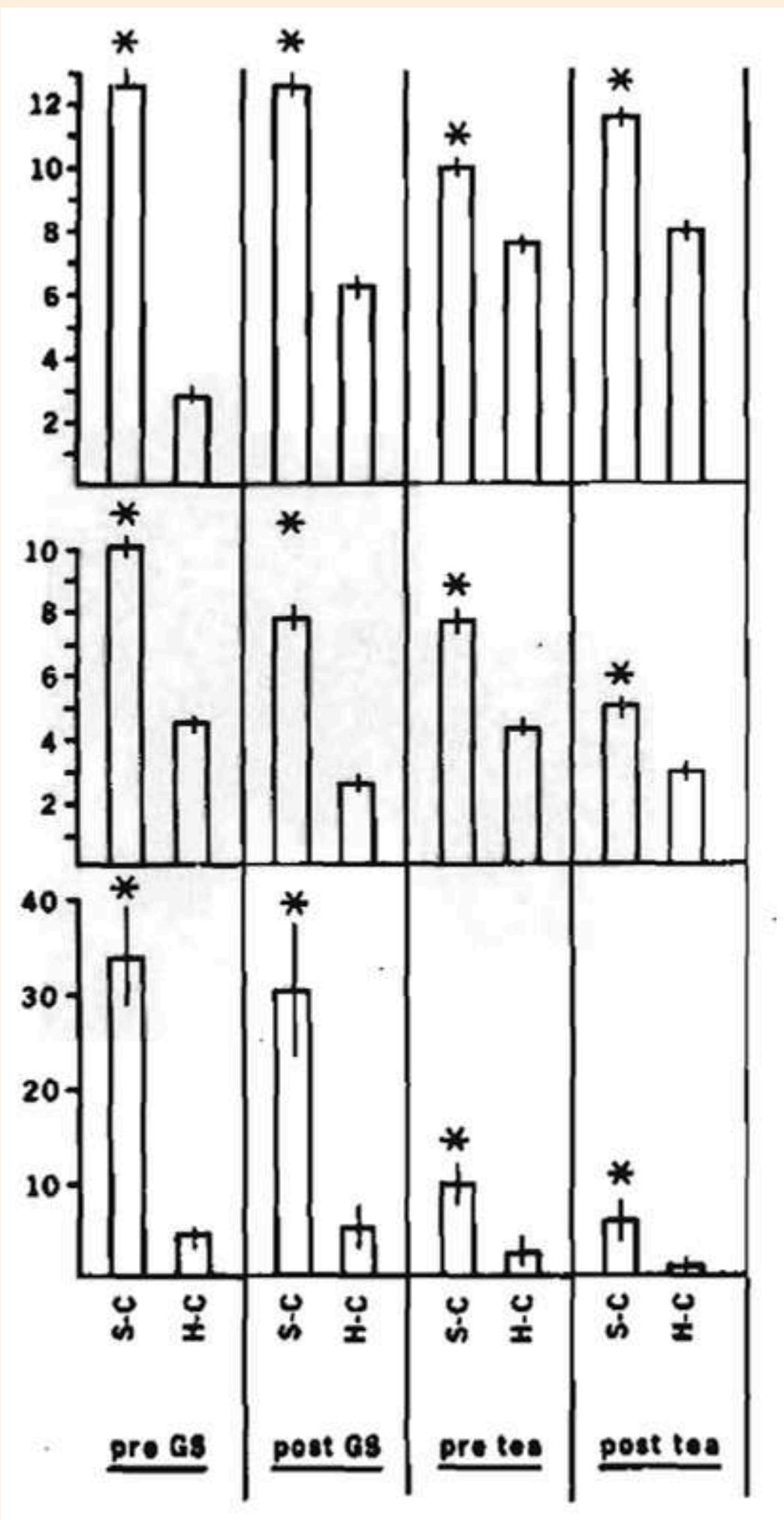


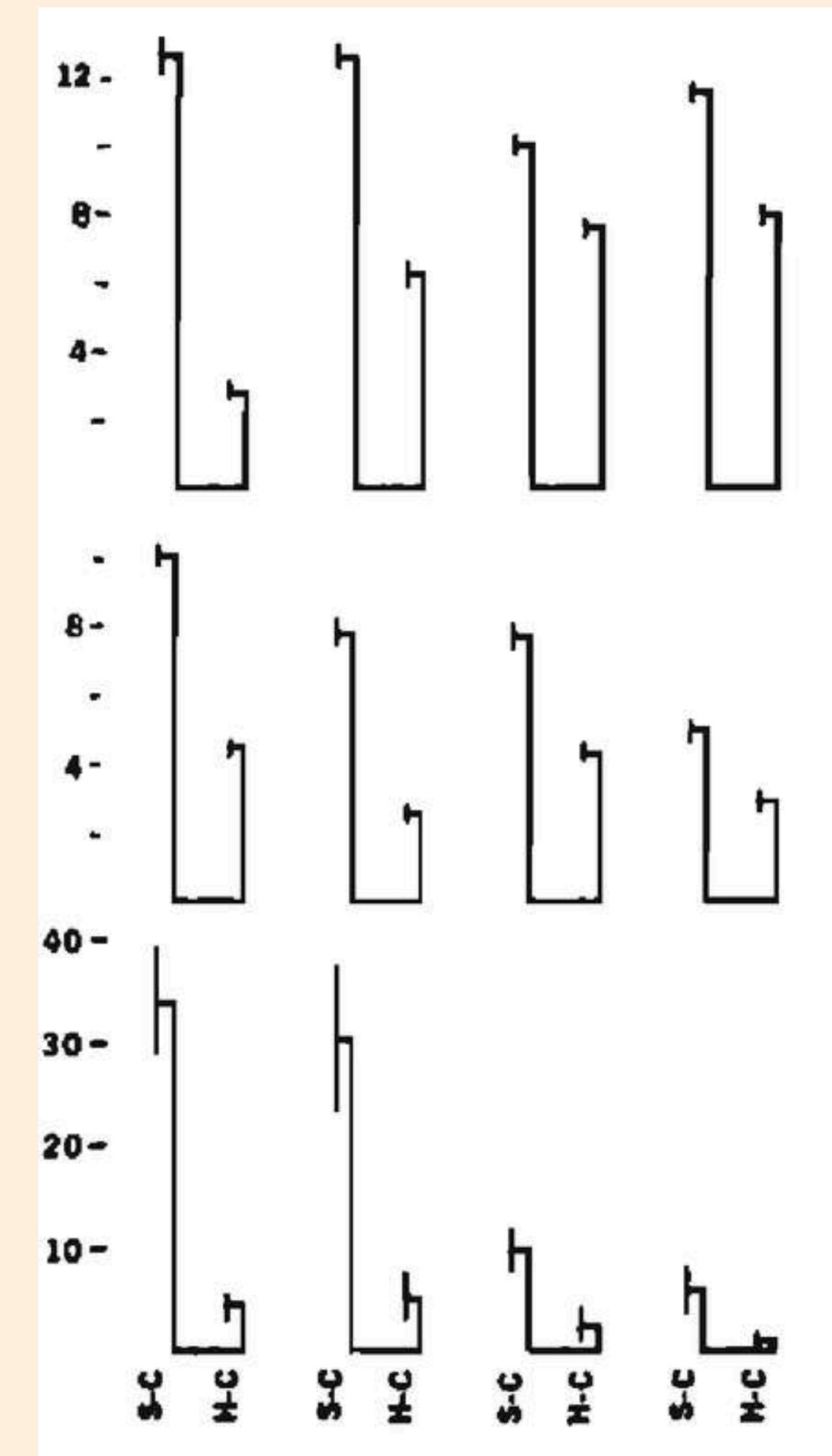
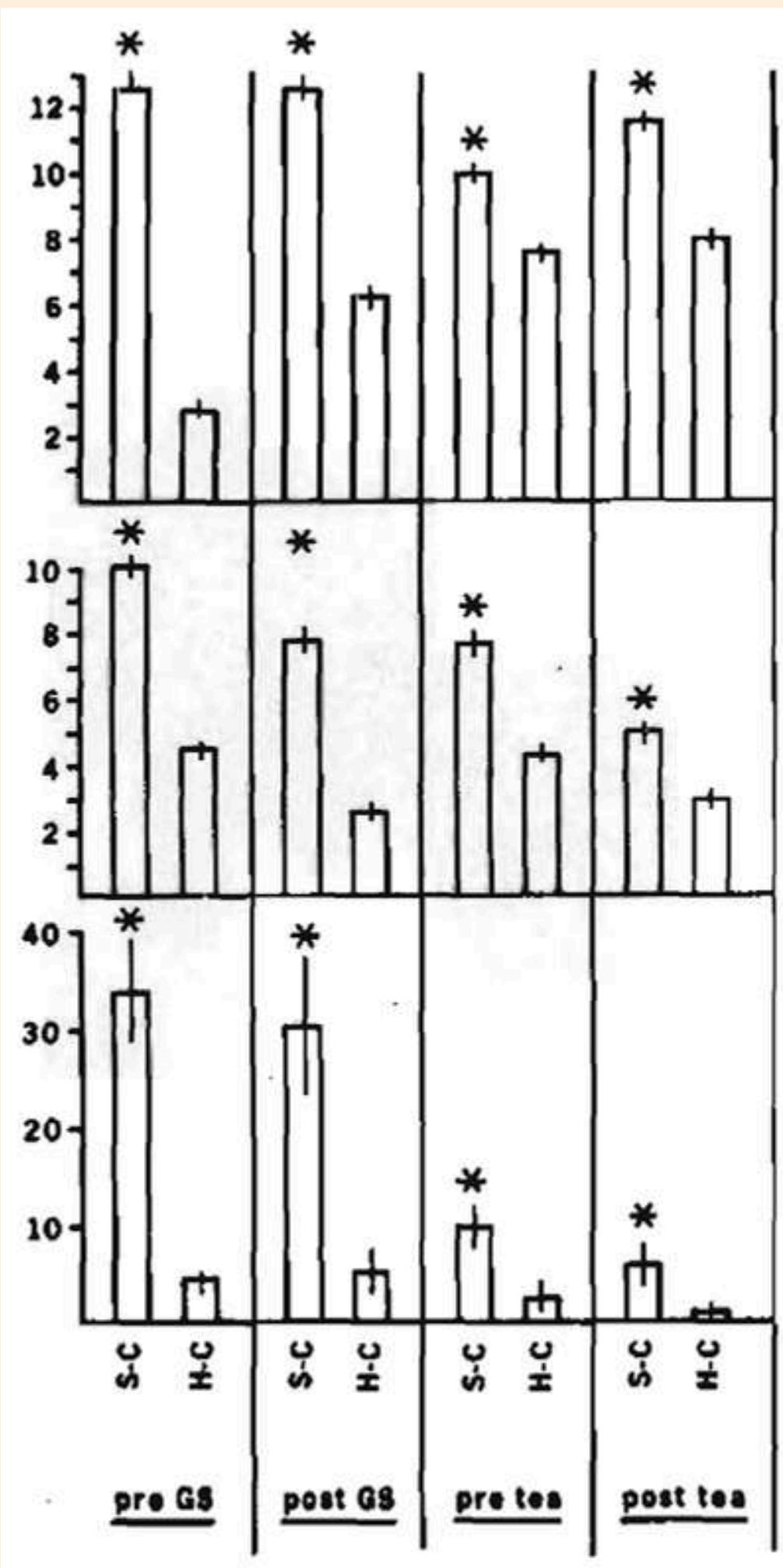


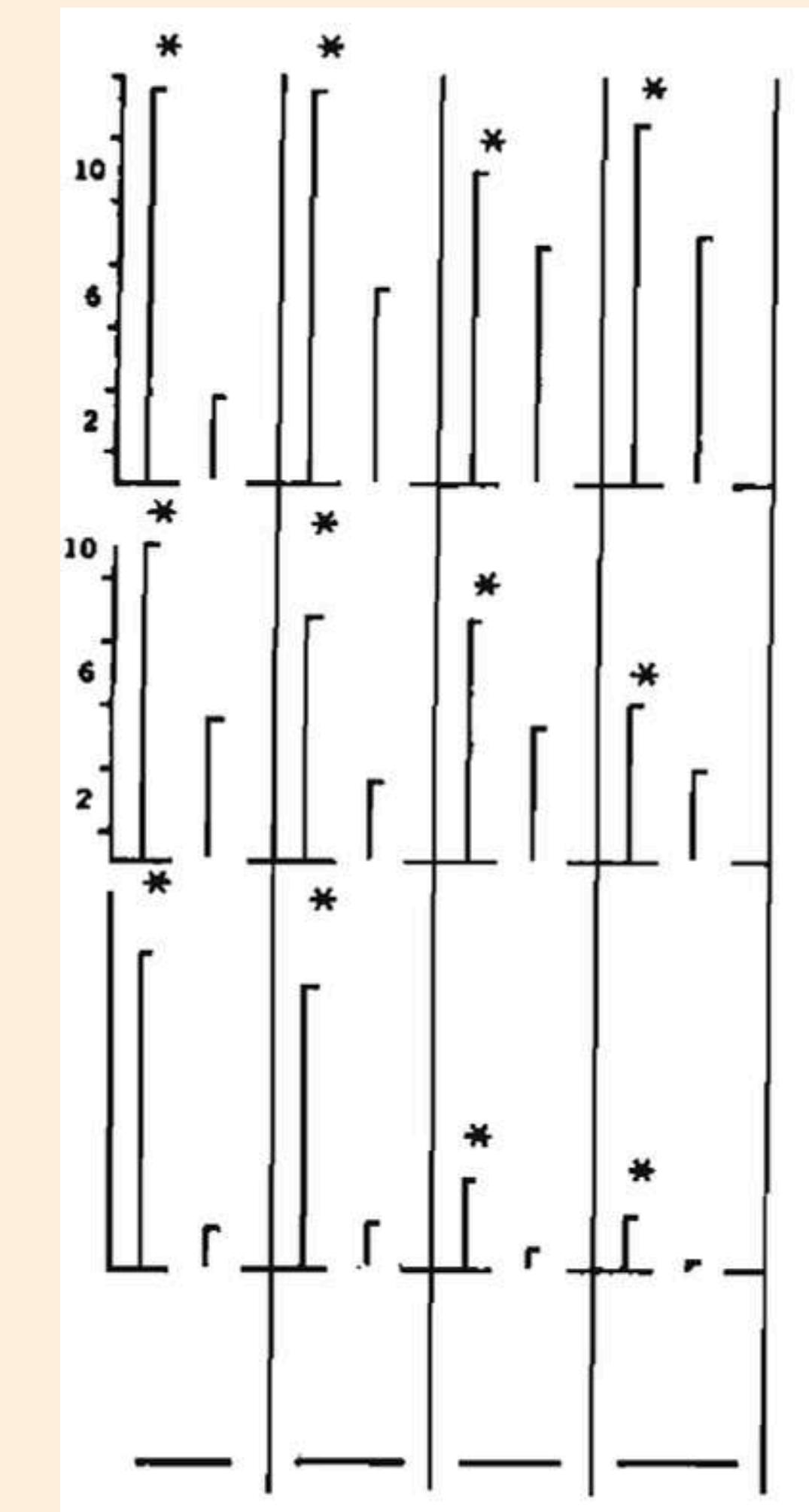
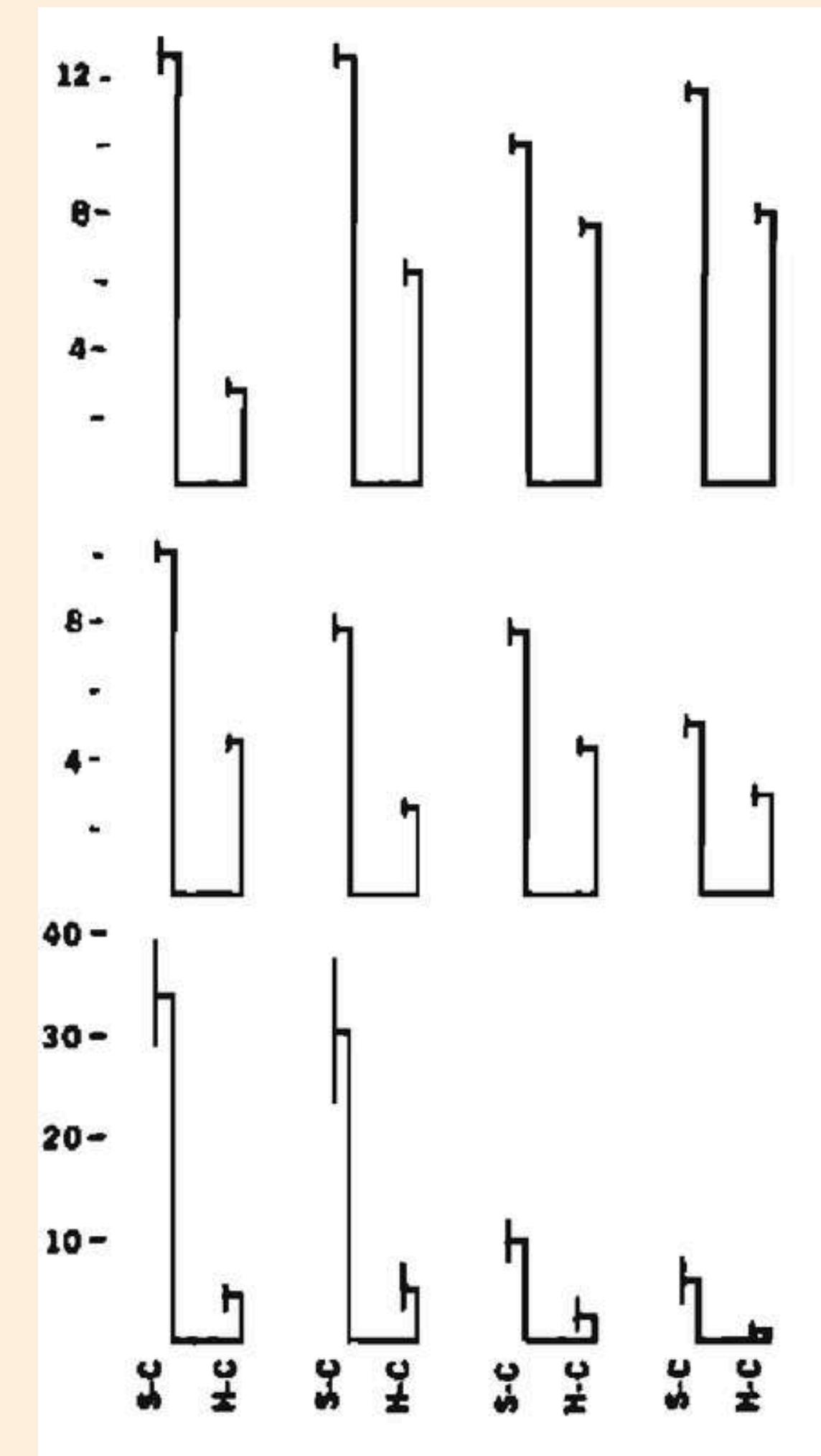
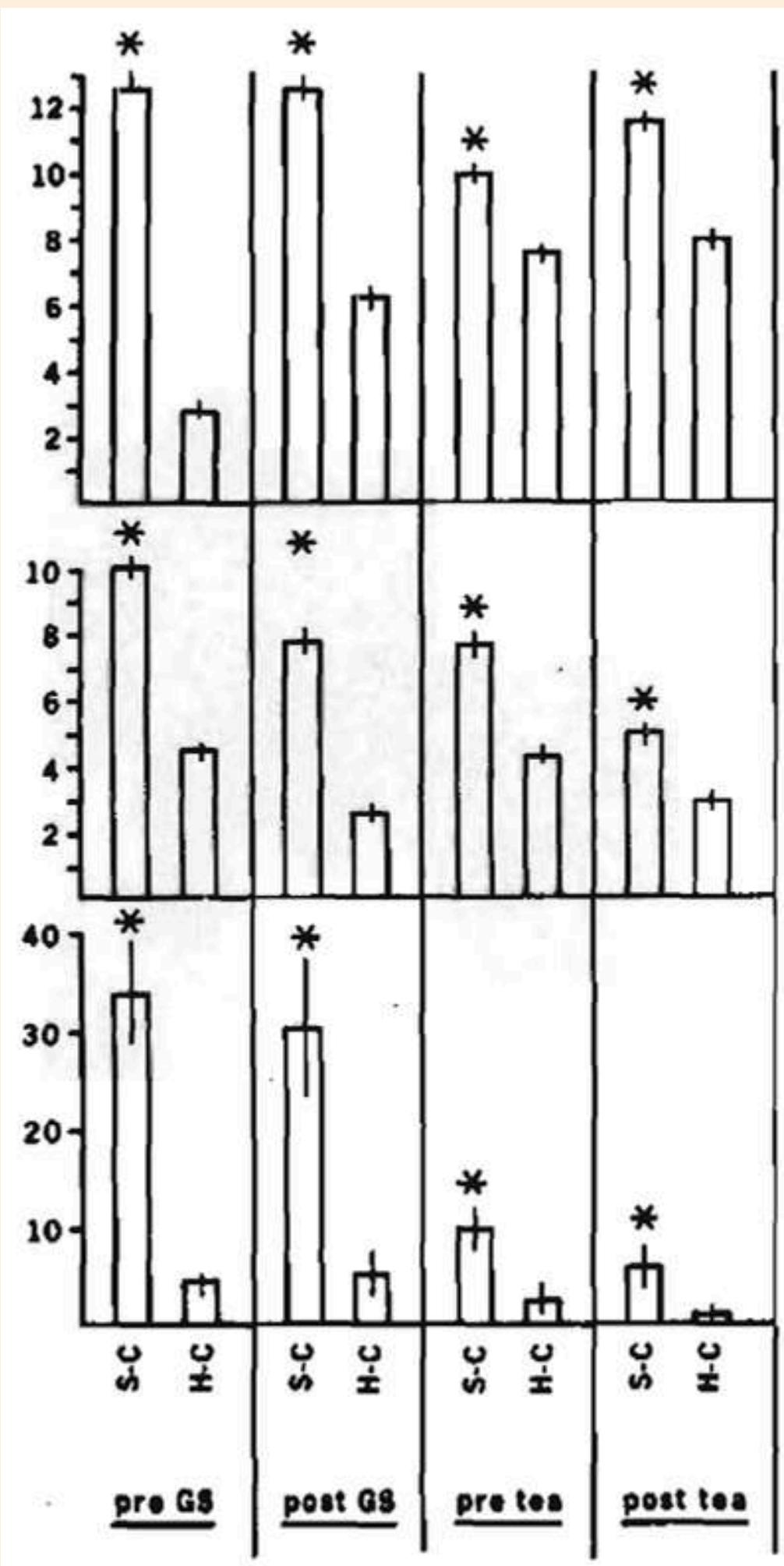


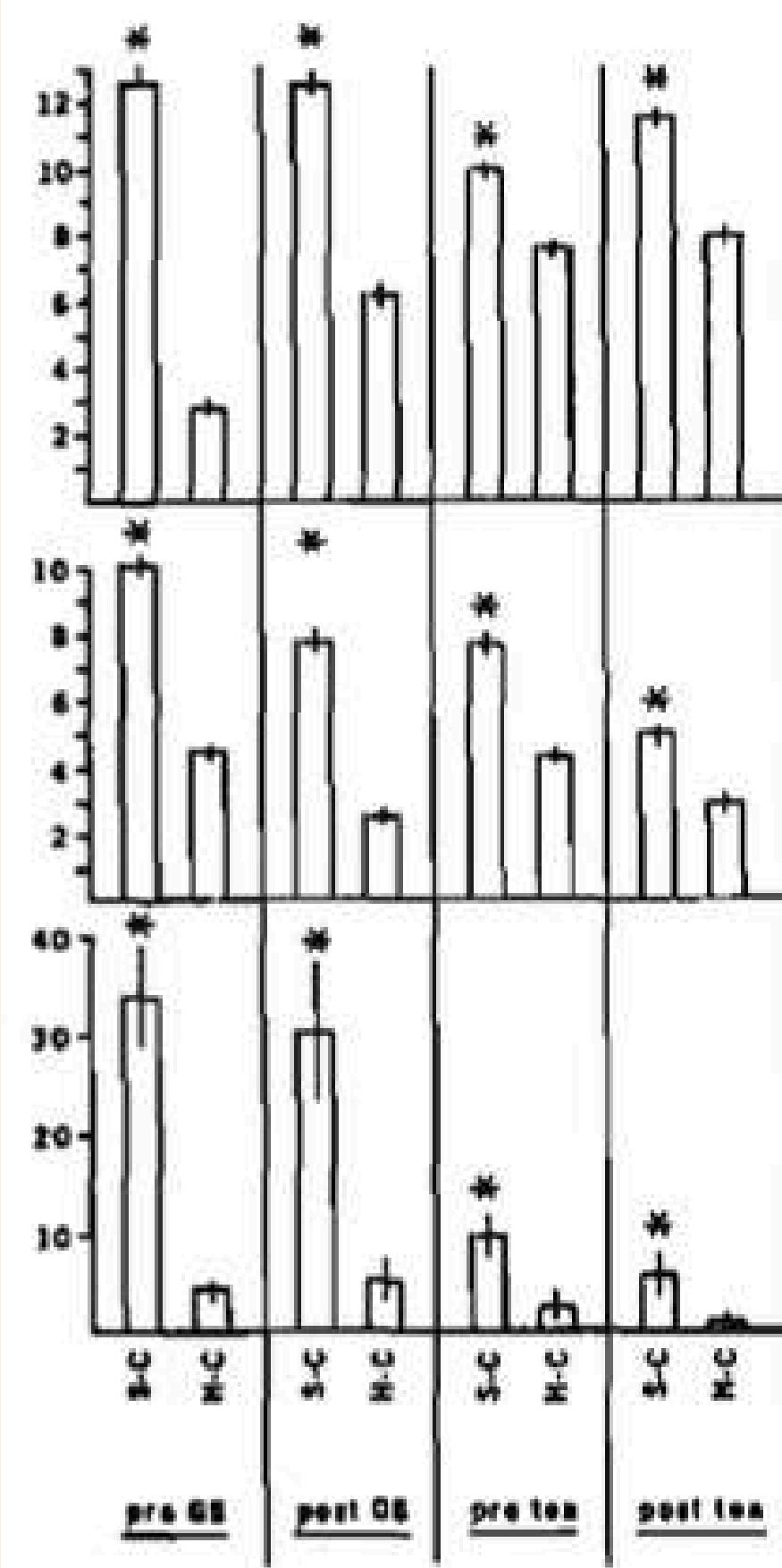




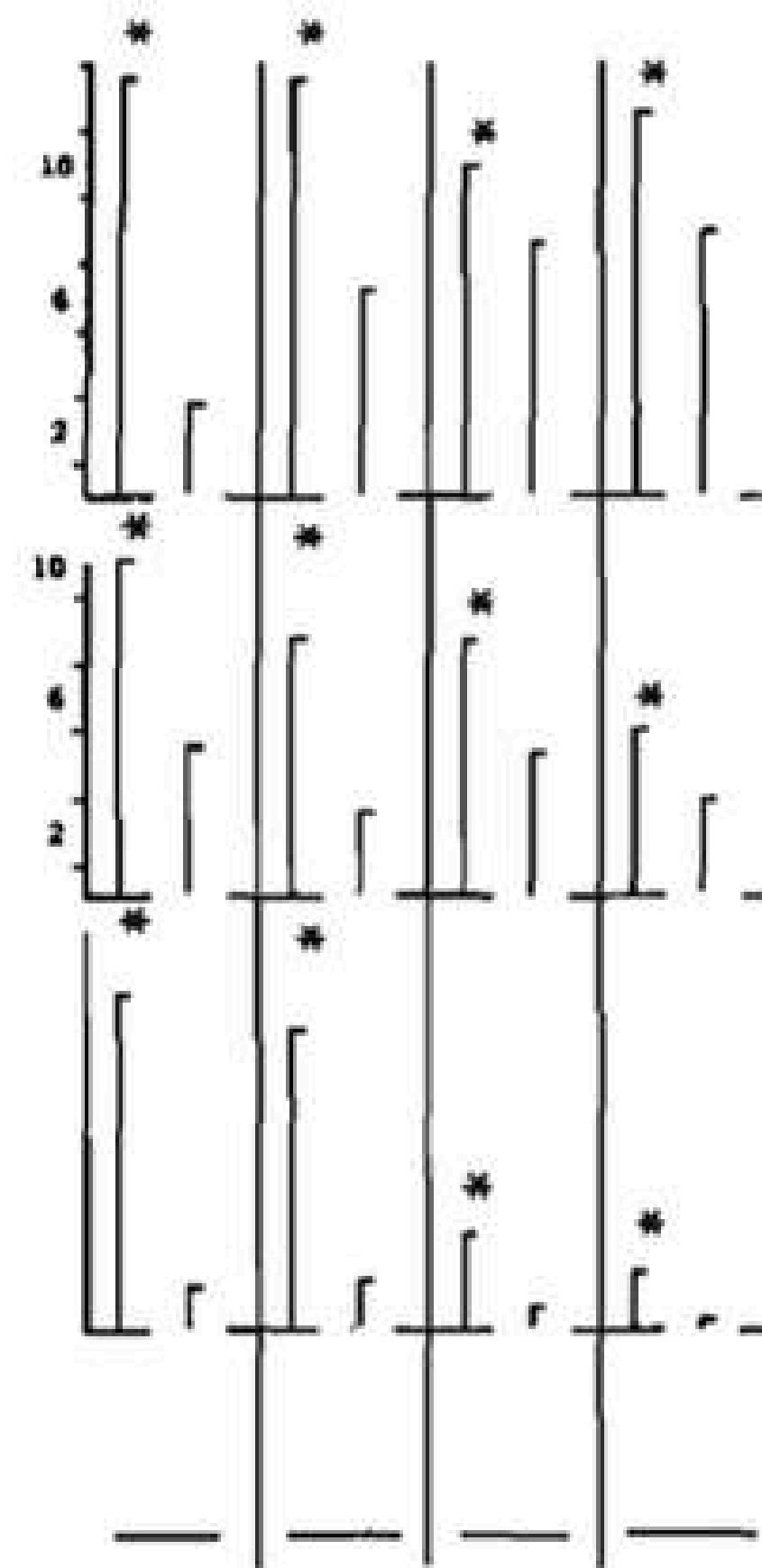




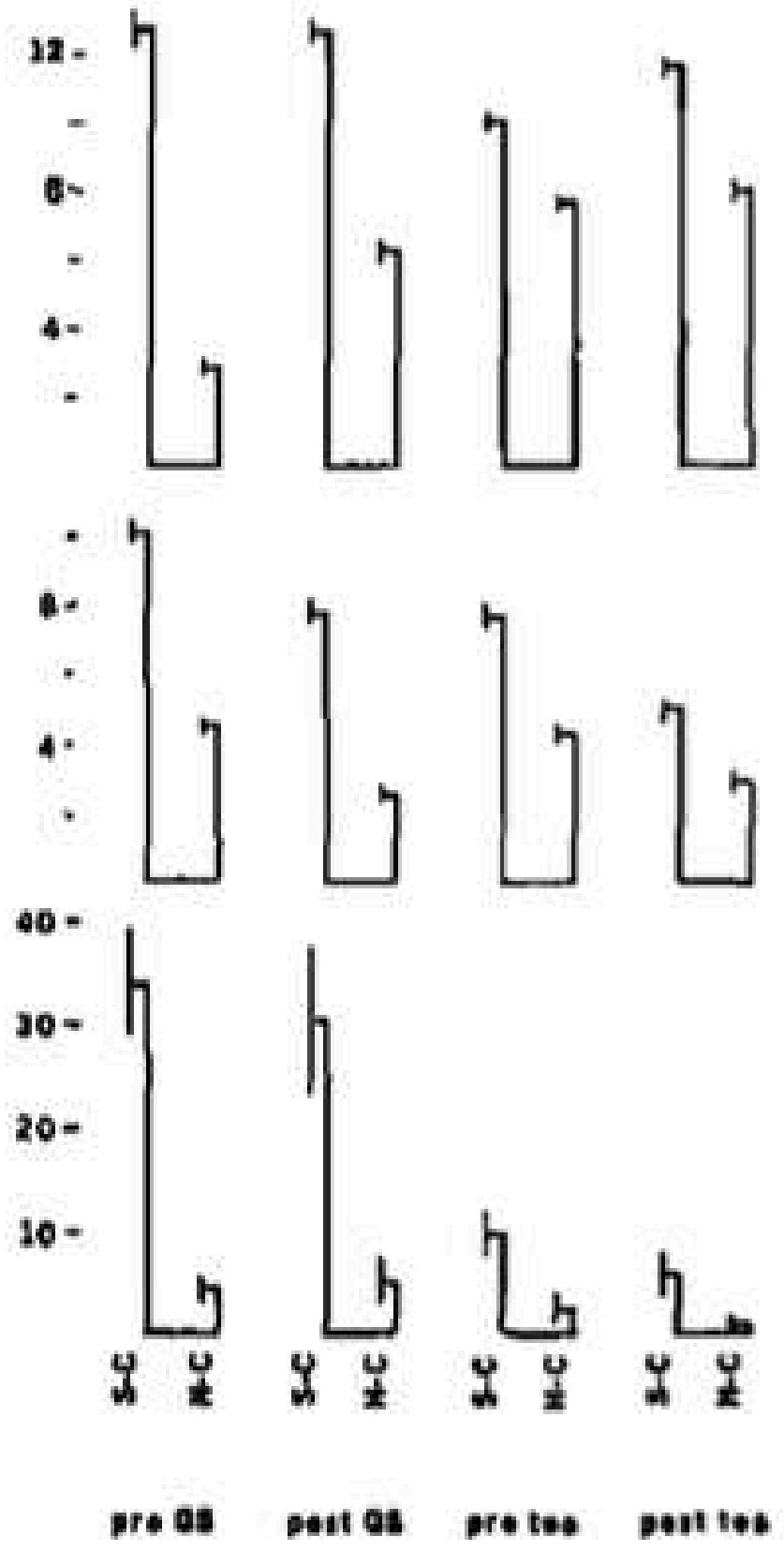


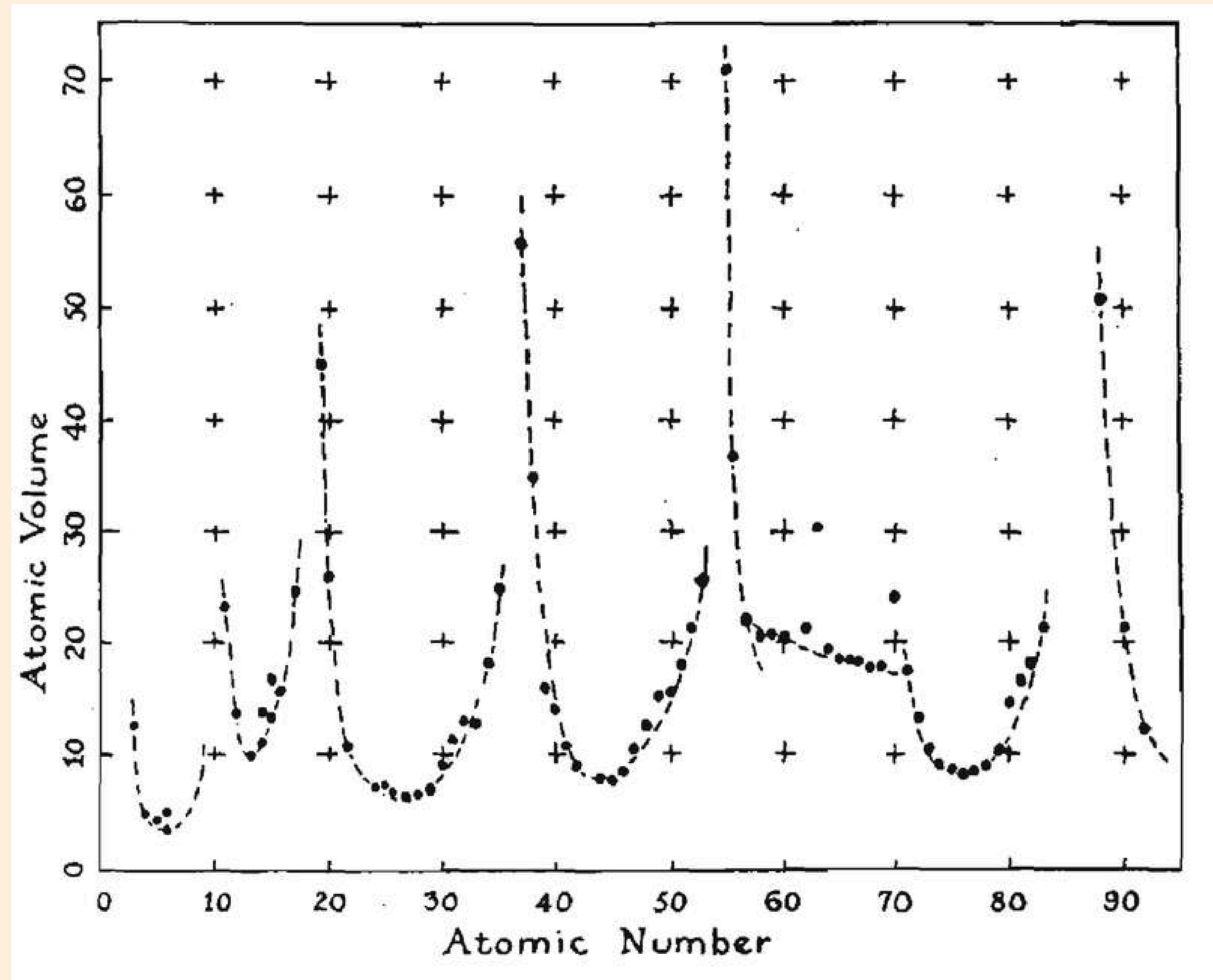


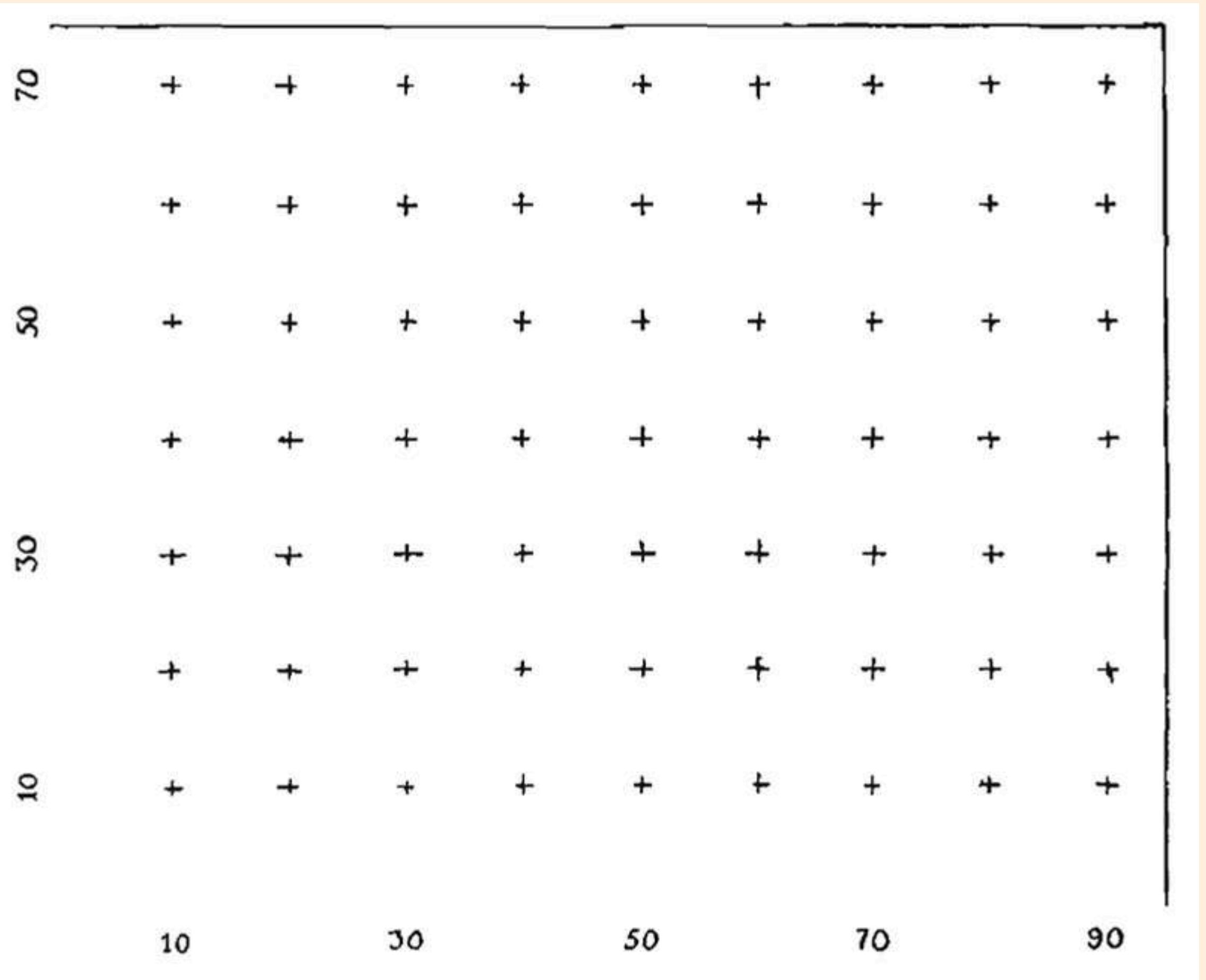
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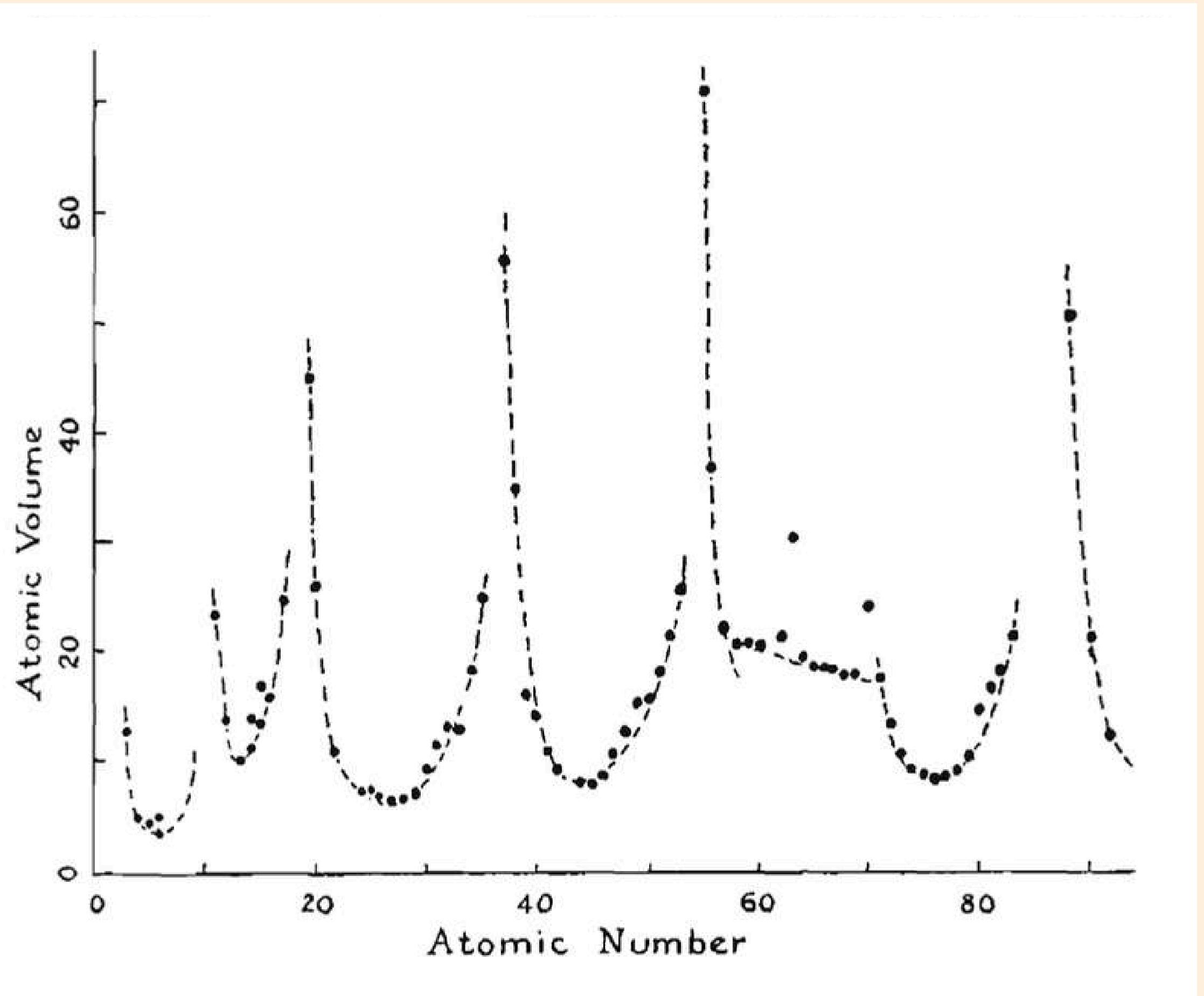


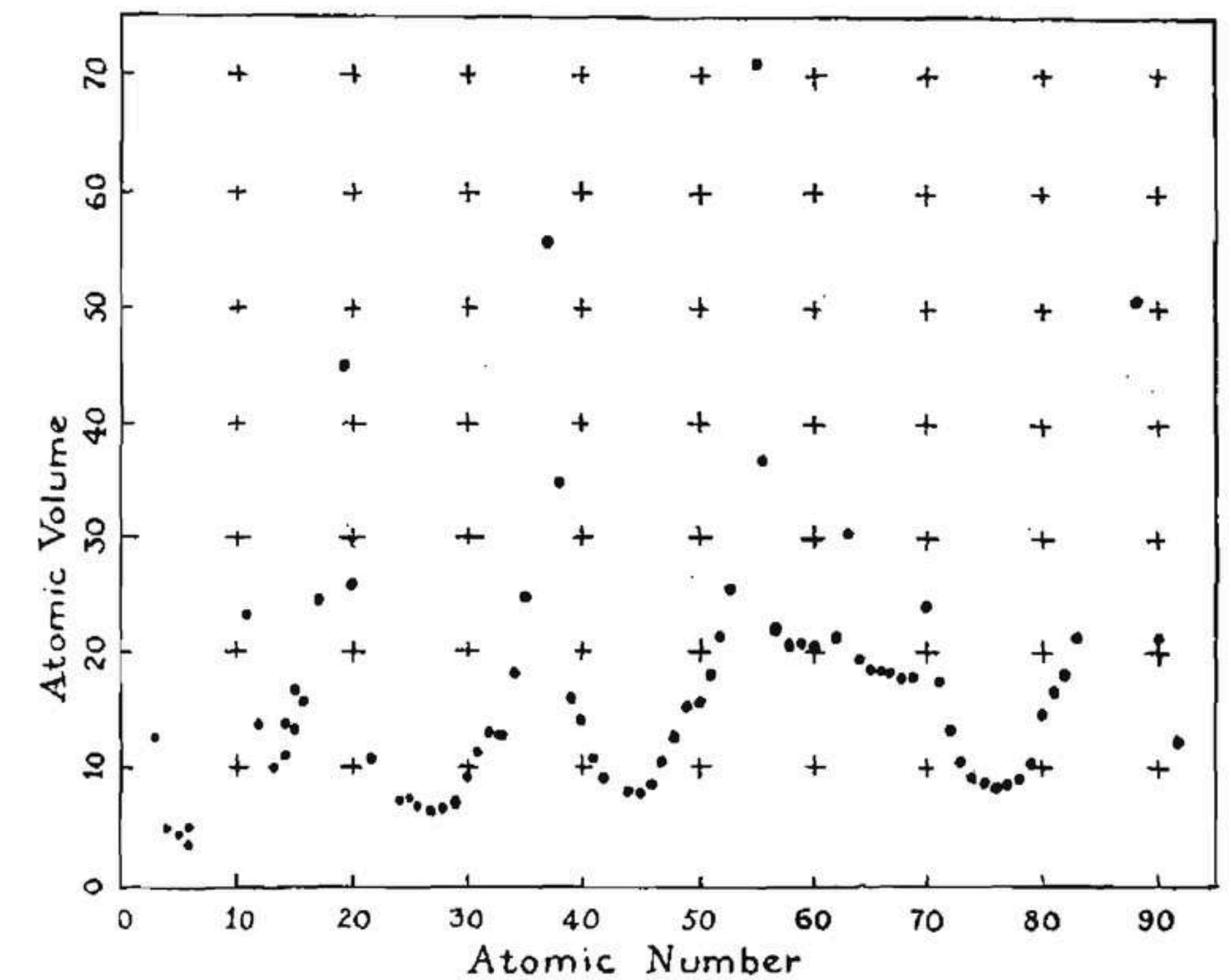
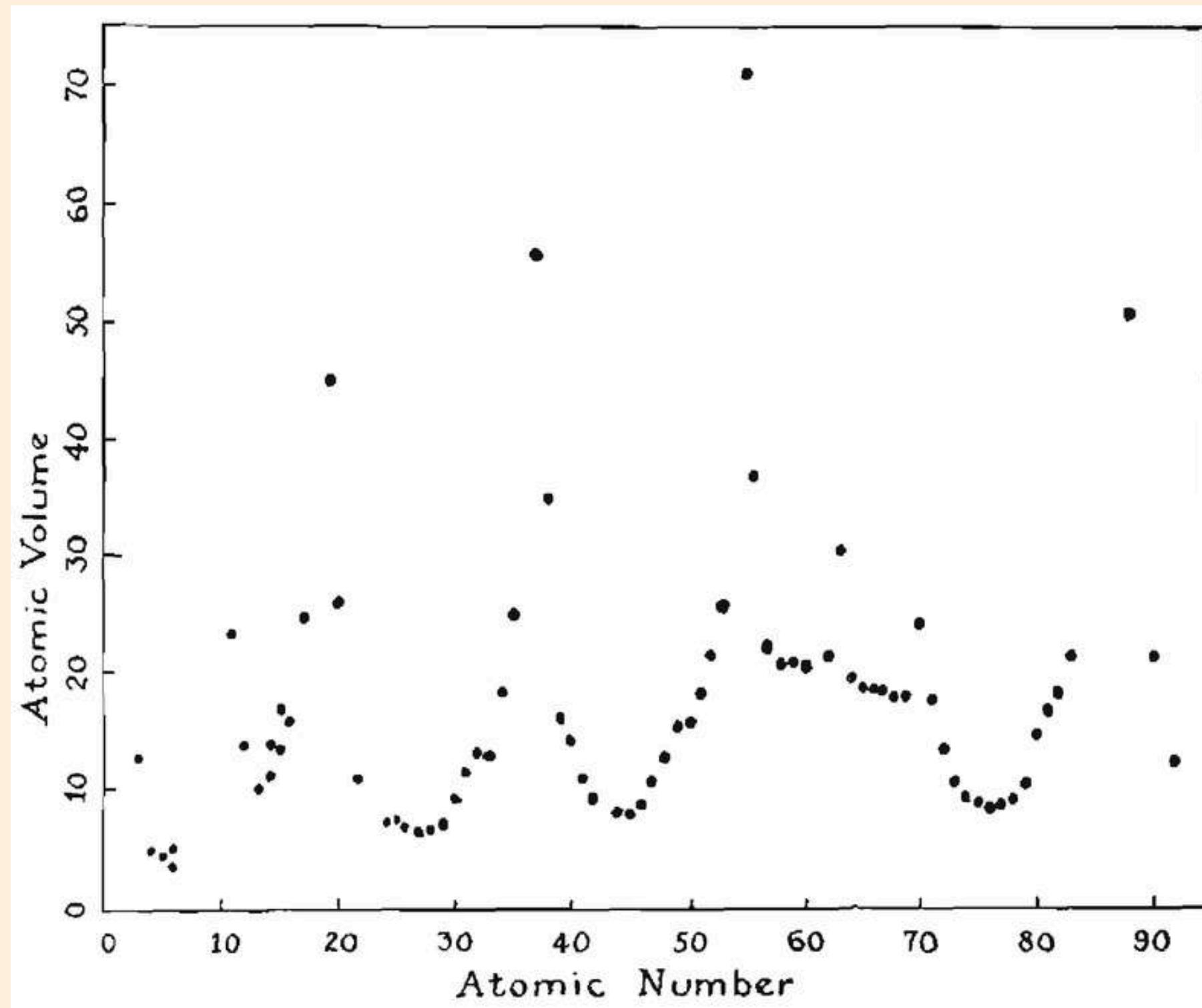
+

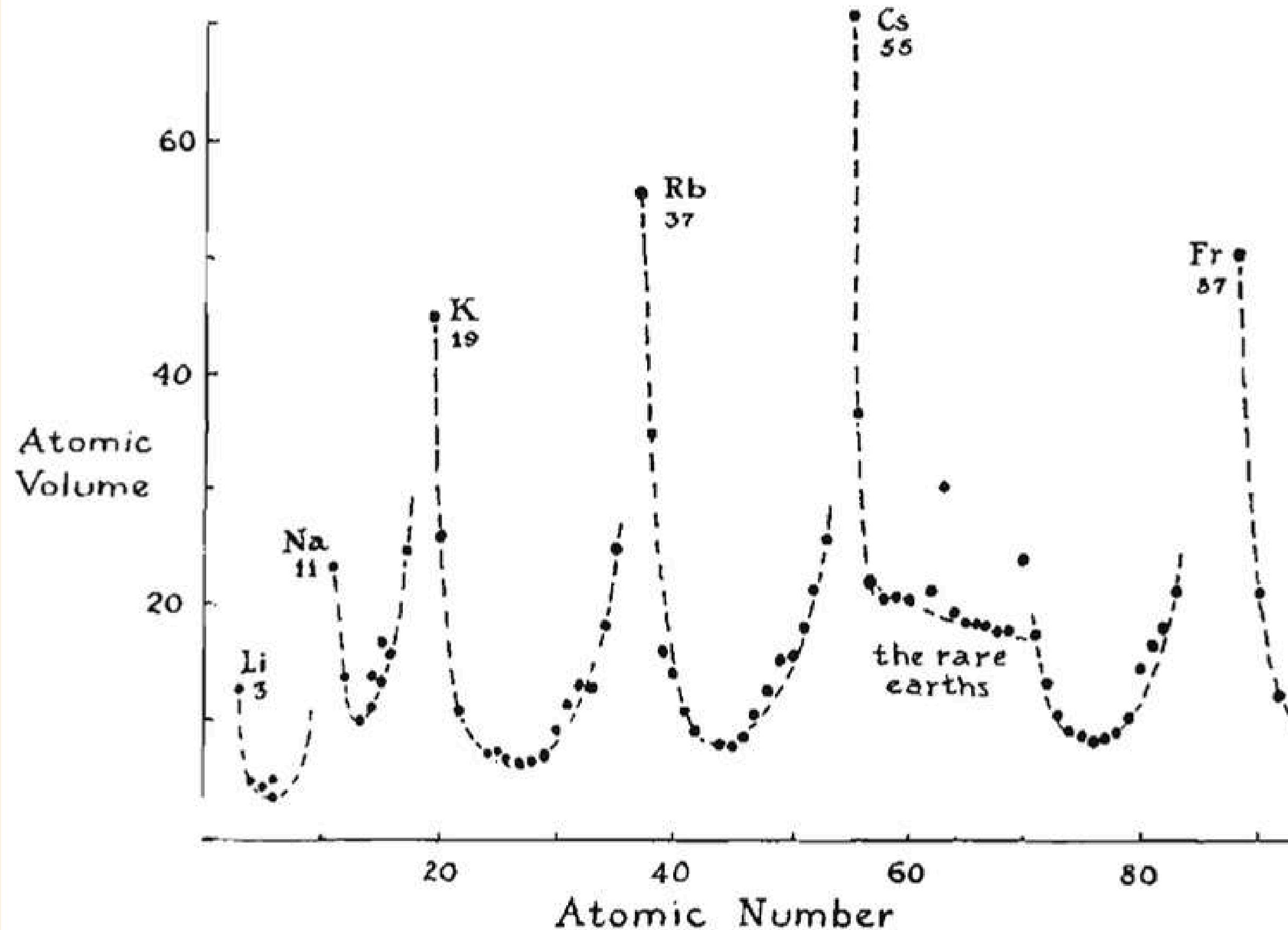








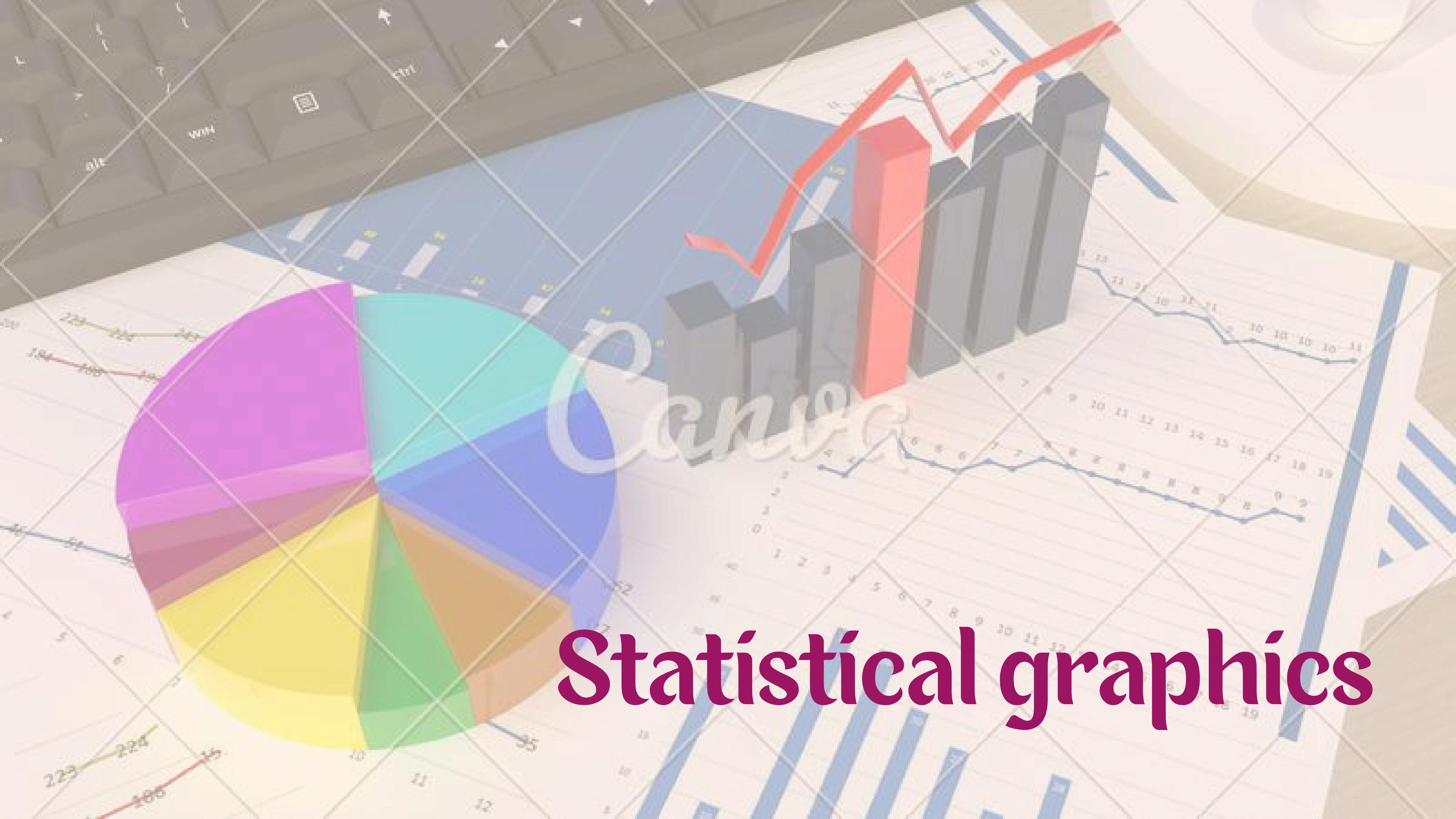




# Five principles in the theory of data graphics produce substantial changes in graphical design

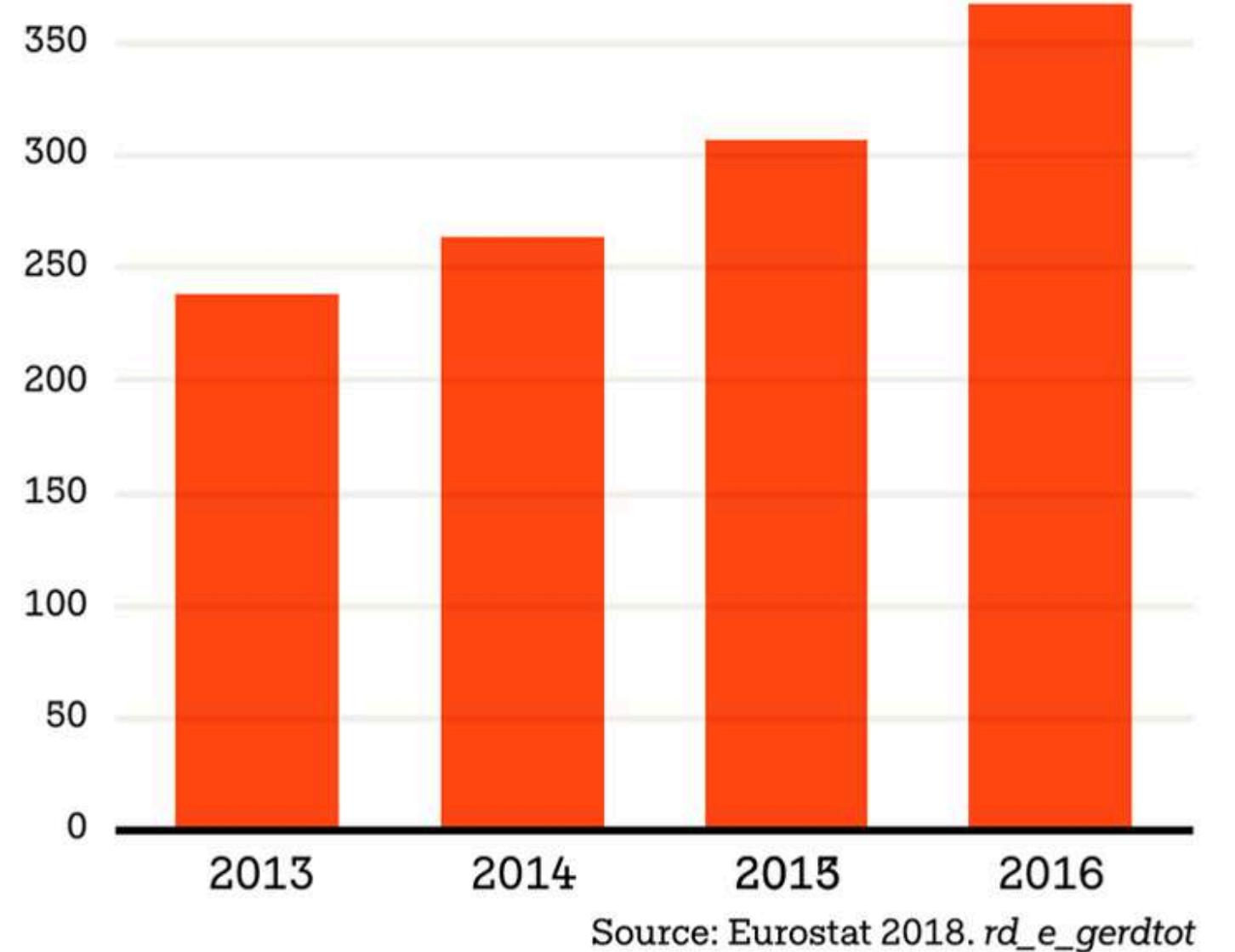
- **Above all else show the data**
- **Maximize the data-ink ratio**
- **Erase non-data-ink**
- **Erase redundant data-ink**
- **Revise and Edit**

# Statistical graphics



## Higher education spending in Iceland

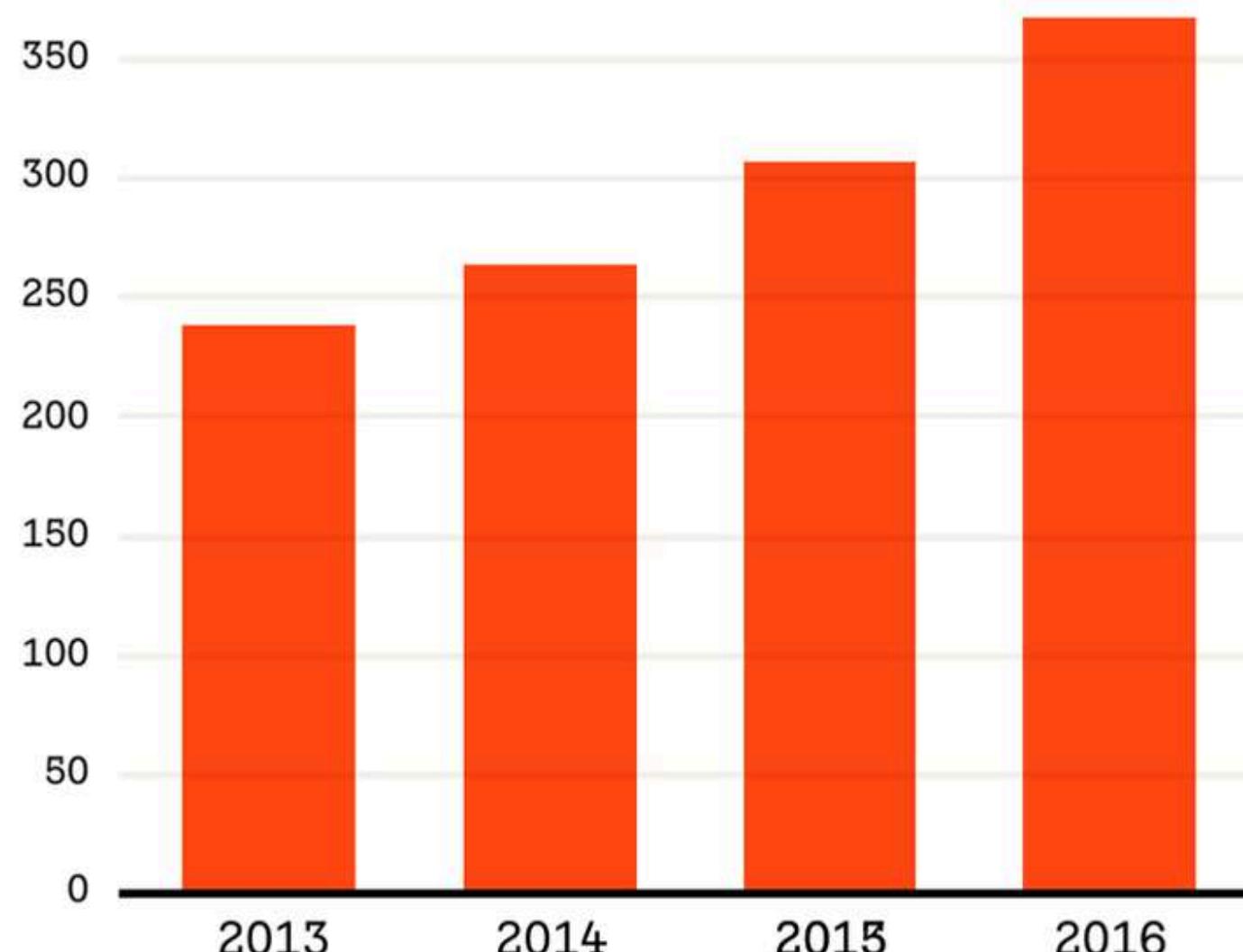
Euros per inhabitant



## VERTICAL BAR CHART

### Higher education spending in Iceland

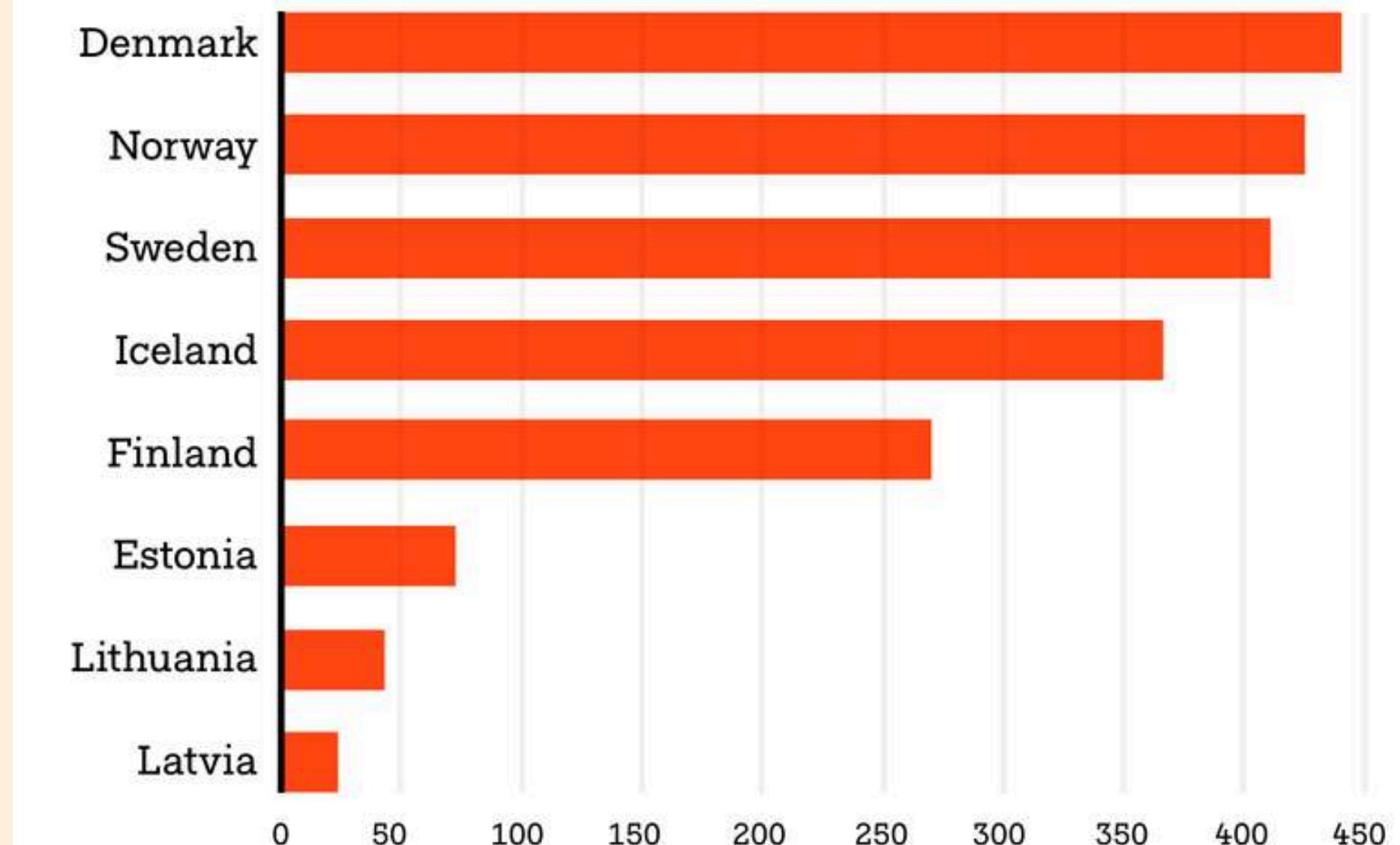
Euros per inhabitant



Source: Eurostat 2018. rd\_e\_gerdtot

### Higher education spending (2016)

Euros per inhabitant

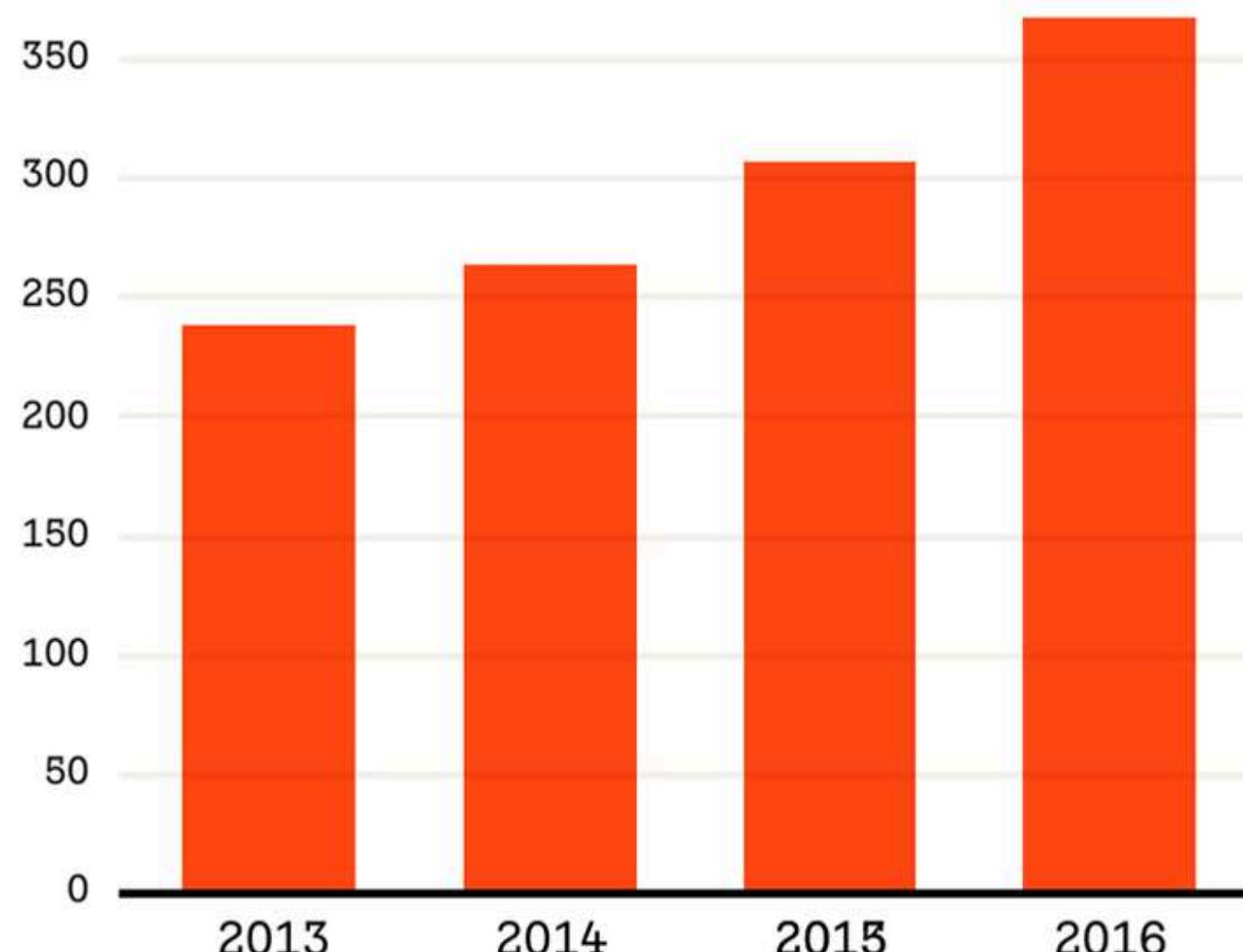


Source: Eurostat 2018. rd\_e\_gerdtot

### VERTICAL BAR CHART

#### Higher education spending in Iceland

Euros per inhabitant

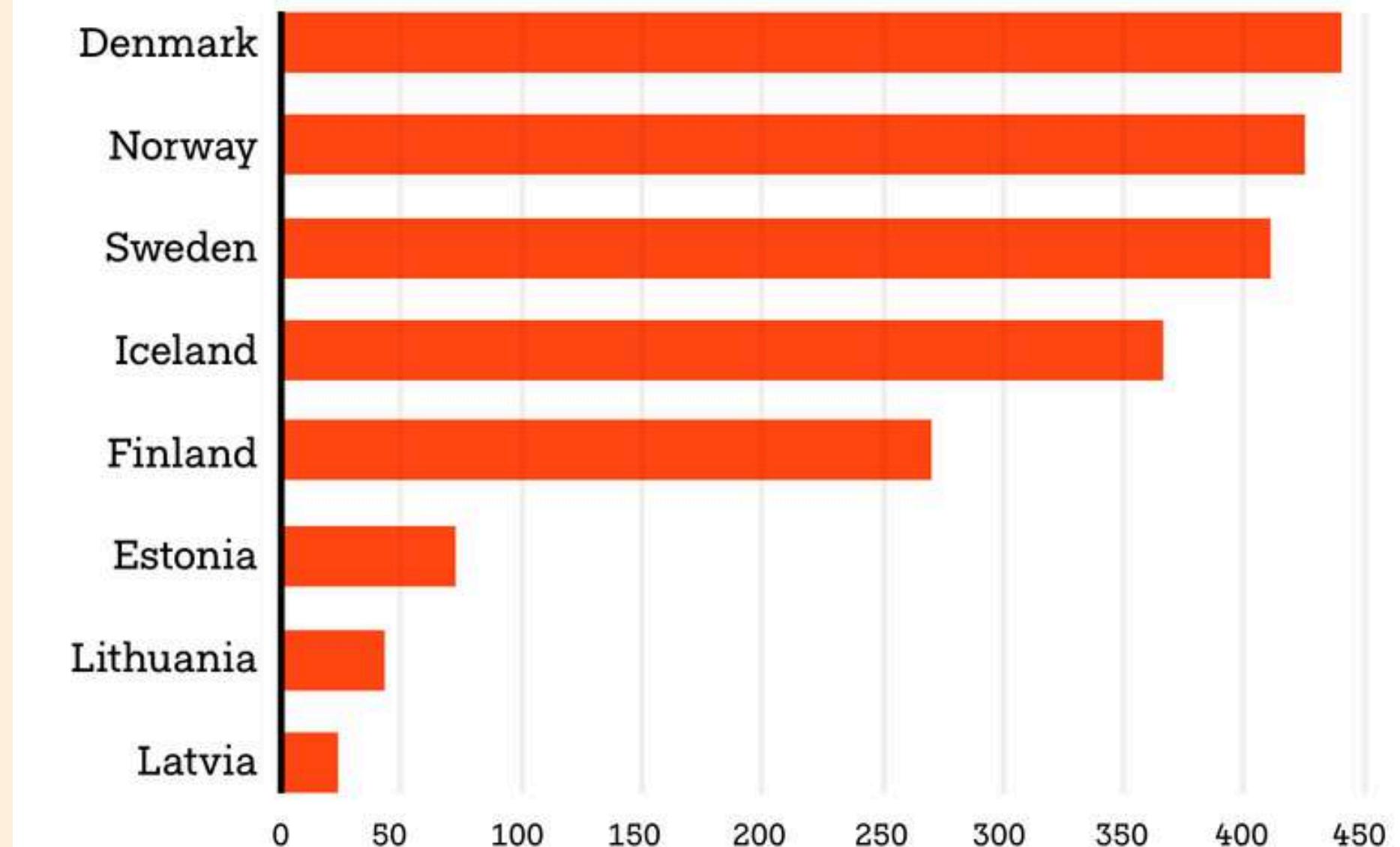


Source: Eurostat 2018. rd\_e\_gerdtot

### HORIZONTAL BAR CHART

#### Higher education spending (2016)

Euros per inhabitant

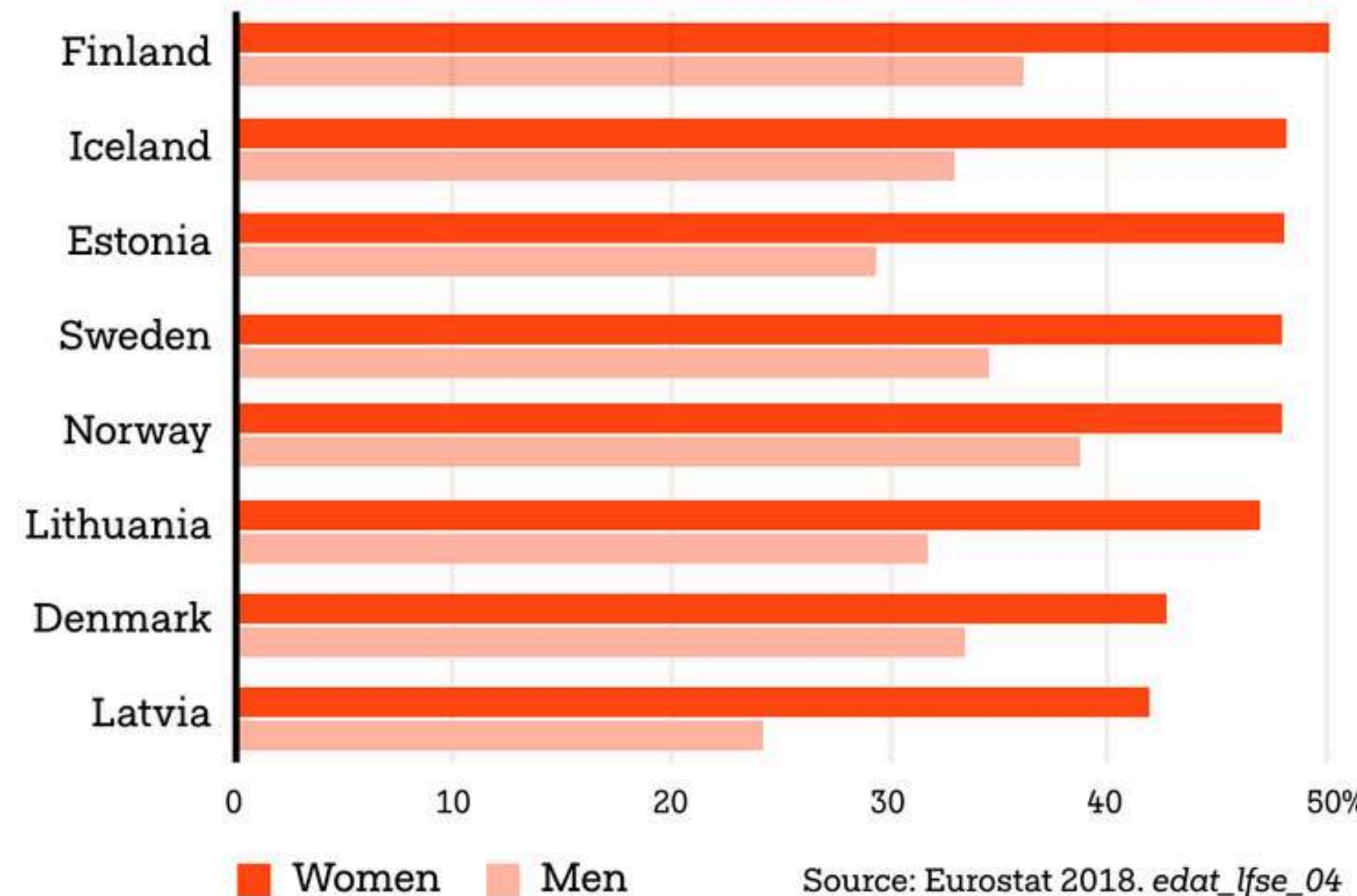


Source: Eurostat 2018. rd\_e\_gerdtot

## GROUPED BAR CHART

### Tertiary education attainment in the Nordic-Baltic countries (2016)

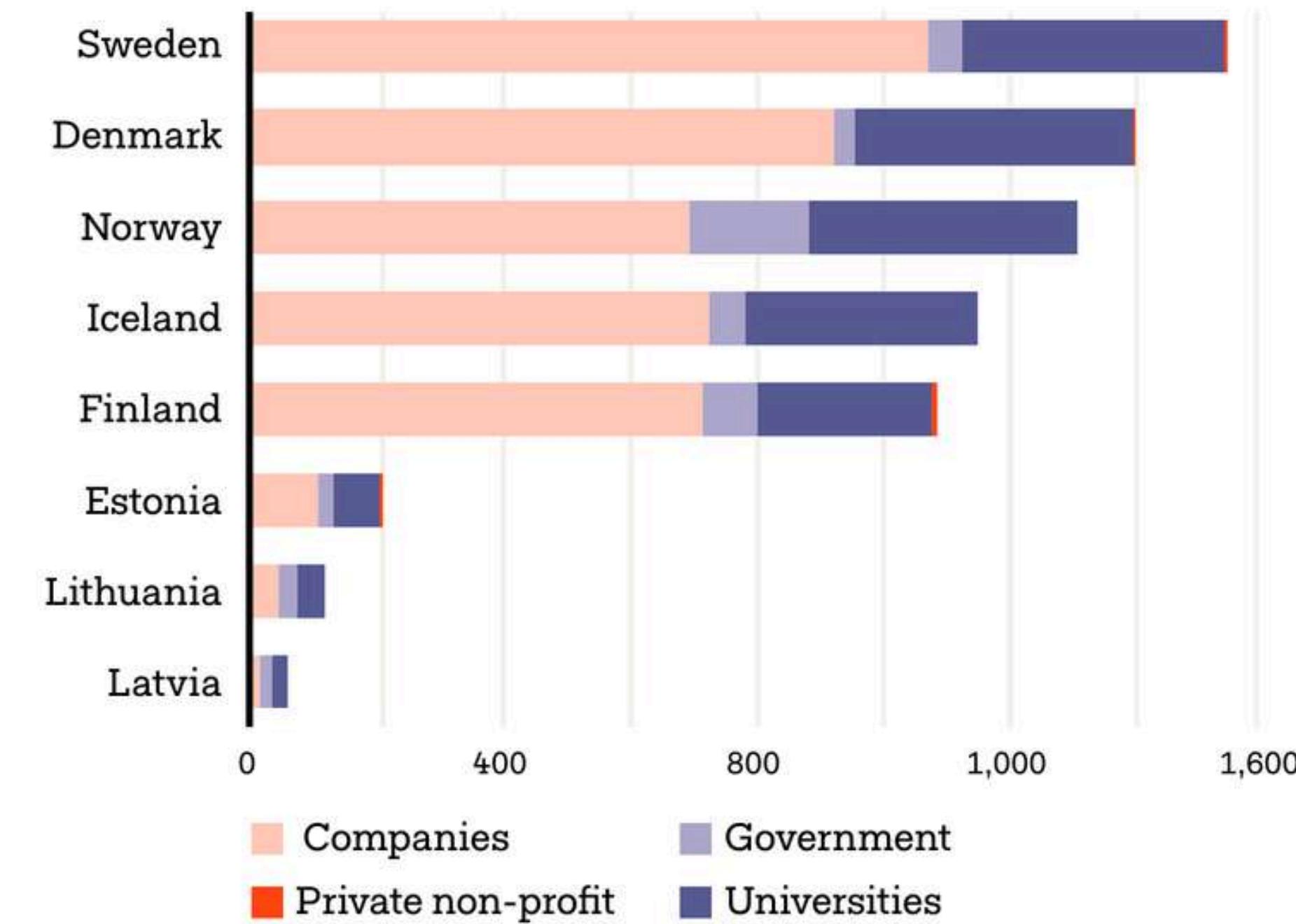
ISCED education levels 5-8, population aged 25-64, %



## STACKED BAR CHART

### R&D spending by sector in the Nordic-Baltic countries (2016)

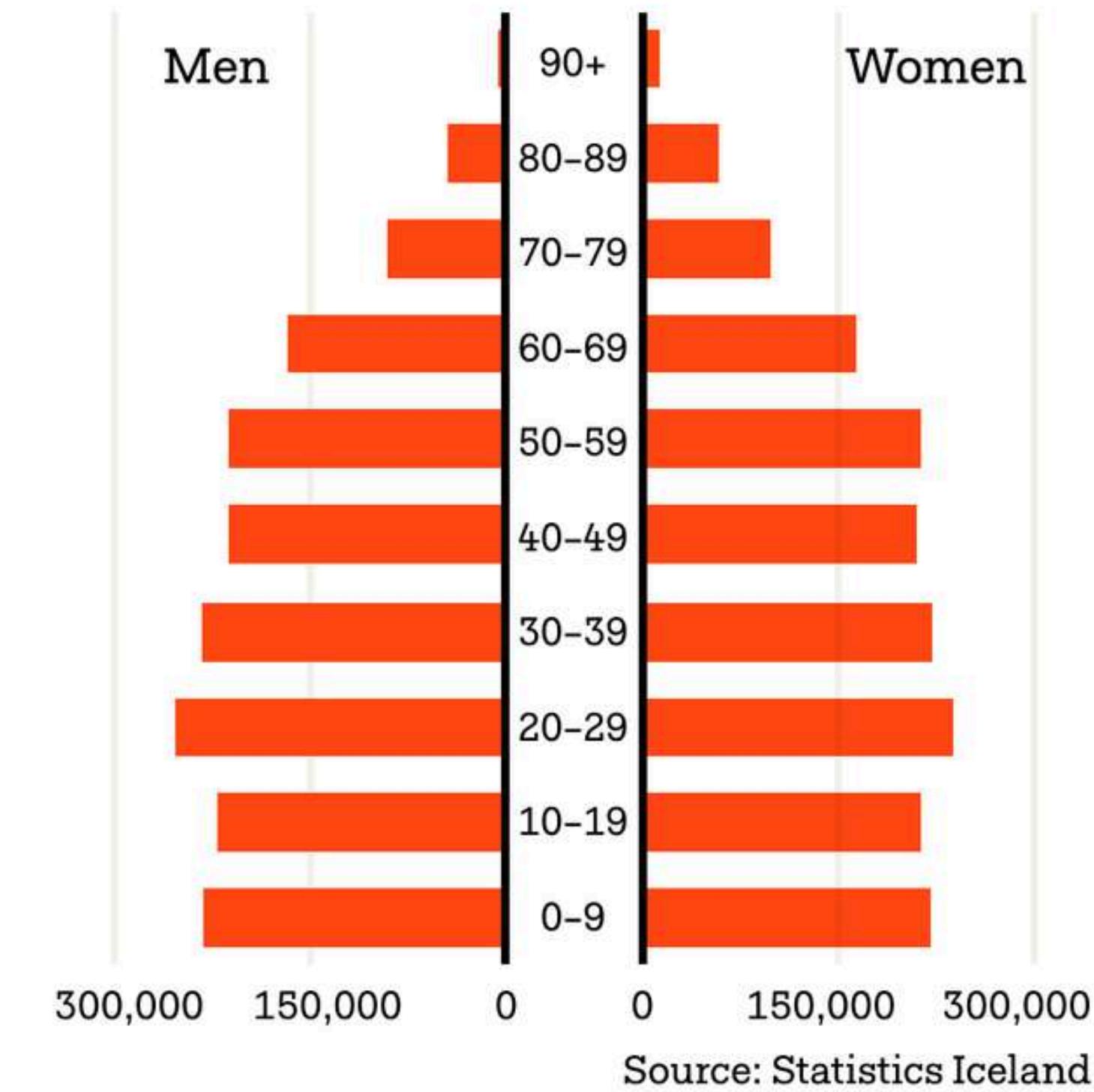
Euros per inhabitant



Source: Eurostat 2018. rd\_e\_gertot

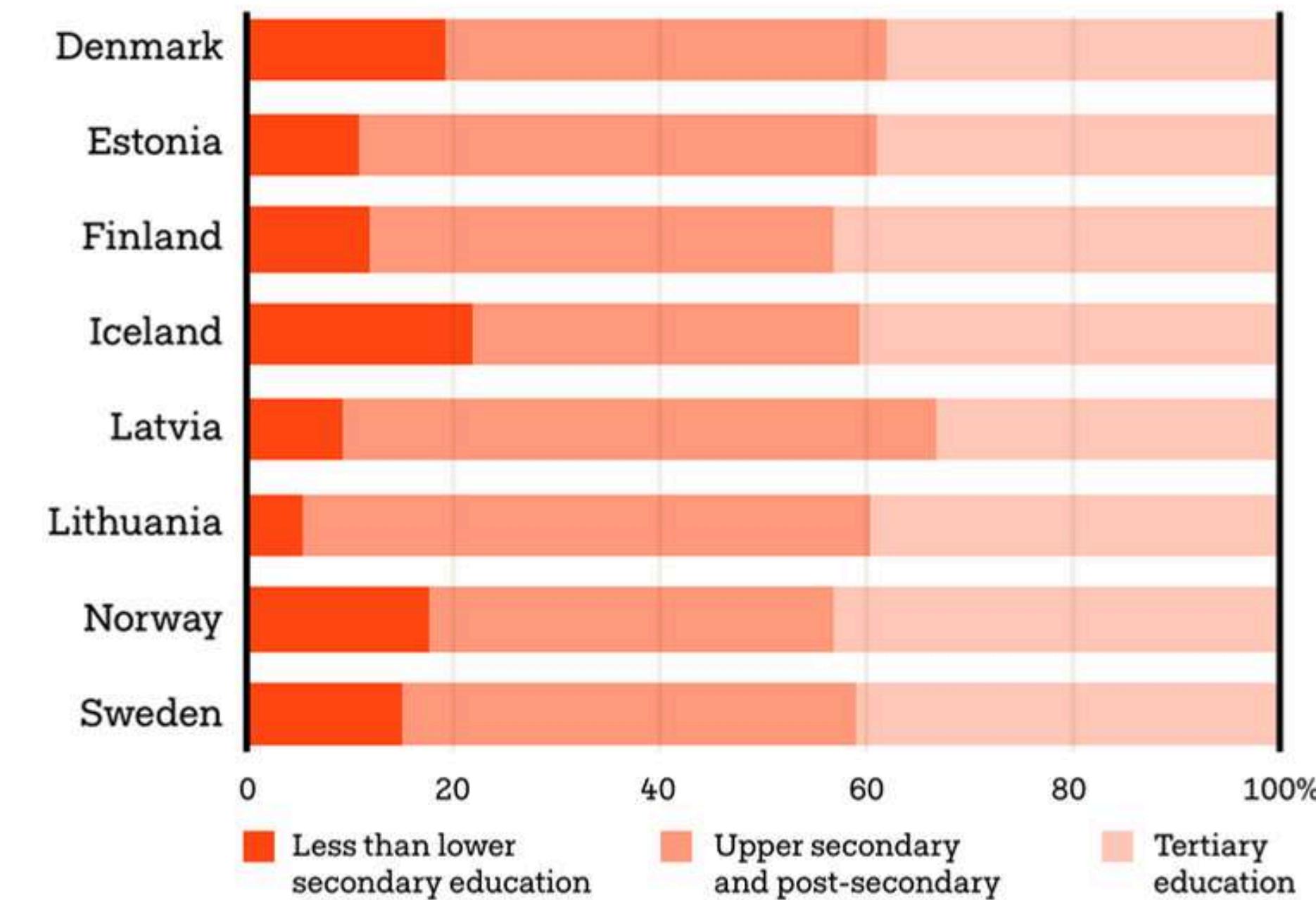
## PYRAMID CHART

### Population of Iceland (2016)



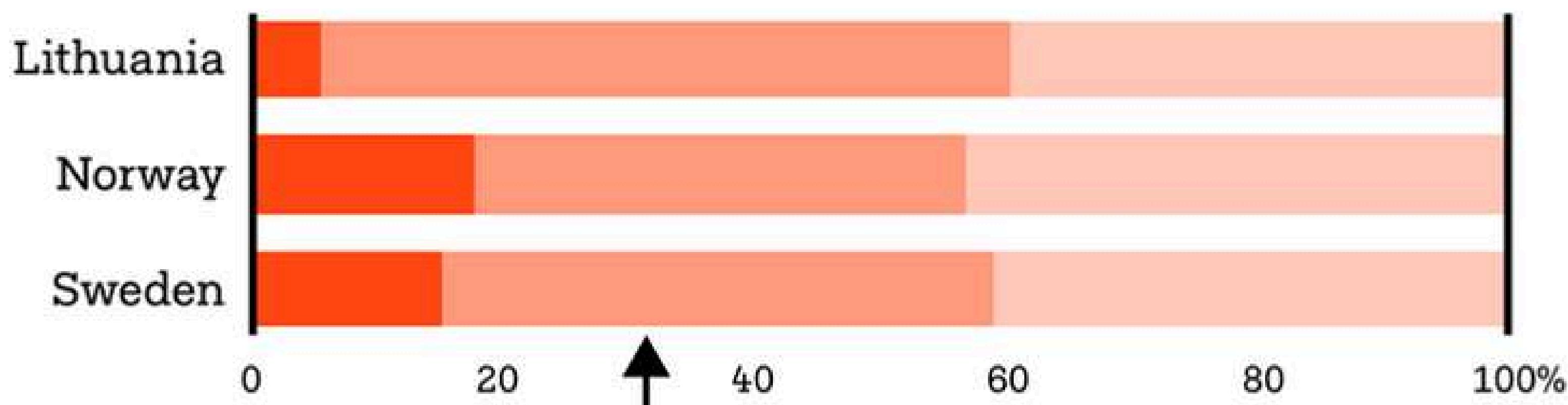
## 100% STACKED BAR CHART

### Educational attainment (2016) Population aged 25-64, %



Source: Eurostat 2018. edat\_lfse\_04

Comparing values at the beginning and the end of the bars is relatively easy



Comparing other parts or values from different parts of the bars is more difficult, since they don't share a baseline

## HISTOGRAM

### Tertiary education attainment in Europe (2017)

Percentage of population aged 25–64 with a university degree, NUTS2 regions ( $n = 318$ )

Count

60

50

40

30

20

10

0

0

5

10

15

20

25

30

35

40

45

50

55

60

65

70

75

%

Source: Eurostat 2018. *edat\_lfse\_04*

Count

60

50

40

30

20

10

0

0

5

10

15

20

25

30

35

40

45

50

55

60

65

70

75

%

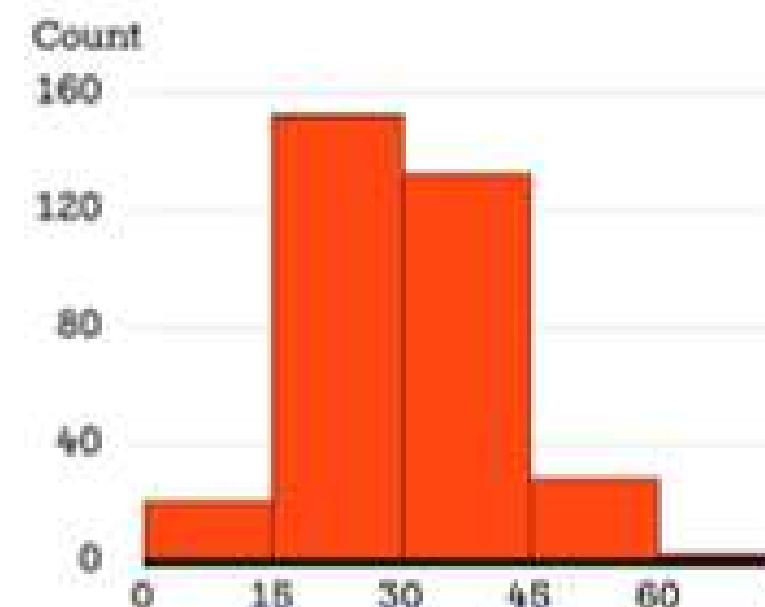
Source: Eurostat 2018. *edat\_lfse\_04*

## THE EFFECT OF BIN SIZE ON HISTOGRAM SHAPE

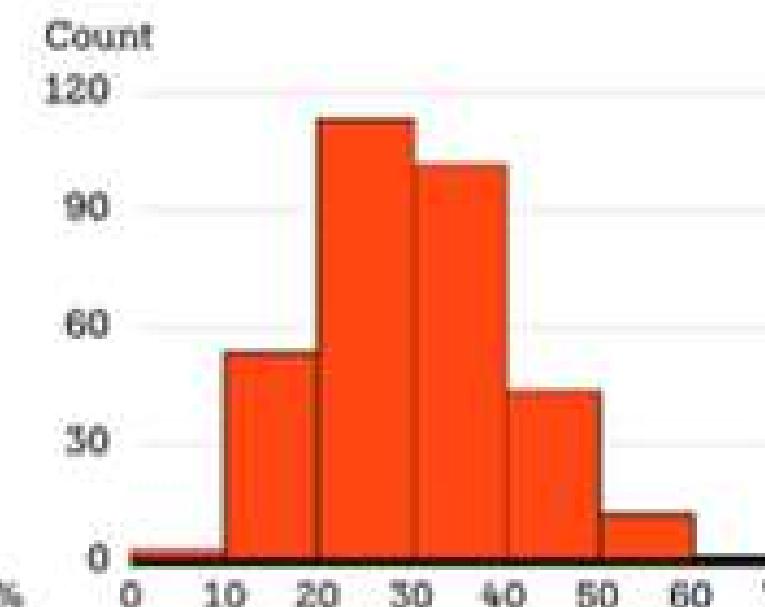
Percentage of population aged 25-64 with a university degree, NUTS2 regions

318 observations

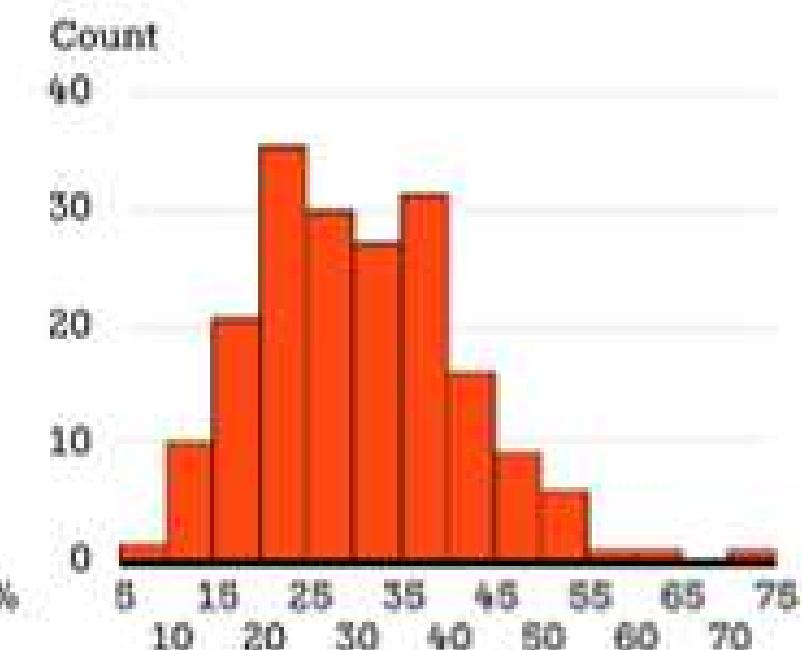
BIN SIZE 15 • 6 BINS



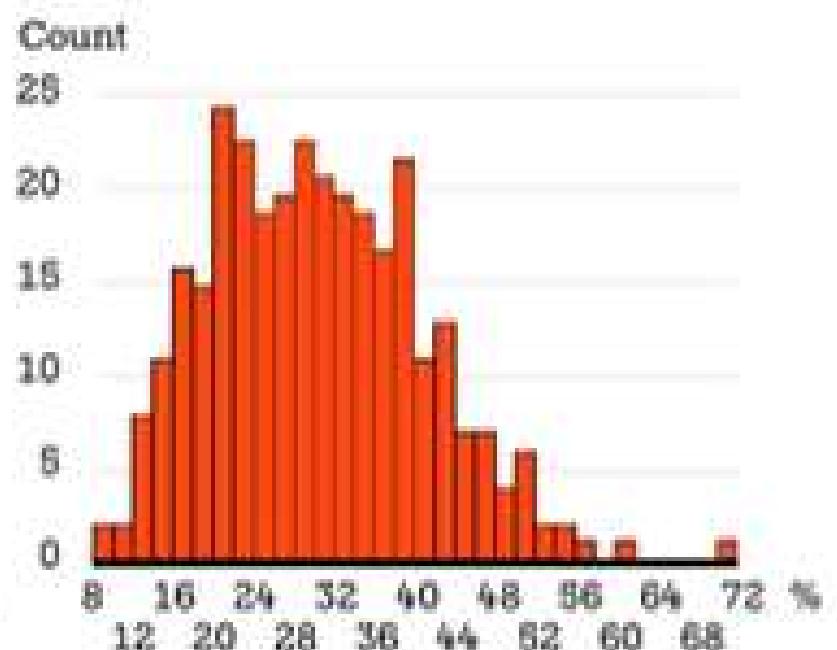
BIN SIZE 10 • 7 BINS



BIN SIZE 5 • 14 BINS



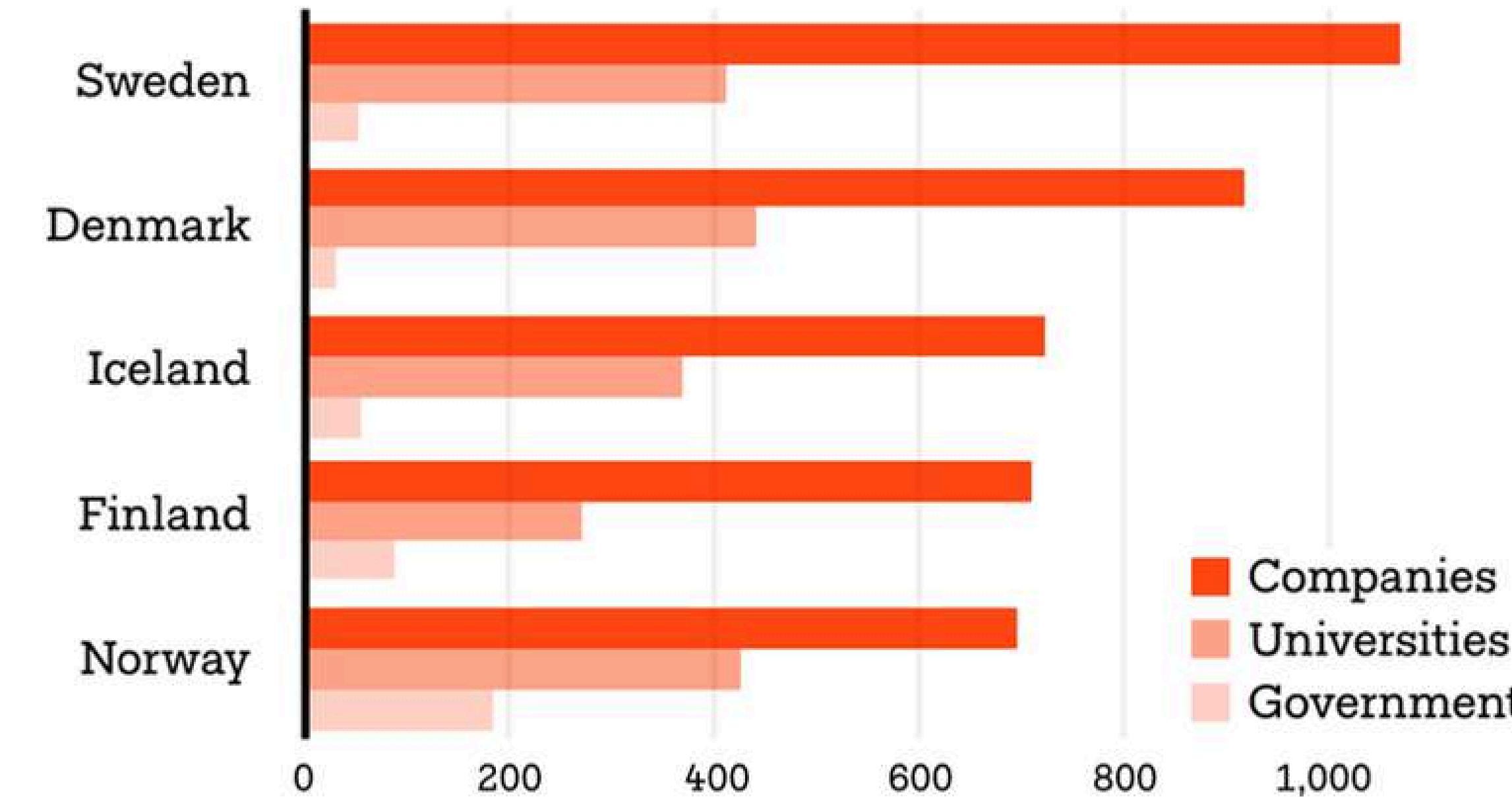
BIN SIZE 2 • 32 BINS



Source: Eurostat 2018. edat\_ifse\_04

# Nordic R&D spending by sector (2016)

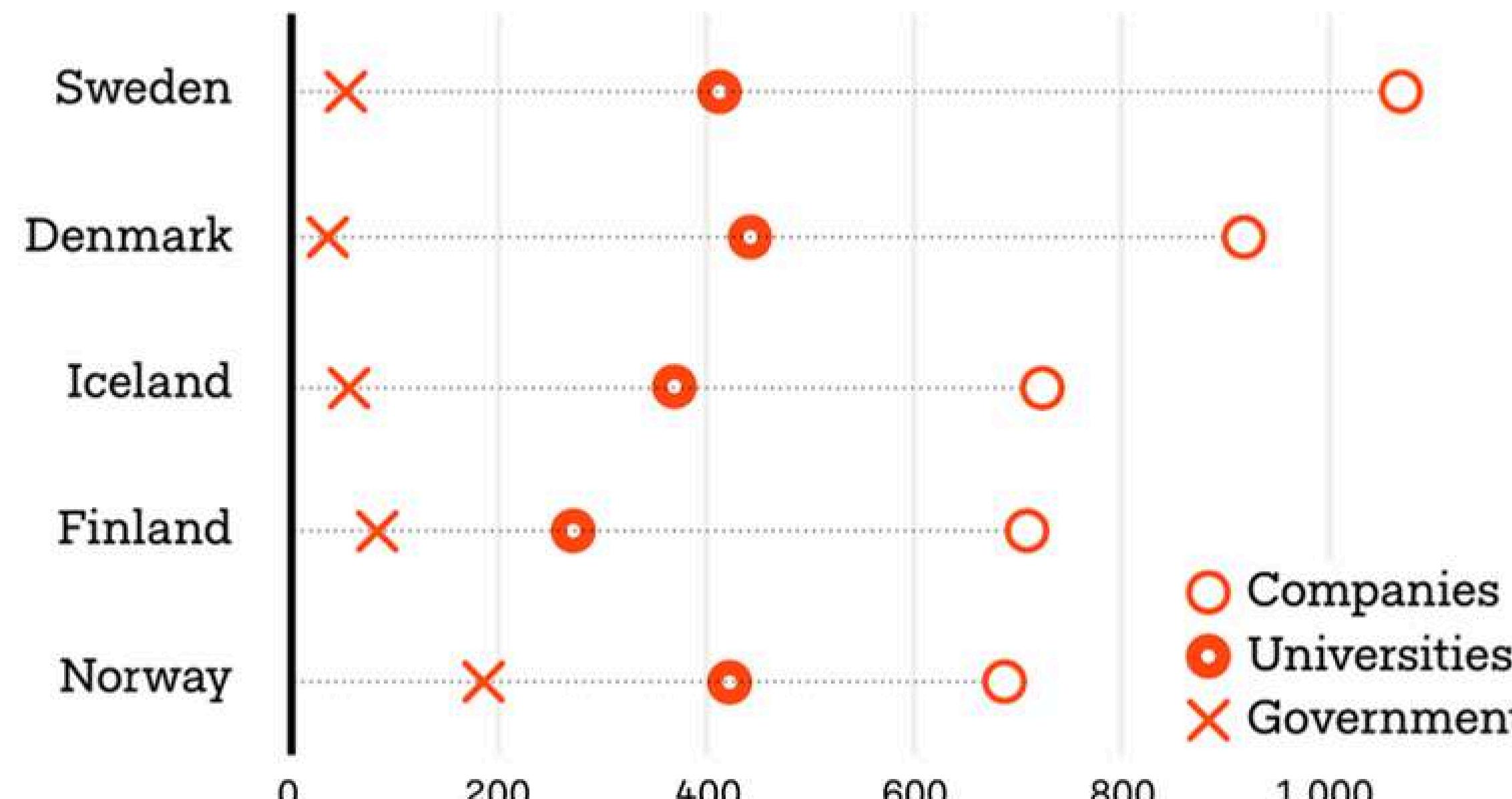
Euros per inhabitant



## DOT PLOT

### Nordic R&D spending by sector (2016)

Euros per inhabitant



Source: Eurostat 2018. *rd\_e\_gerdtot*

## DISTINCTIVE PLOTTING SYMBOLS

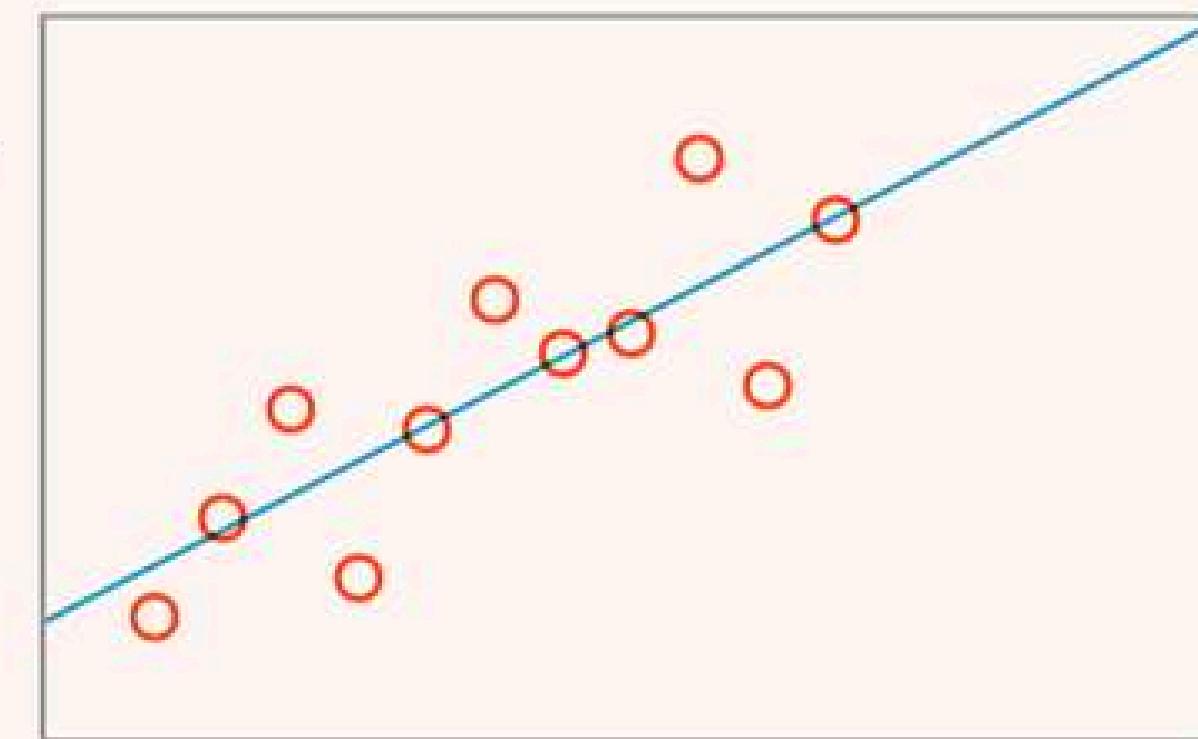
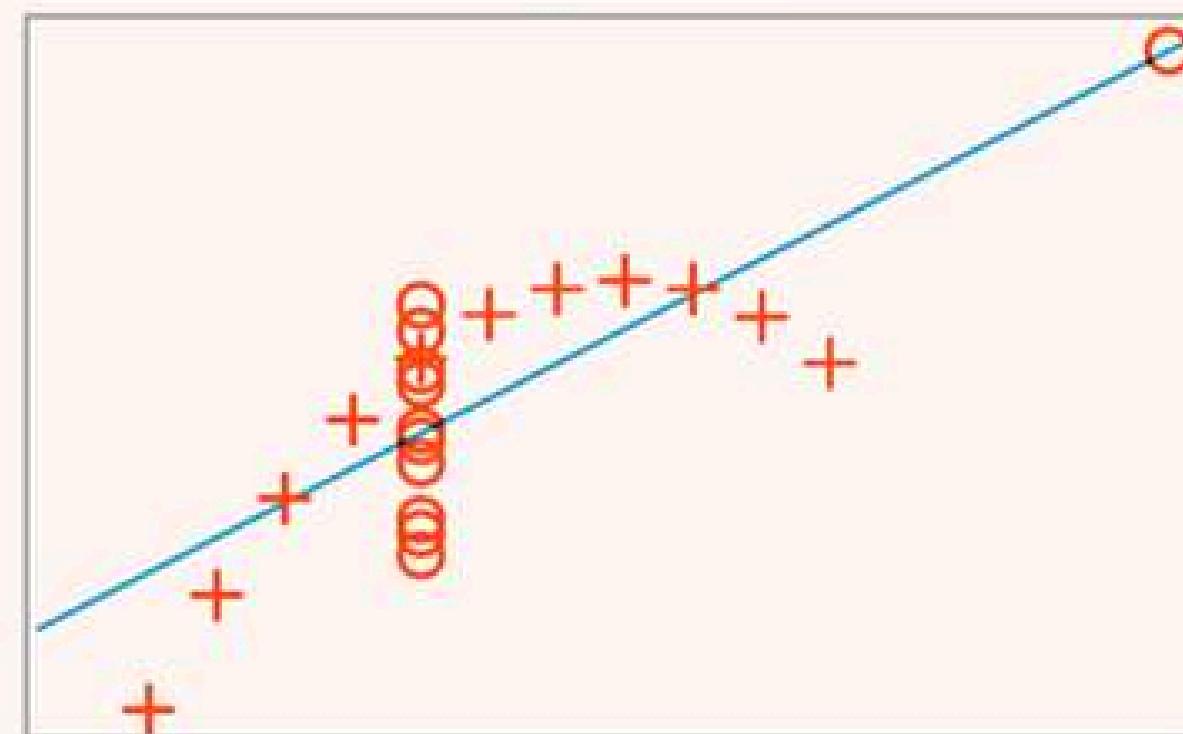
Symbols that can be used when there are few overlapping data points →



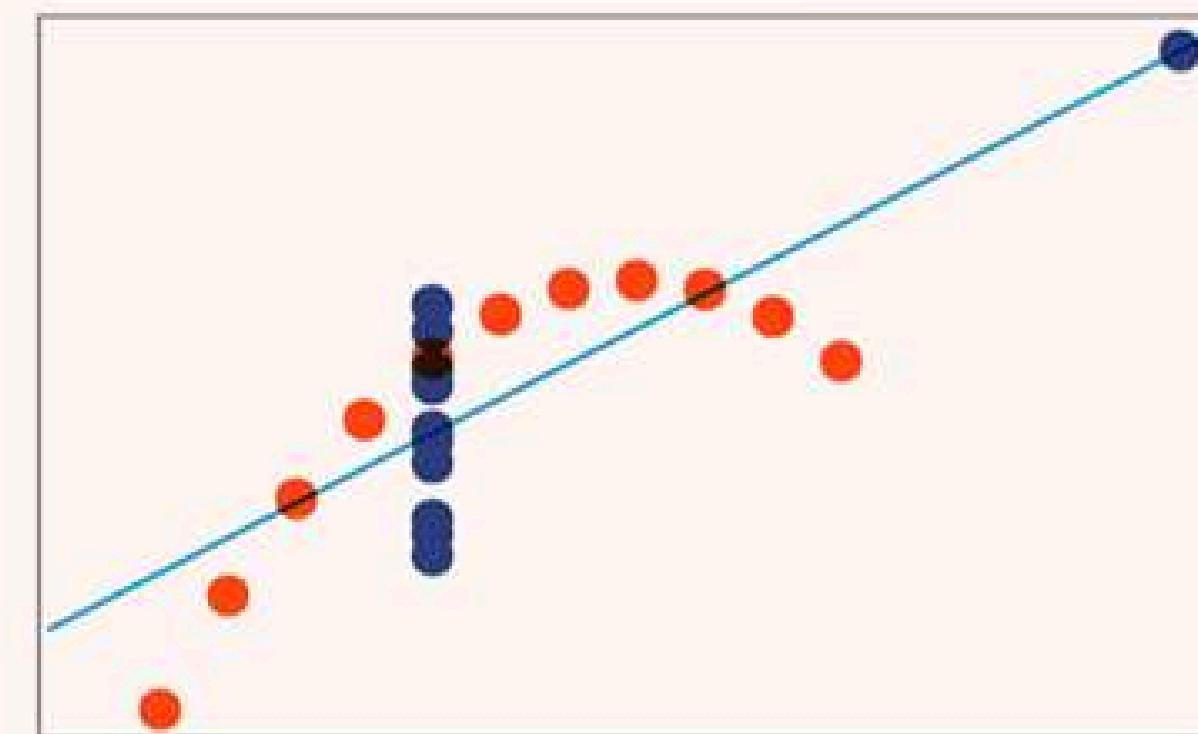
Symbols that stand out from each other if there are many overlapping data points



Good symbol separation



Poor symbol separation



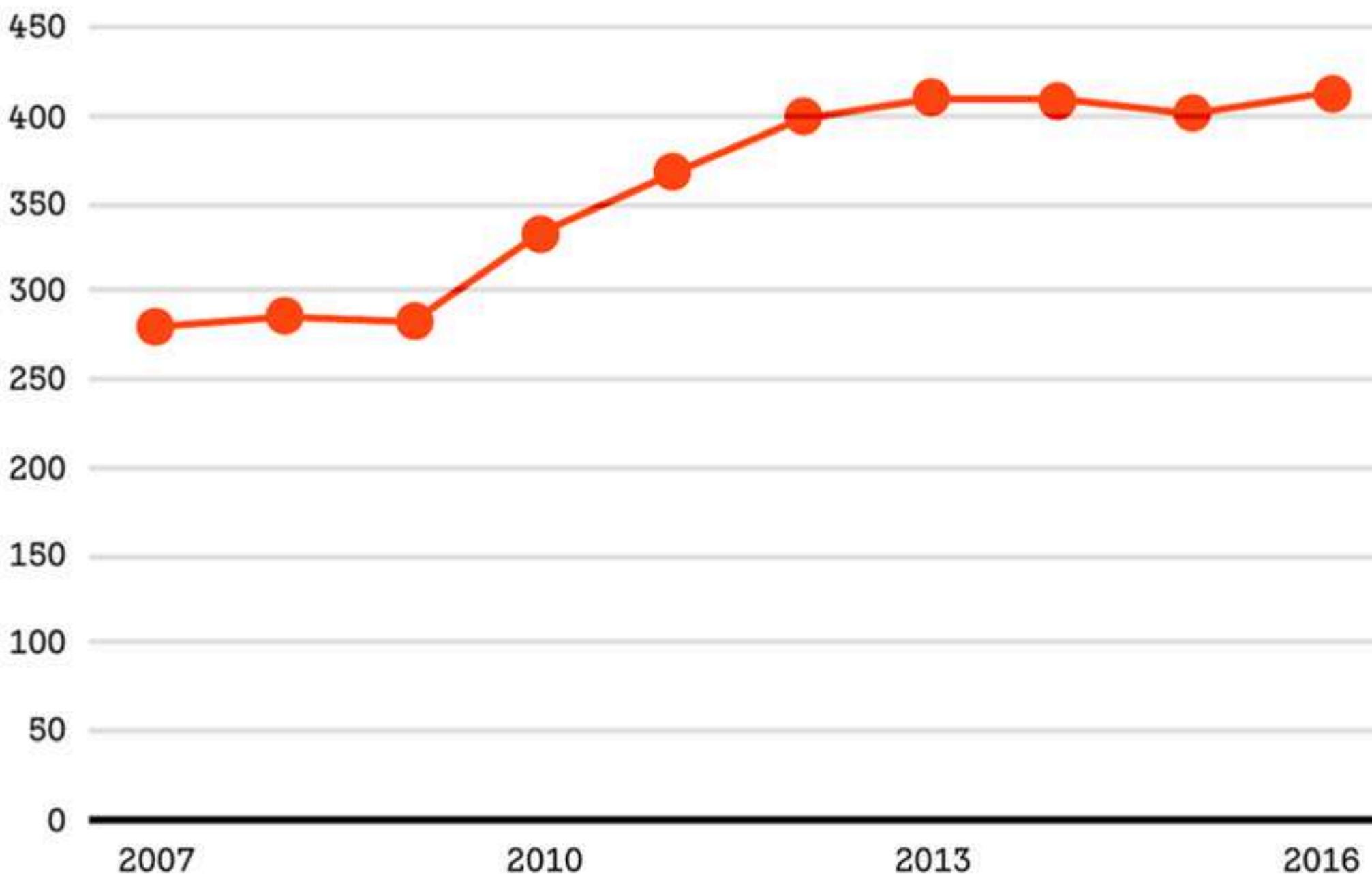
These plotting symbols, introduced by William Cleveland in his book *The elements of graphing data* (1985/1994), are suitable for use in dot plots, scatter plots and strip plots with many overlapping points.

Compared to filled dots, these symbols are easier to visually separate from each other when they overlap, because the basic shapes of the symbols are clearly different.

## LINE CHART

### Higher education spending in Sweden (2007-2016)

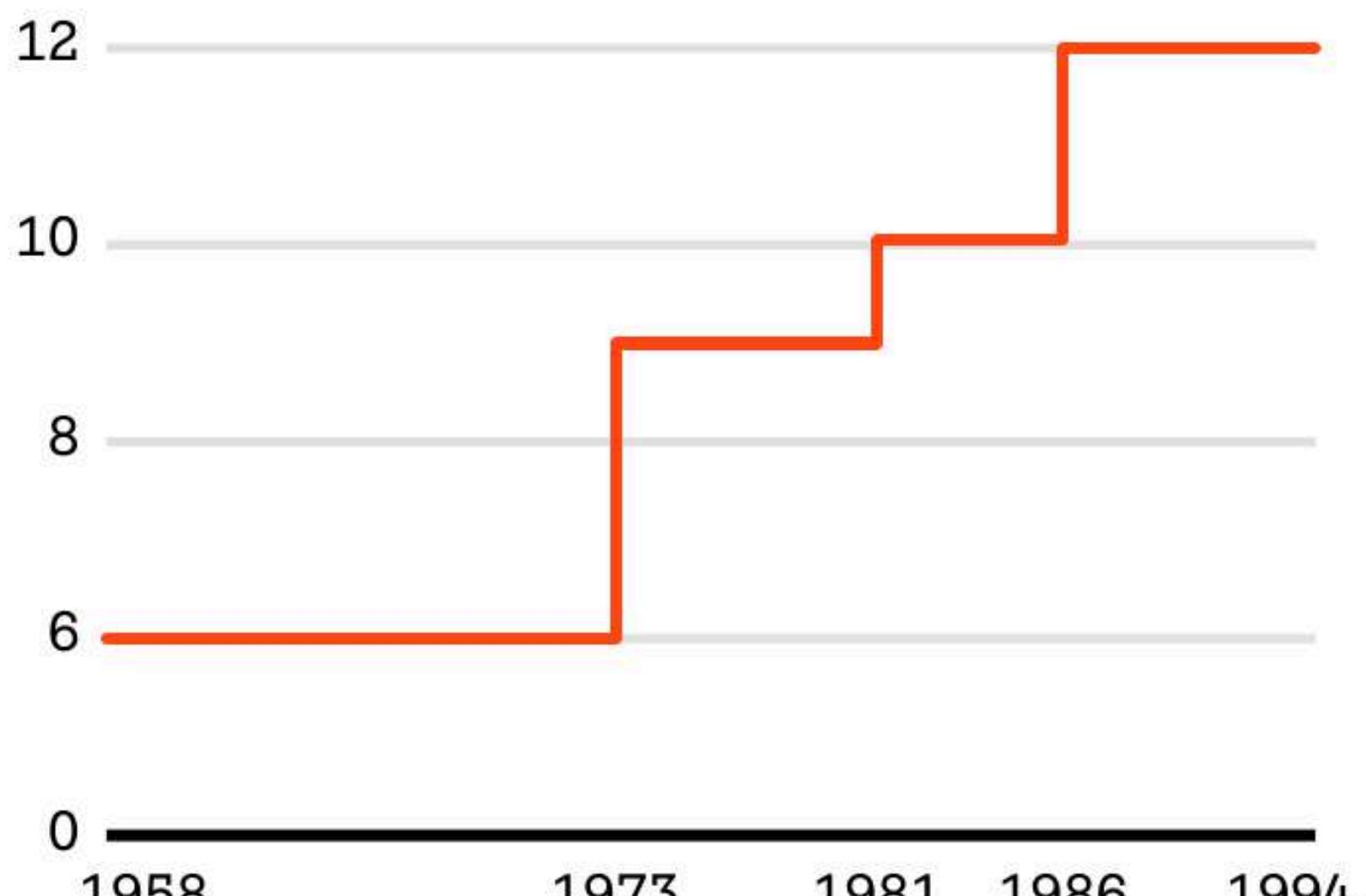
Euros per inhabitant



Source: Eurostat 2018. *rd\_e\_gerdtot*

## STEPPED LINE CHART

The number of EEC/EC/EU member states

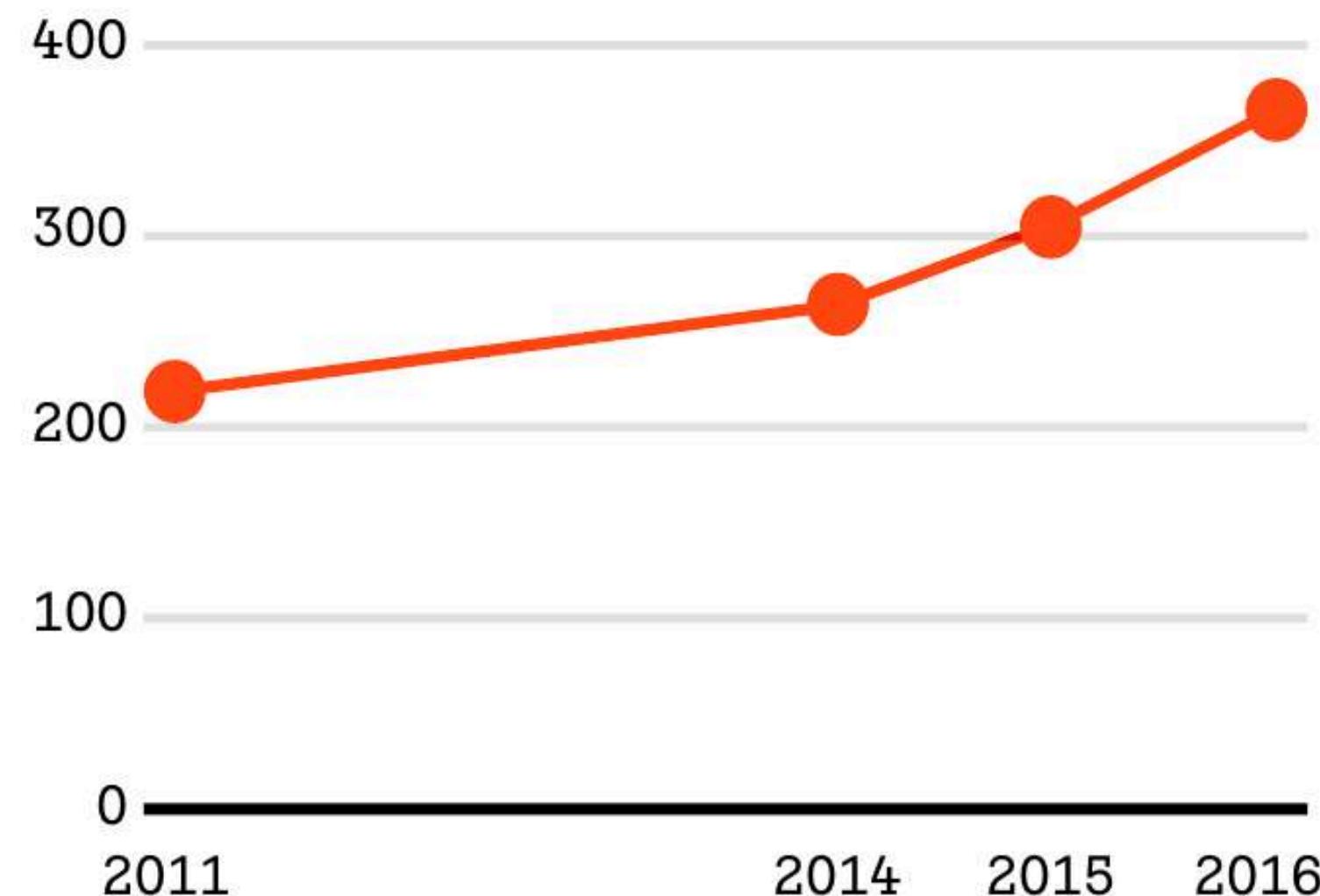


Source: European Union

## UNEVENLY SPACED DATA POINTS

### Higher education spending in Iceland (2011–2016)

Euros per inhabitant

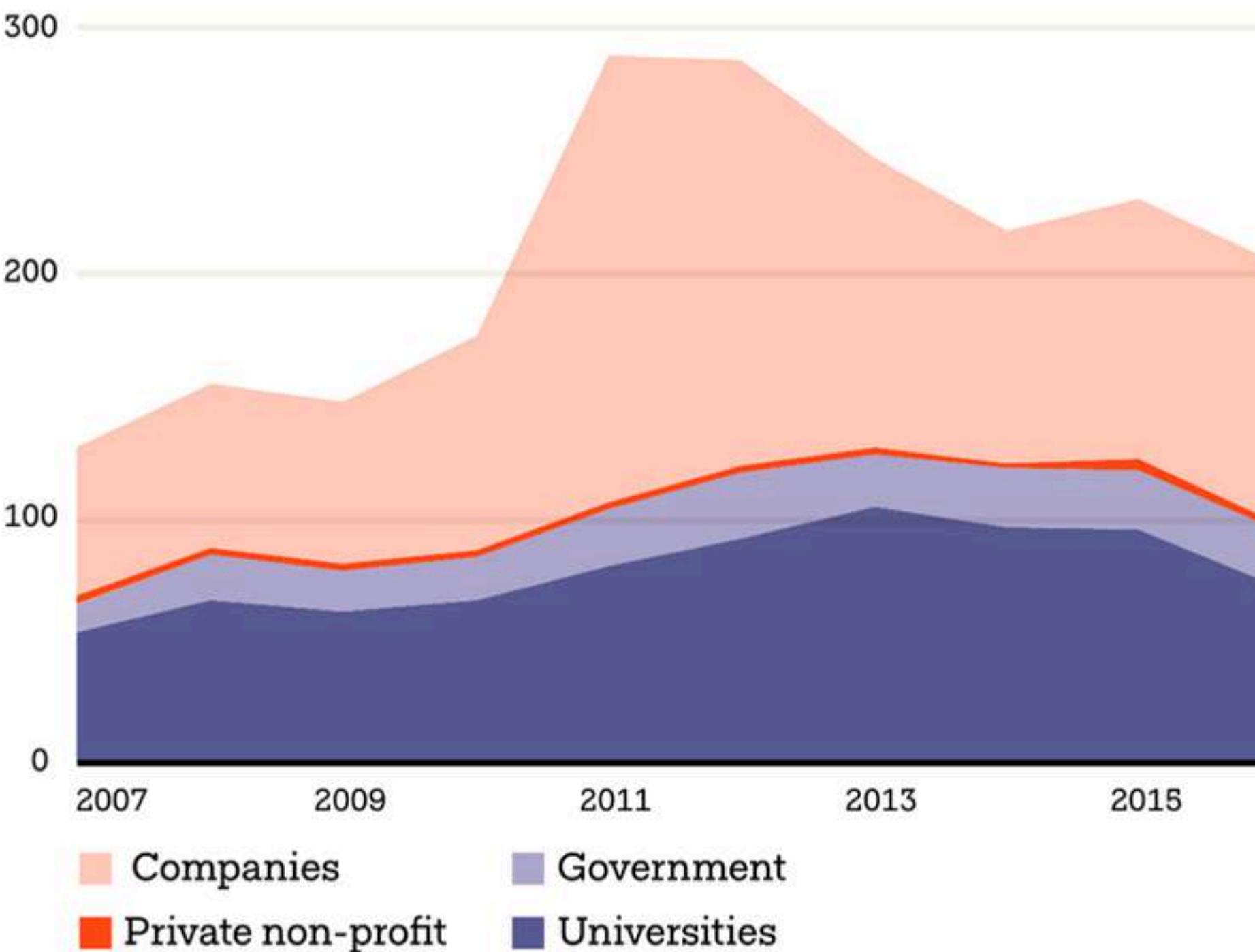


Source: Eurostat 2018. *rd\_e\_gerdtot*

## AREA CHART

### R&D spending by sector in Estonia (2007–2016)

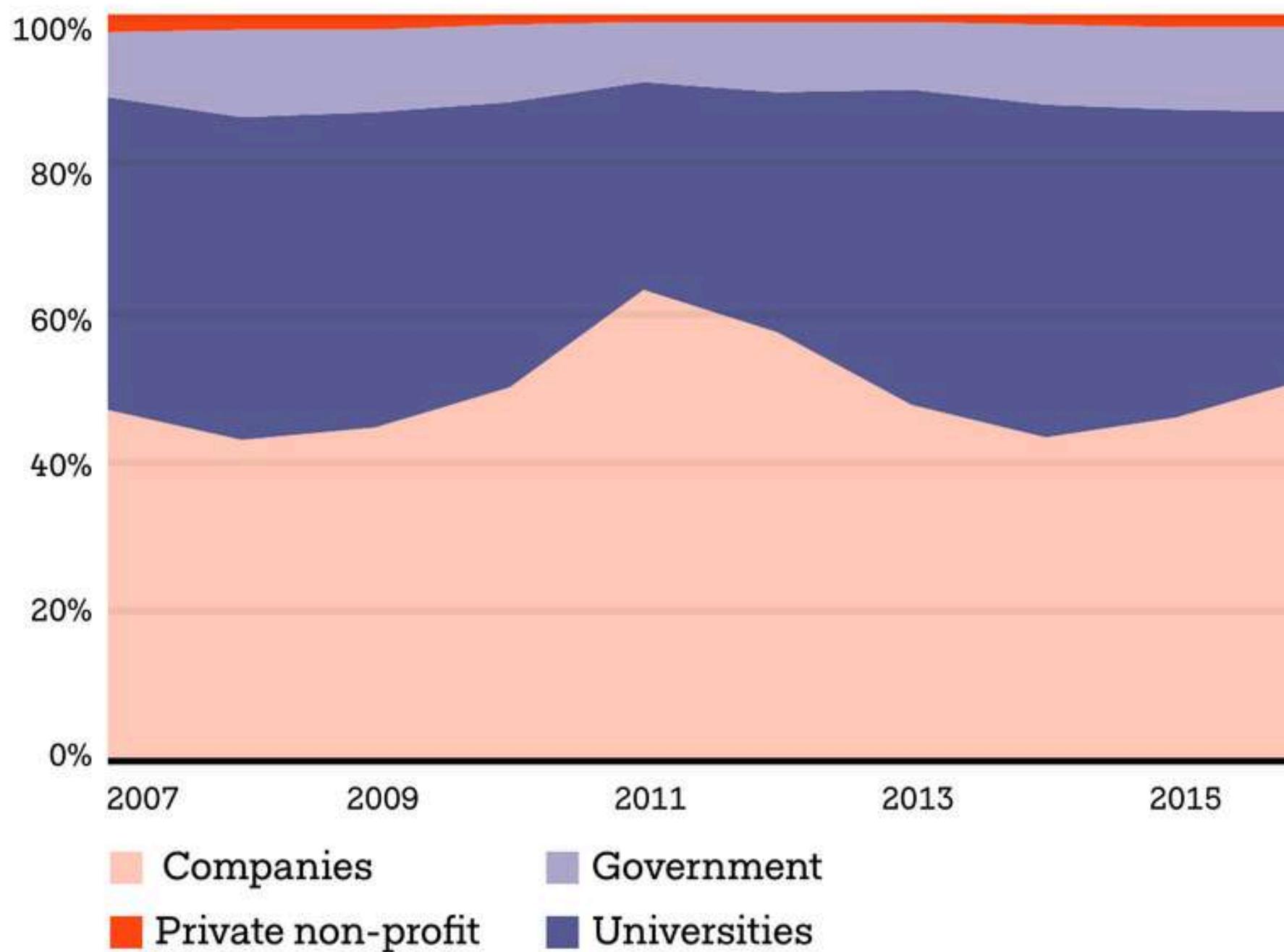
Euro per inhabitant



## 100% STACKED LINE CHART

### R&D spending by sector in Estonia (2007–2016)

Percentage of total spending, %

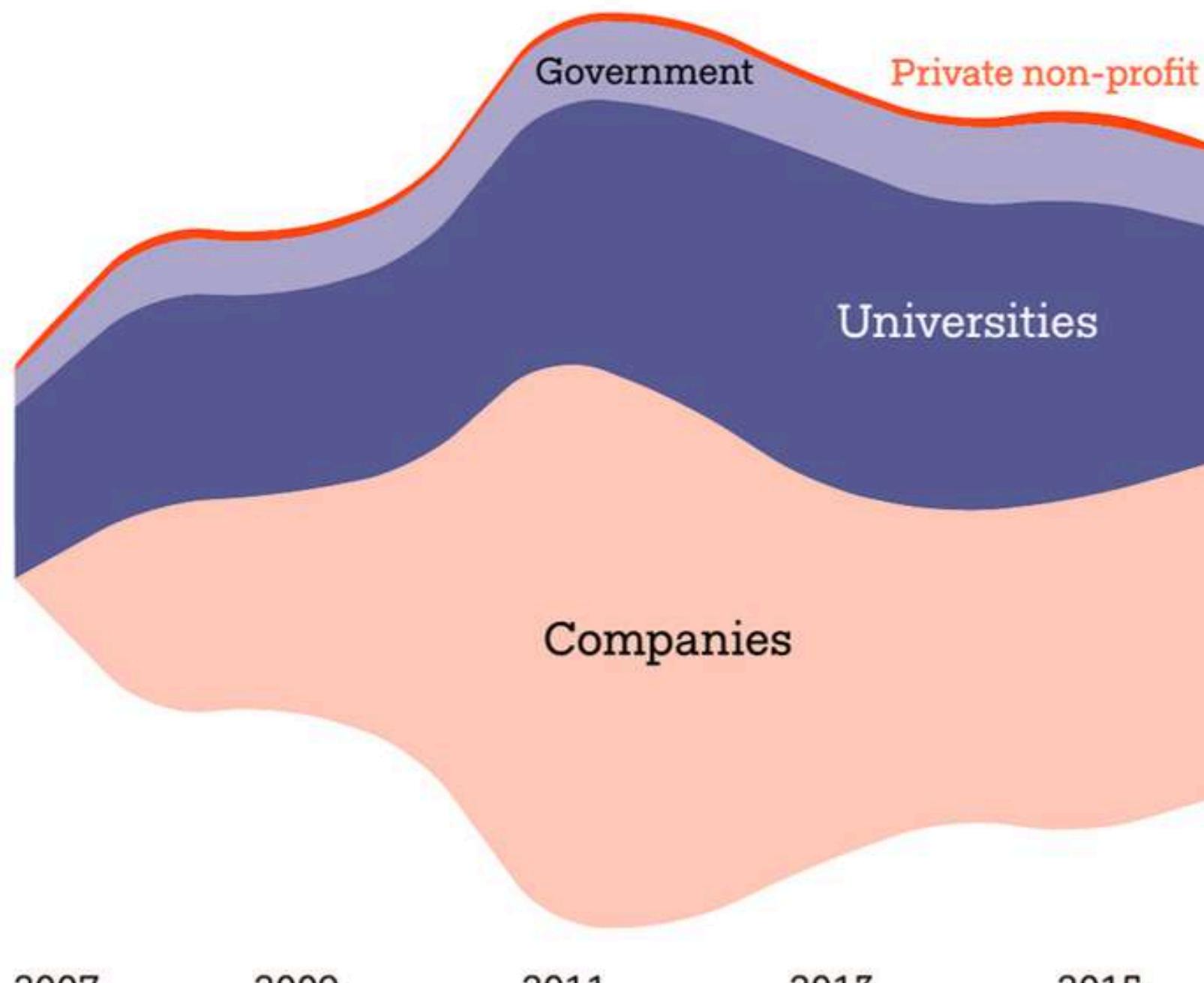


Source: Eurostat 2018. [rd\\_e\\_qerdtot](#)

## STREAMGRAPH

# R&D spending by sector in Estonia

Spending per inhabitant (euros)



2007

2009

2011

2013

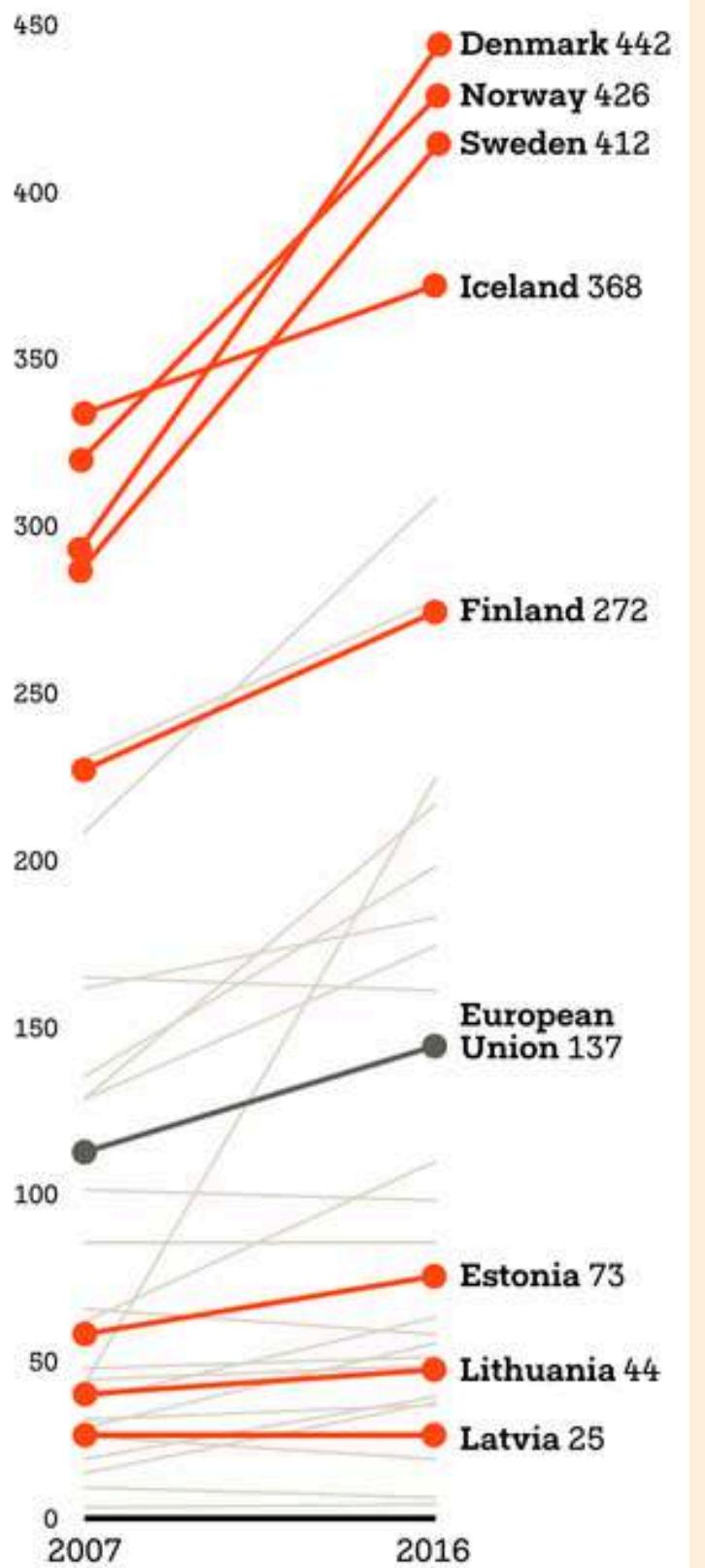
2015

Source: Eurostat 2018. rd\_e\_gertot

## SLOPEGRAPH

### Higher education spending in Europe (2007–2016)

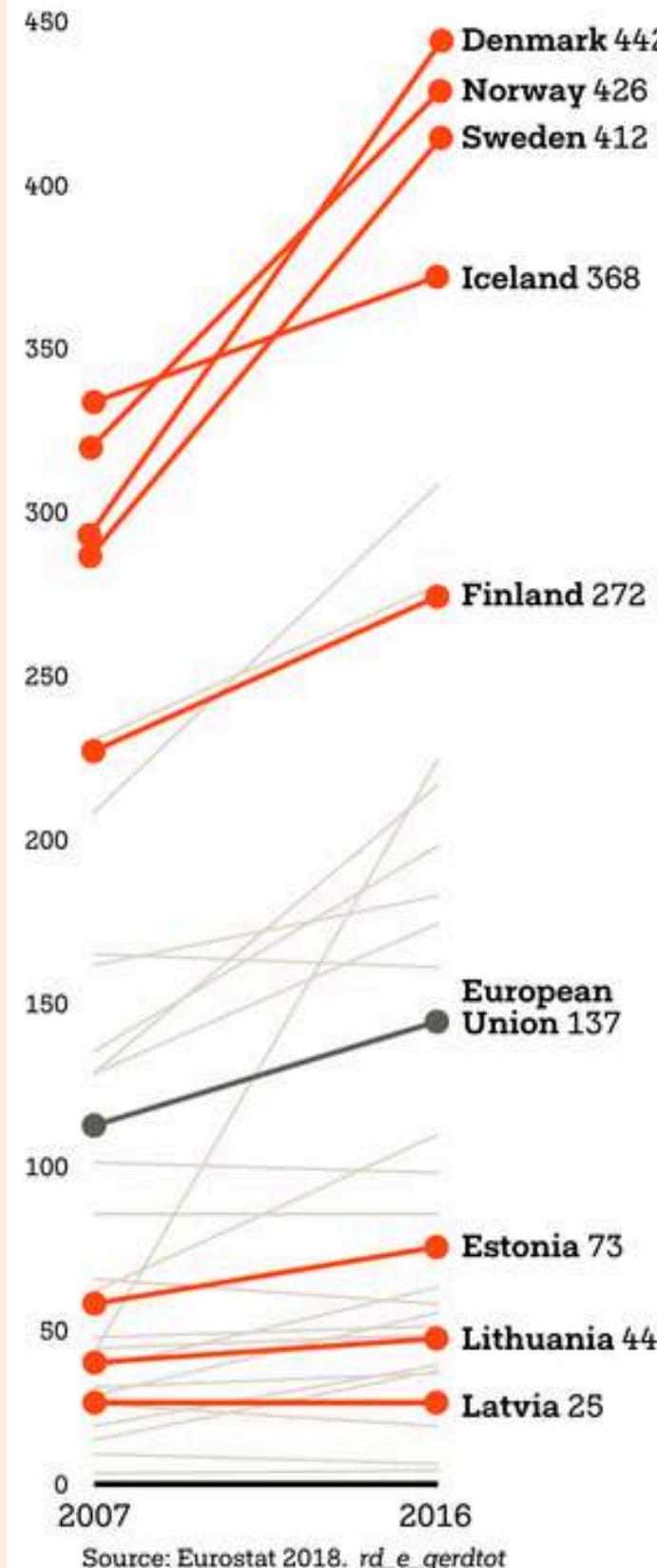
Euros per inhabitant



### SLOPEGRAPH

#### Higher education spending in Europe (2007–2016)

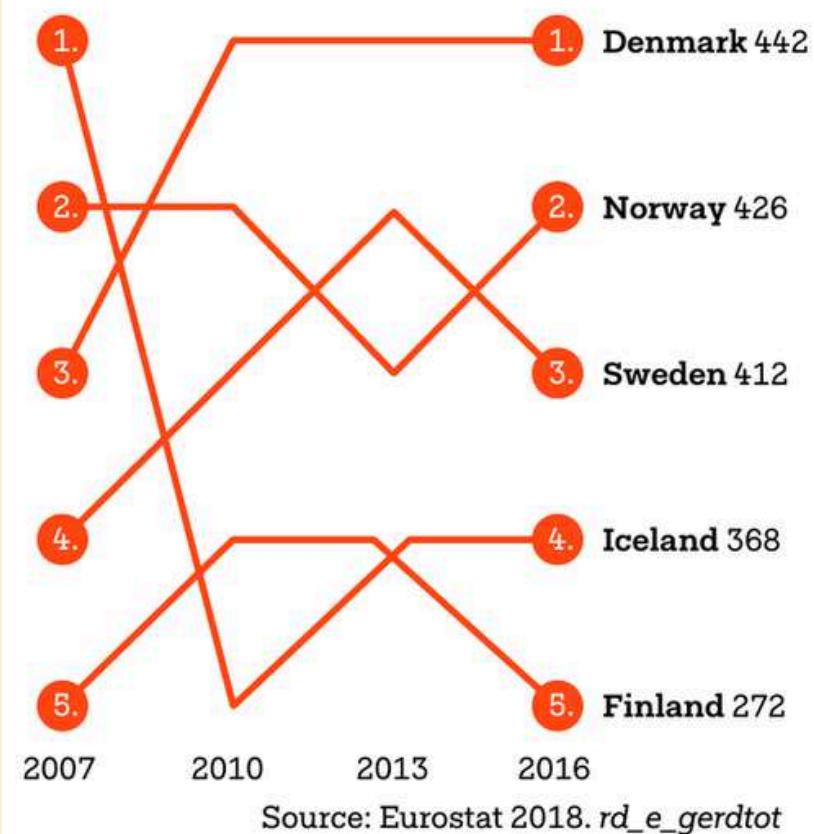
Euros per inhabitant



### BUMPS CHART

#### Higher education spending ranking of the Nordic countries

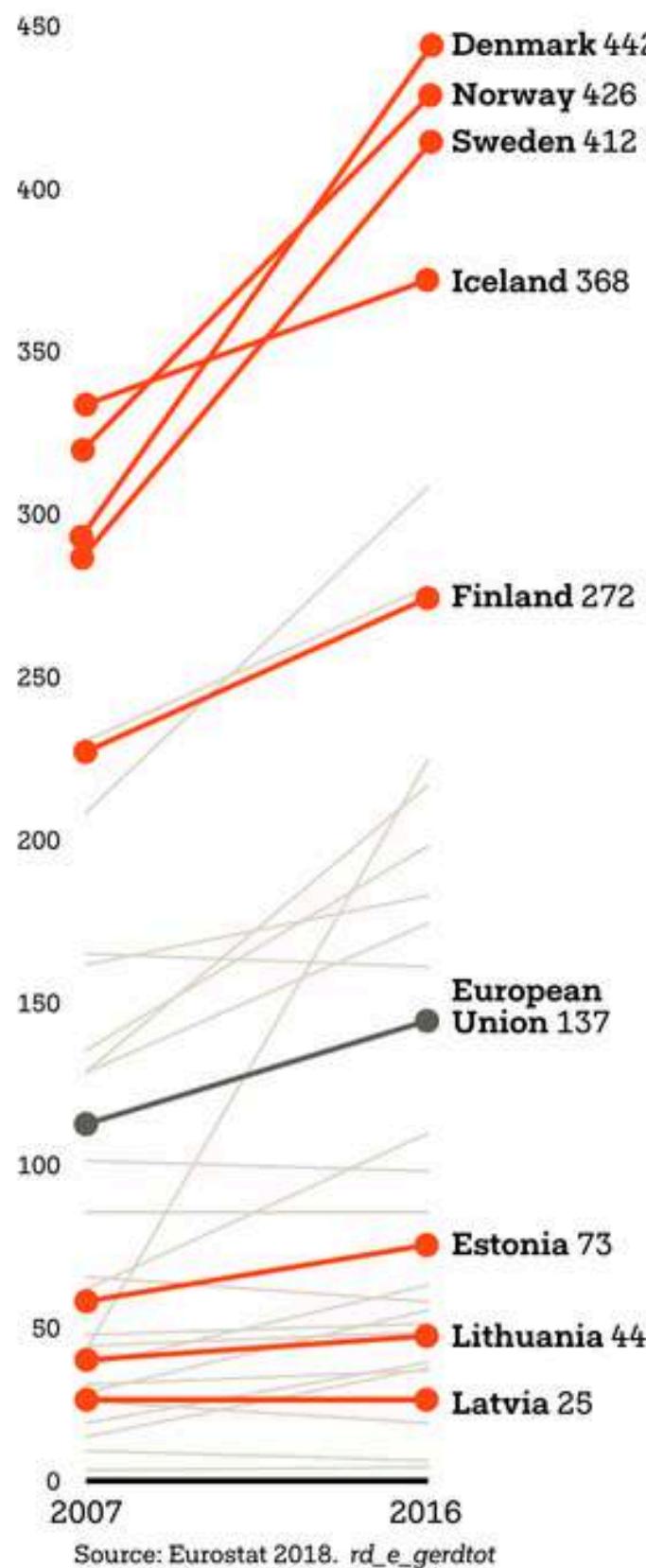
Based on spending per inhabitant (euros)



Source: Eurostat 2018. rd\_e\_gerdtot

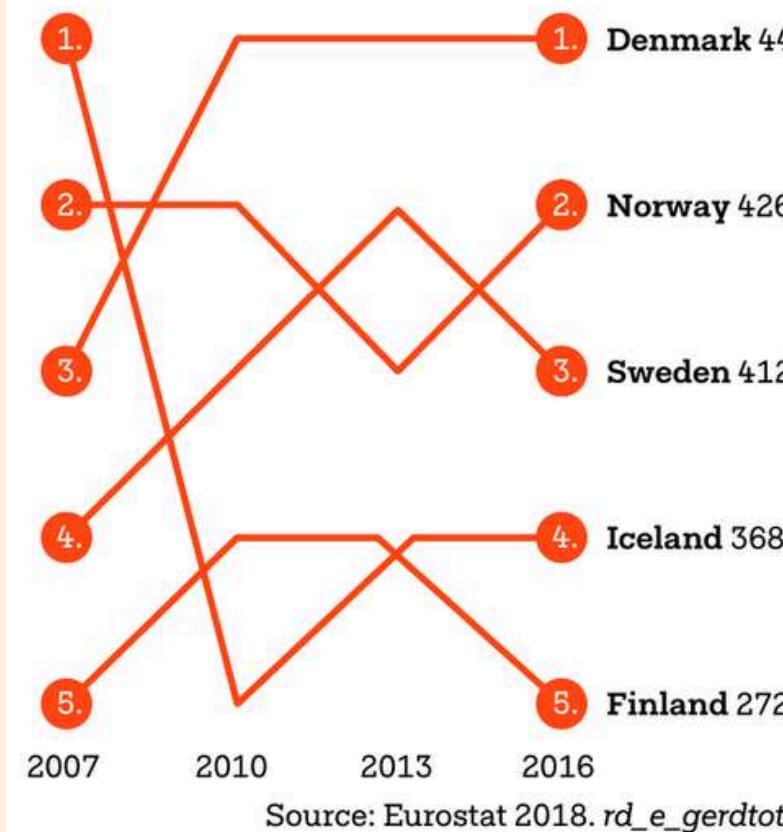
### SLOPEGRAPH

#### Higher education spending in Europe (2007–2016) Euros per inhabitant



### BUMPS CHART

#### Higher education spending ranking of the Nordic countries Based on spending per inhabitant (euros)



### SPARKLINES

#### Higher education spending in Nordic-Baltic countries

Euros per inhabitant



## CYCLE PLOT

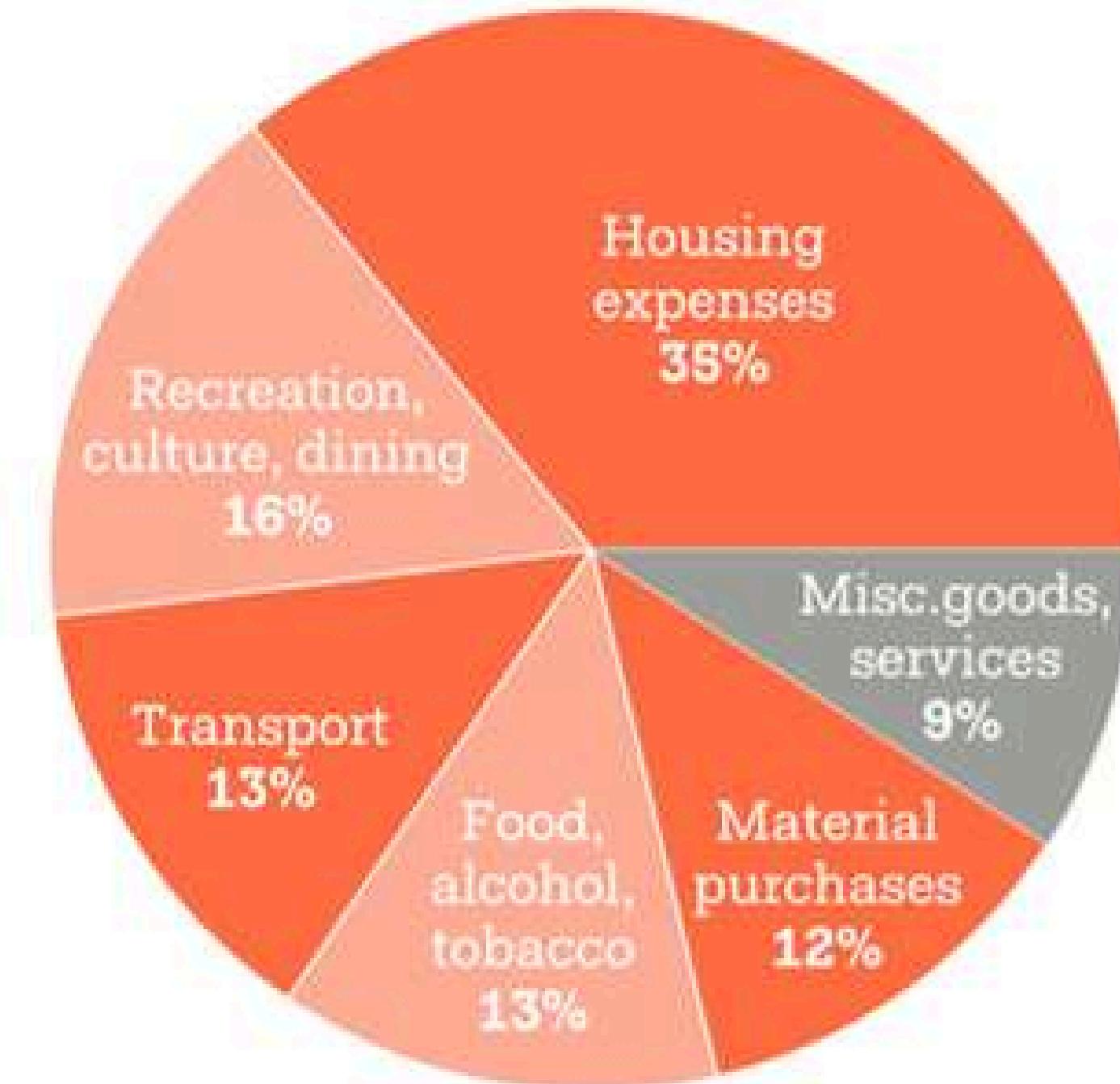
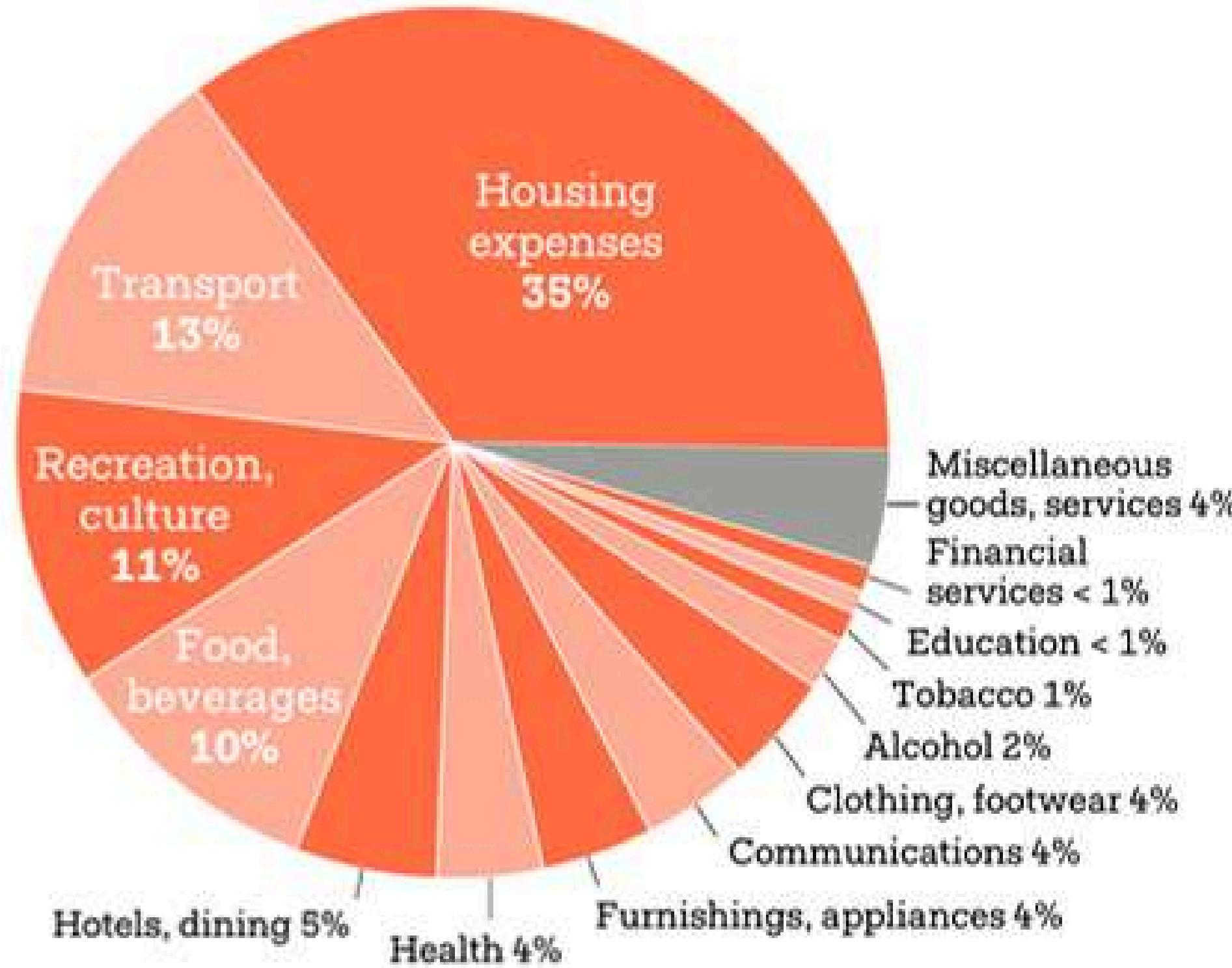
### Average monthly temperatures in Ivalo, Finland 1960-2017

Degrees in Celcius (C°), five-year moving average



Source: Finnish Meteorological Institute (FMI) 2018

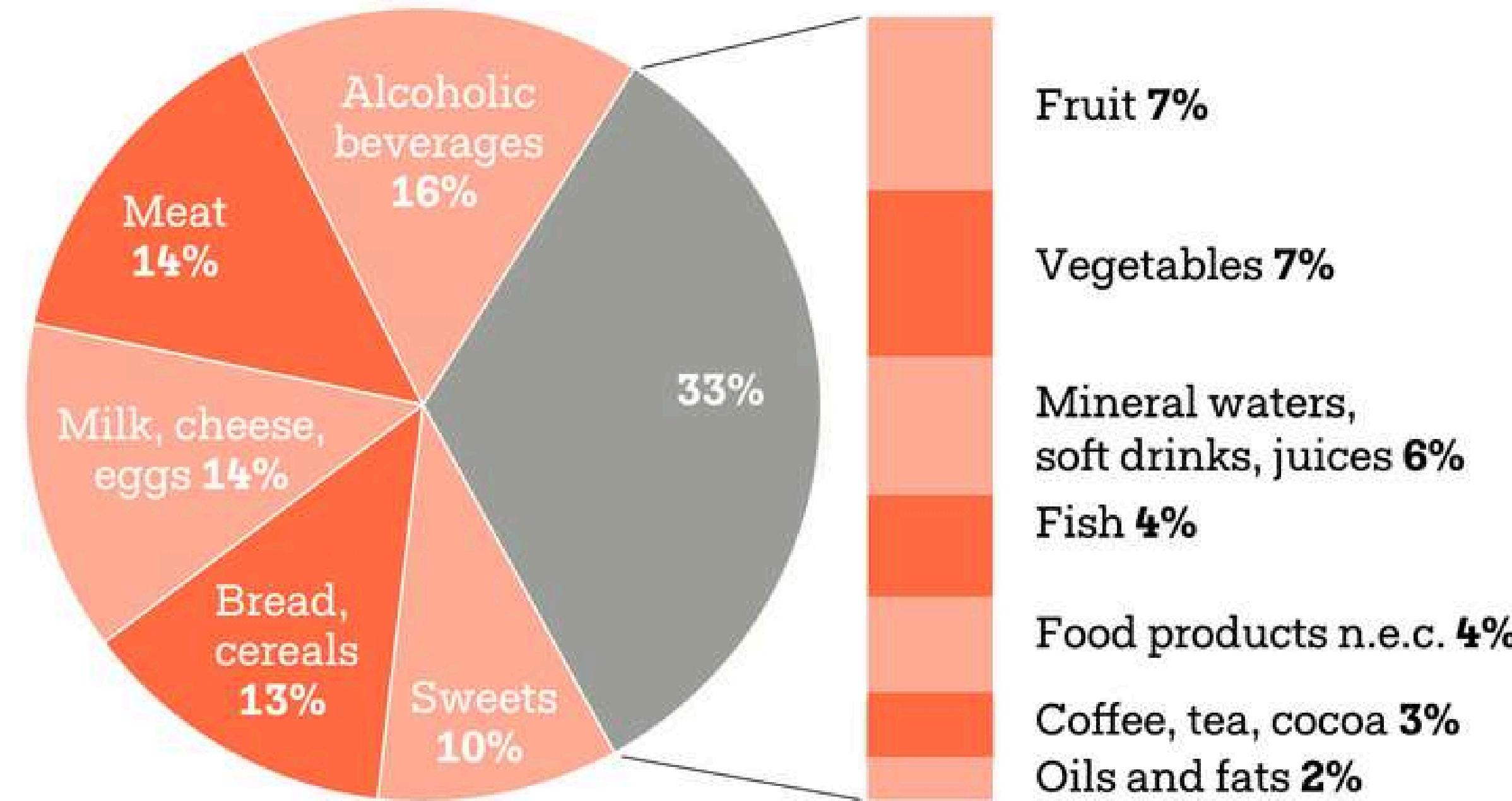
# Single-person household expenditures in Iceland (2013-2016)



Source: Statistics Iceland

The pie chart on the left includes too many slices to be clear or insightful.

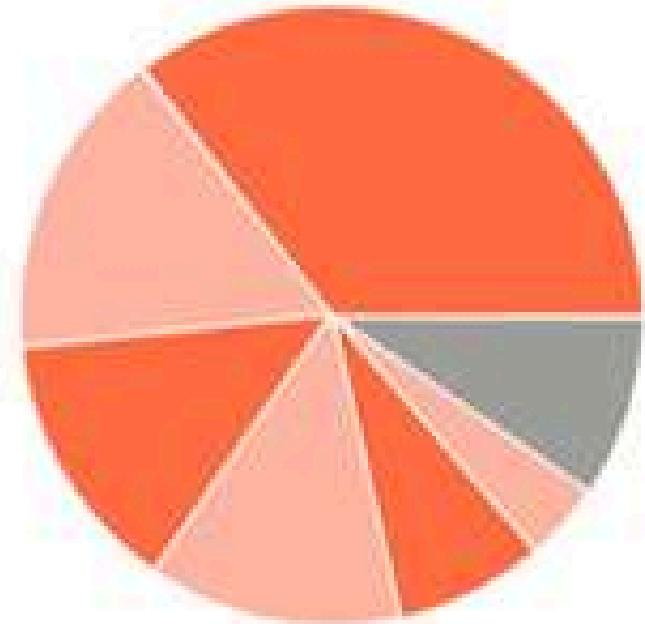
# Single-person food and drink expenditures in Iceland (2013–2016)



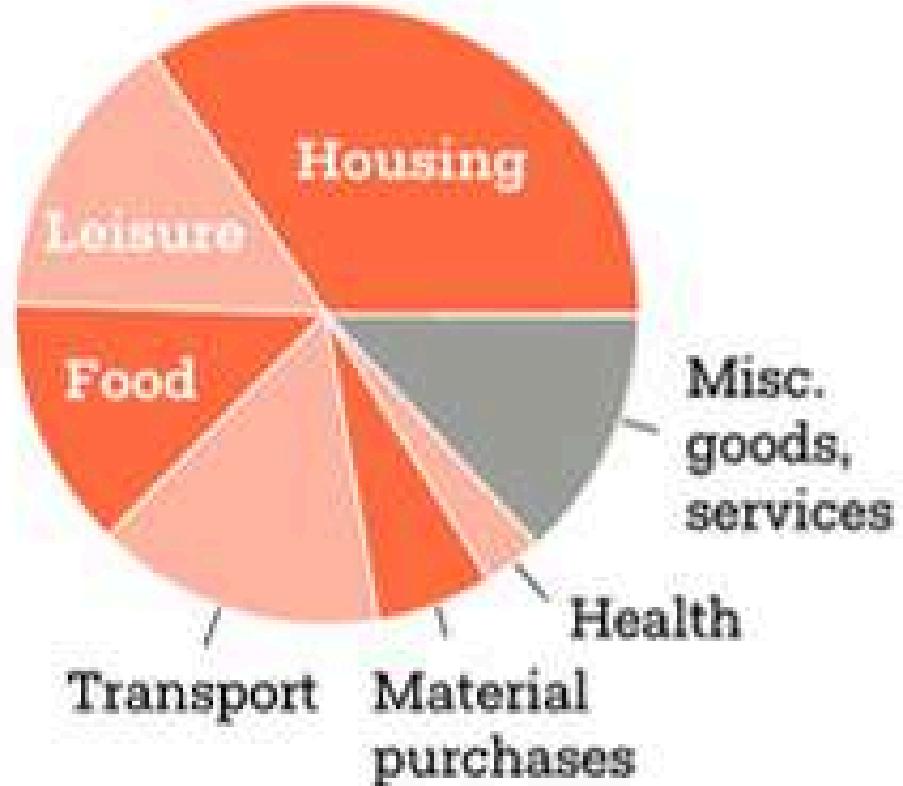
Source: Statistics Iceland

## Single-person household expenditures

Iceland



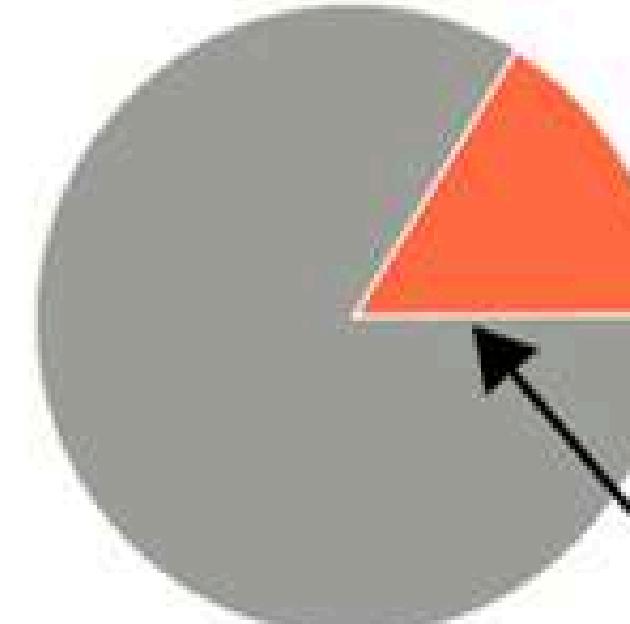
Finland



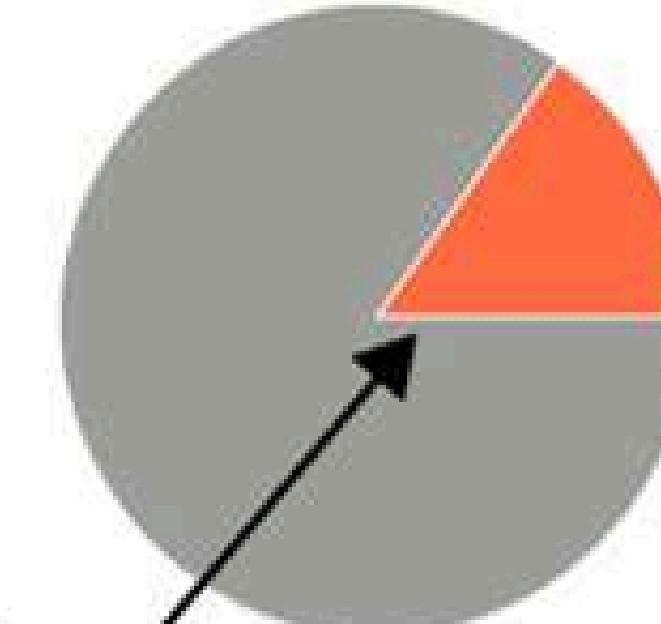
Source: Statistics Iceland (avg. 2013-2016 expenditures),  
Statistics Finland (2016)

## Leisure as a share of single-person household expenditures

Iceland

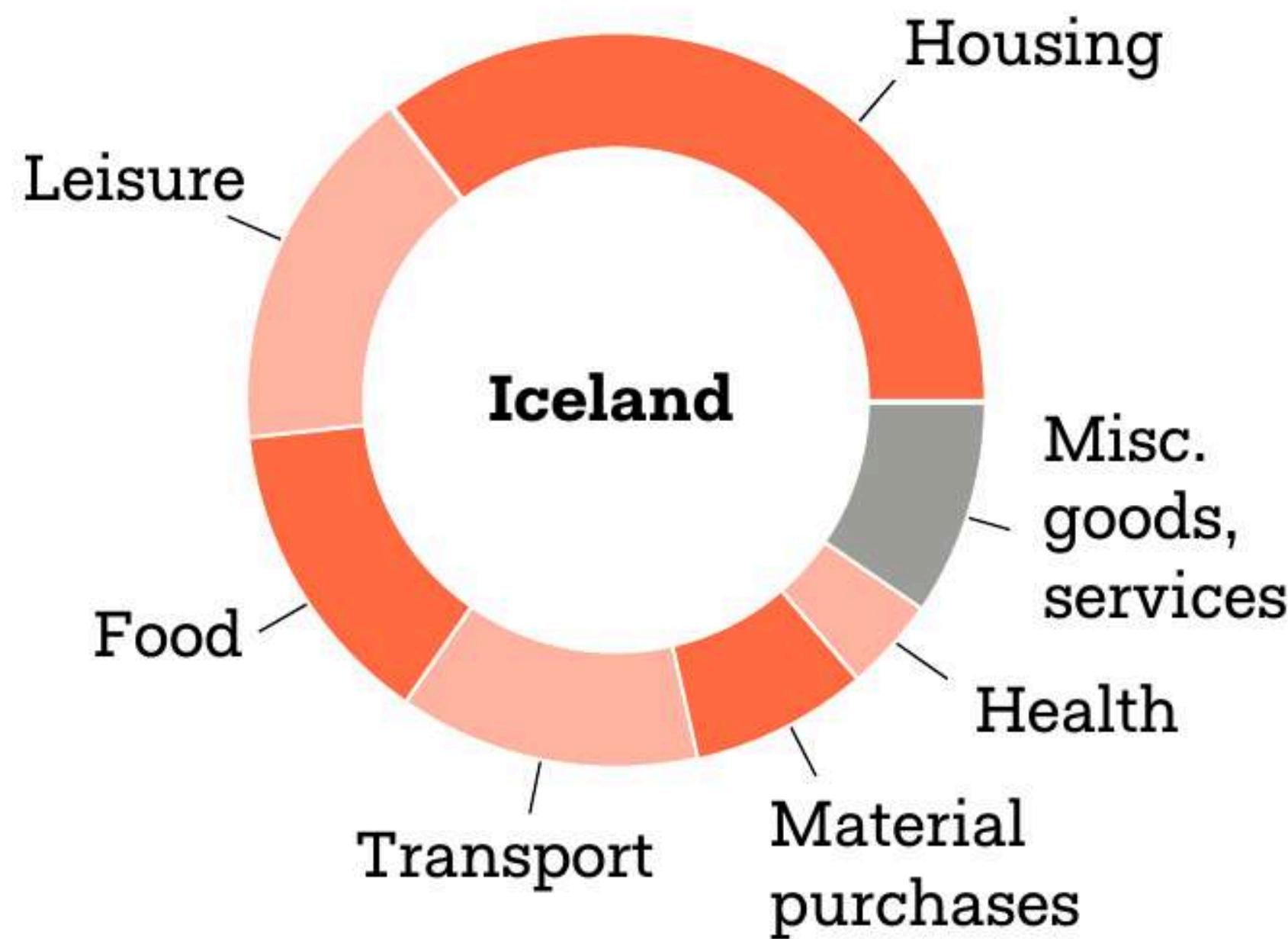


Finland



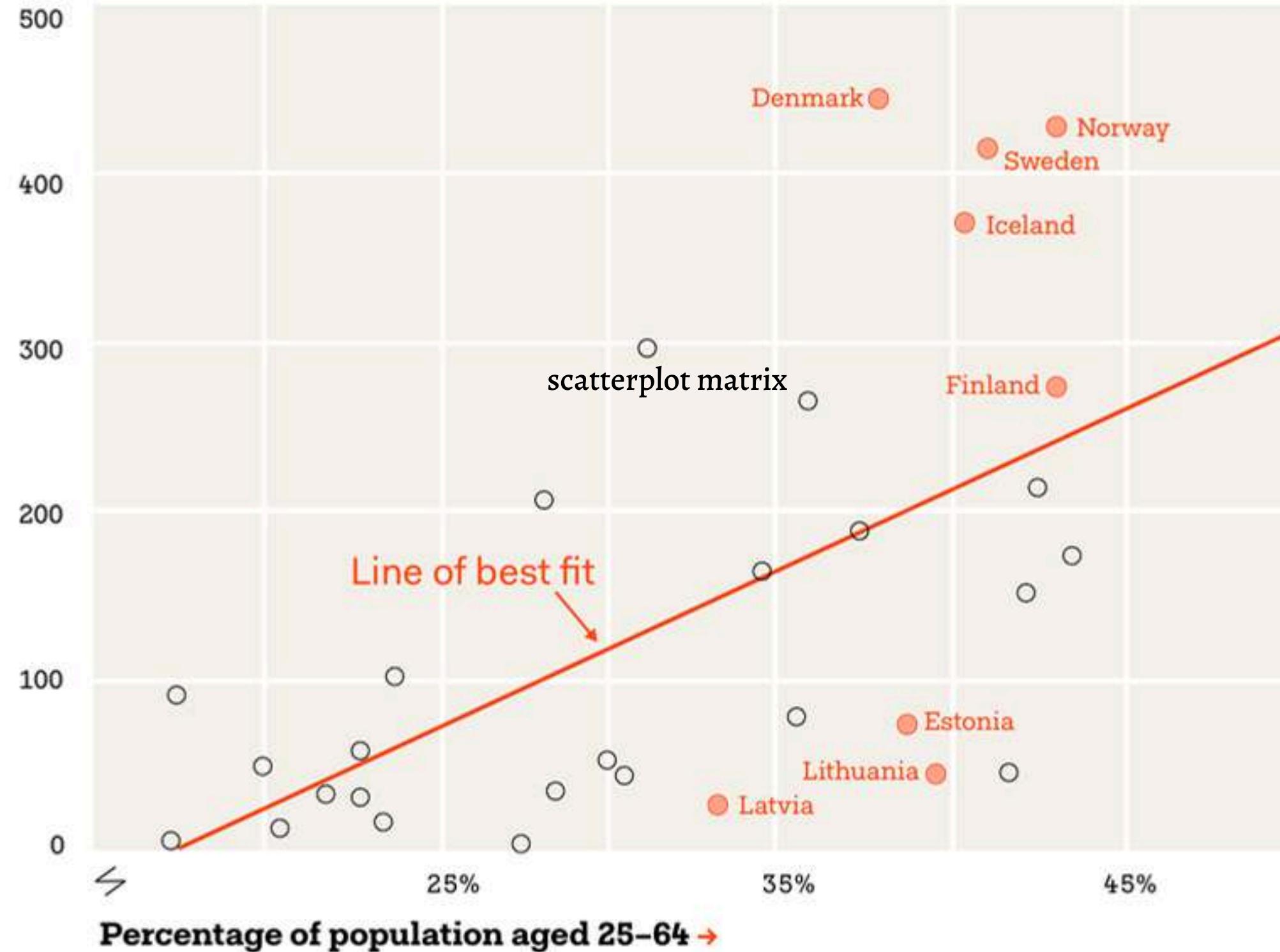
Visually comparing these slices is easier than in the chart on the left

## Single-person household expenditures



## European higher education spending and rate of tertiary education (2016)

Euro spent per inhabitant ↑

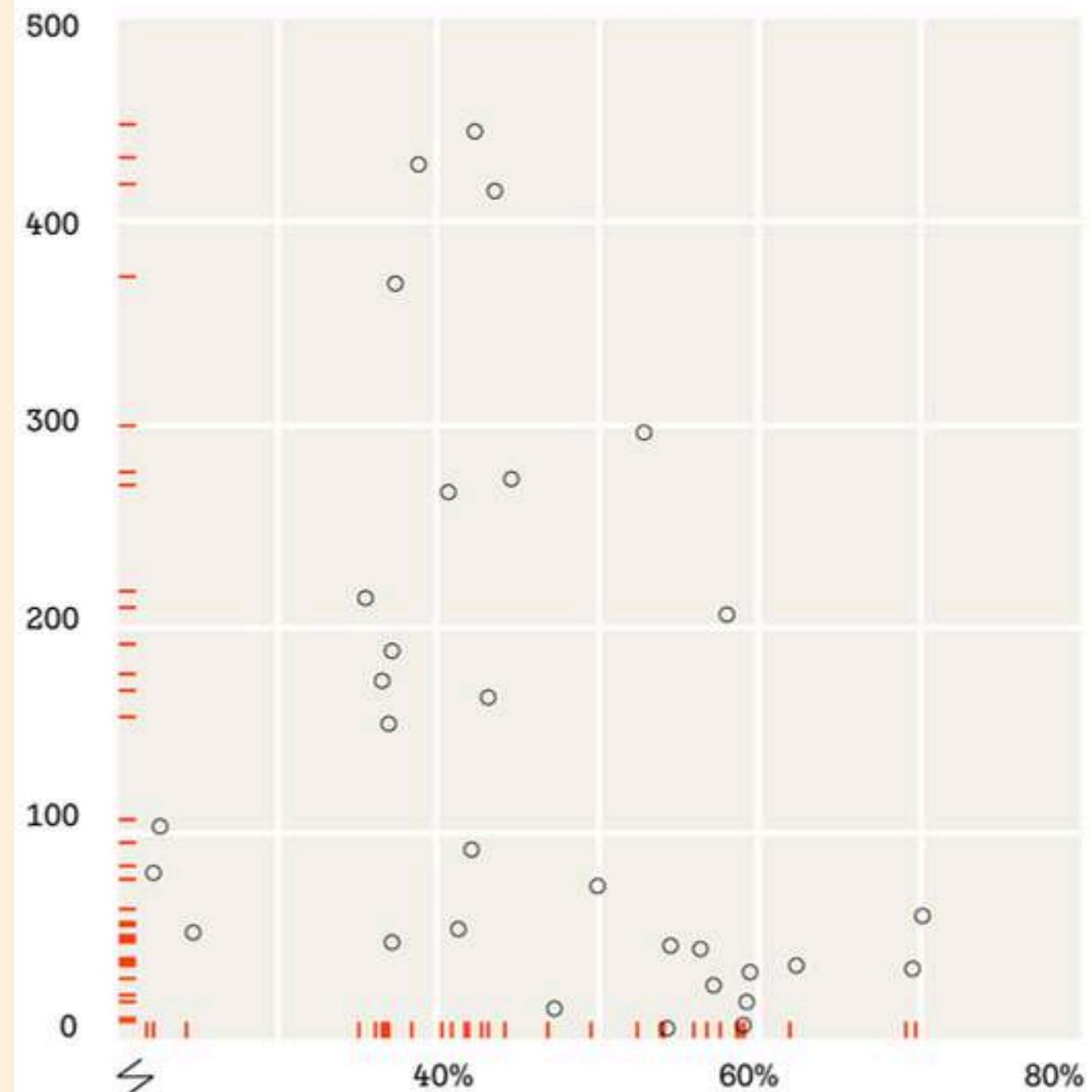


## DOT-DASH PLOT

### European higher education spending and rate of upper secondary education (2016)

Upper secondary and post-secondary non-tertiary education

Euro spent per inhabitant ↑

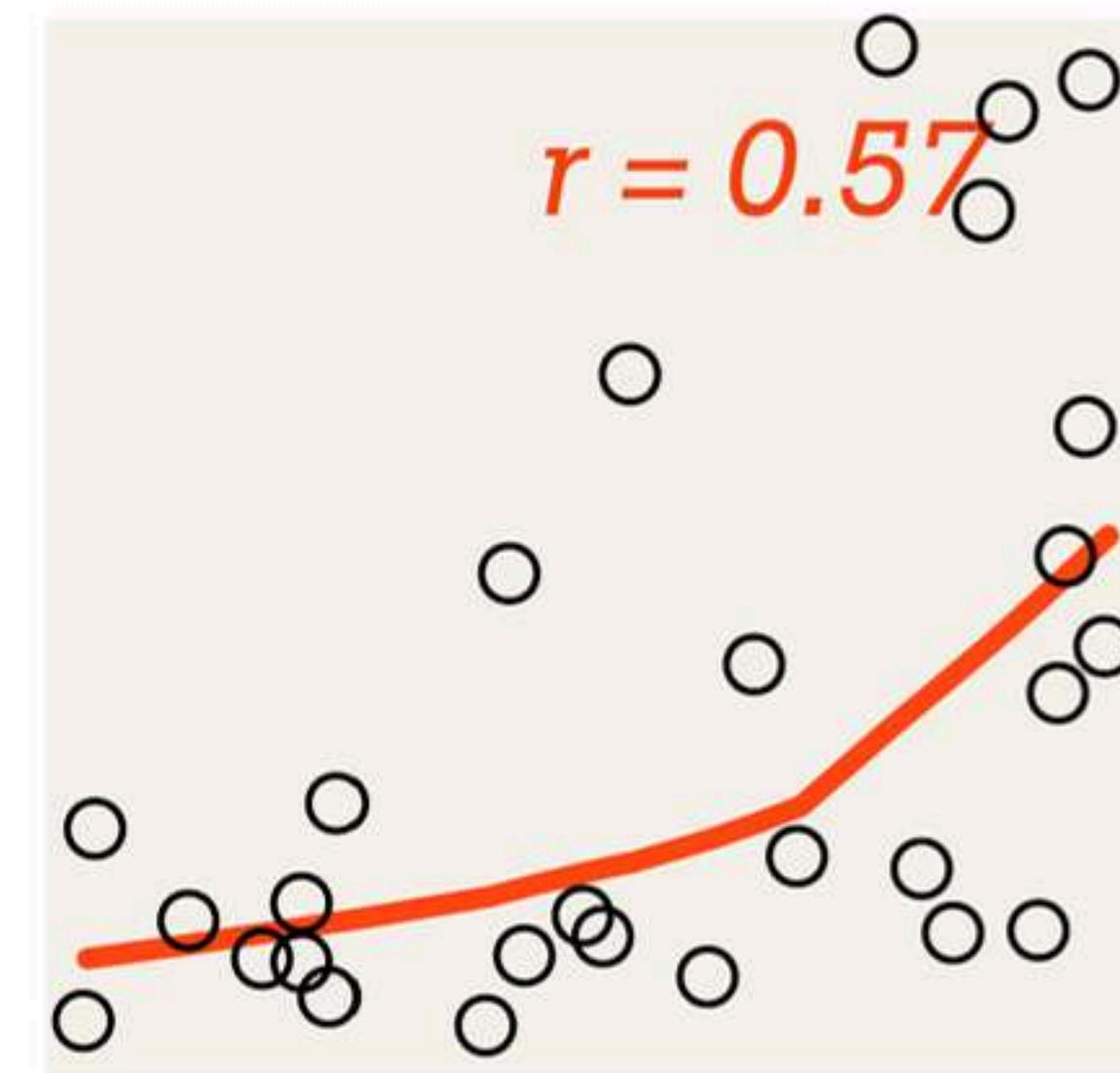


Percentage of population aged 25-64 →

Source: Eurostat 2018. edat\_lfse\_04 and rd\_e\_gerdtot

Higher  
education  
spending

Education  
levels 5–8



## STRIP PLOT

### R&D spending by sector in the Nordic-Baltic countries (2016)

Euros per inhabitant

0                  250                  500                  750                  1,000

Companies        

Universities        

Government       

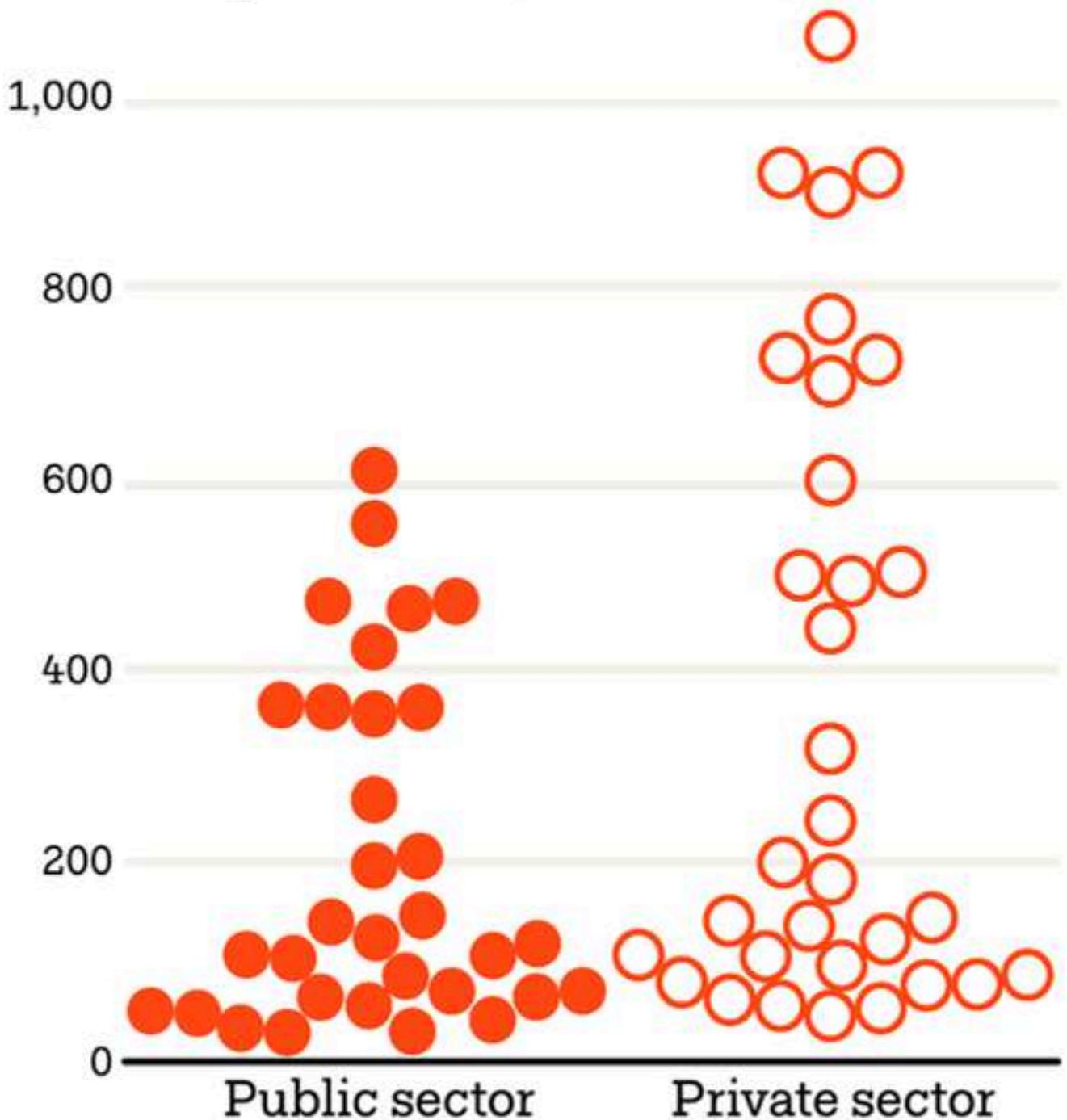
 Non EU-members

Source: Eurostat 2018. *rd\_e\_gertot*

## BEESWARM PLOT

### R&D spending by sector (2016)

Euros per inhabitant, selected European countries

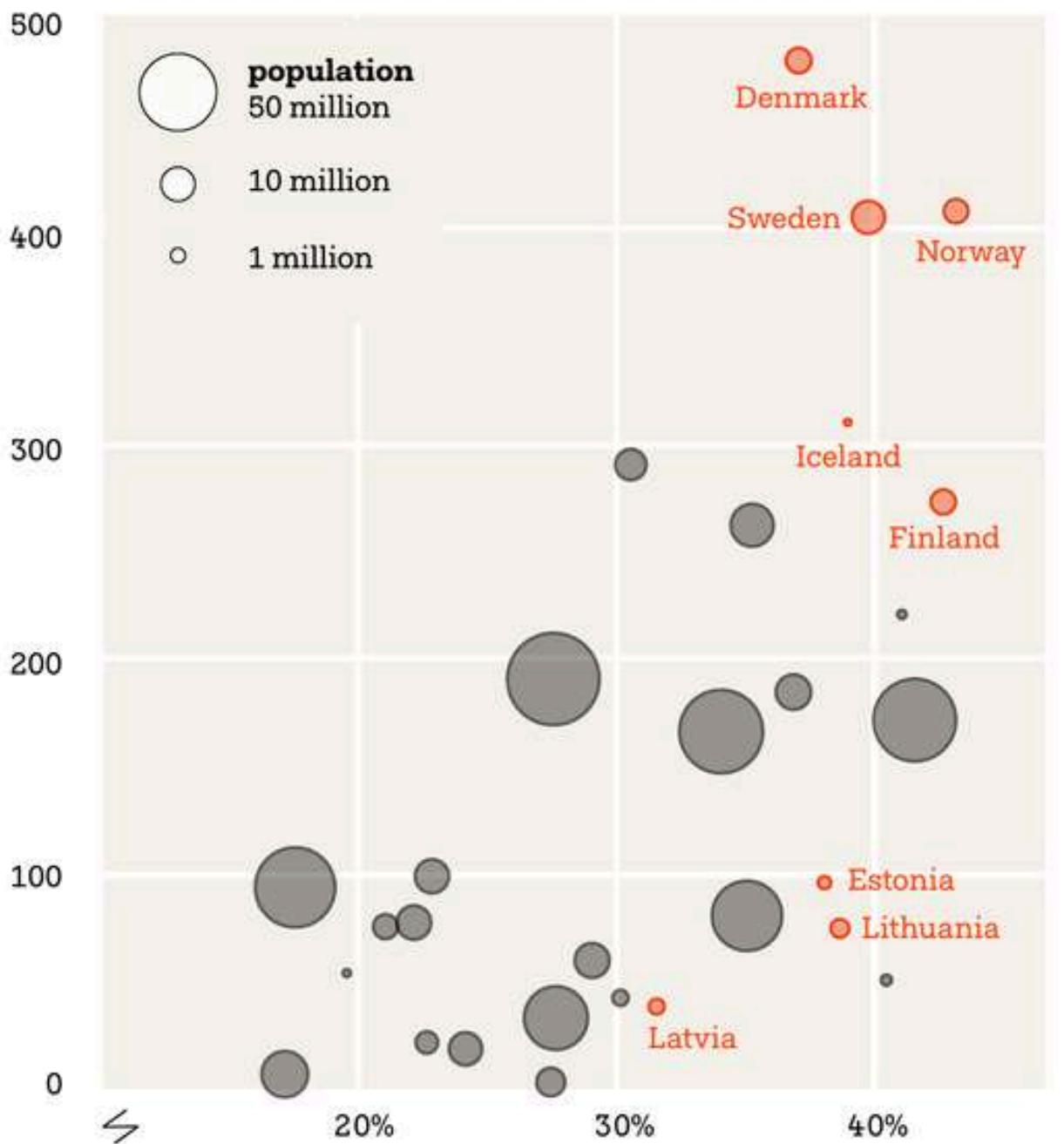


Source: Eurostat 2018. [rd\\_e\\_gerdtot](#)

## BUBBLE CHART

### Tertiary education attainment and higher education sector spending (2015)

Euro spent per inhabitant ↑      Selected European countries



Population aged 25–64 with a university degree, % →

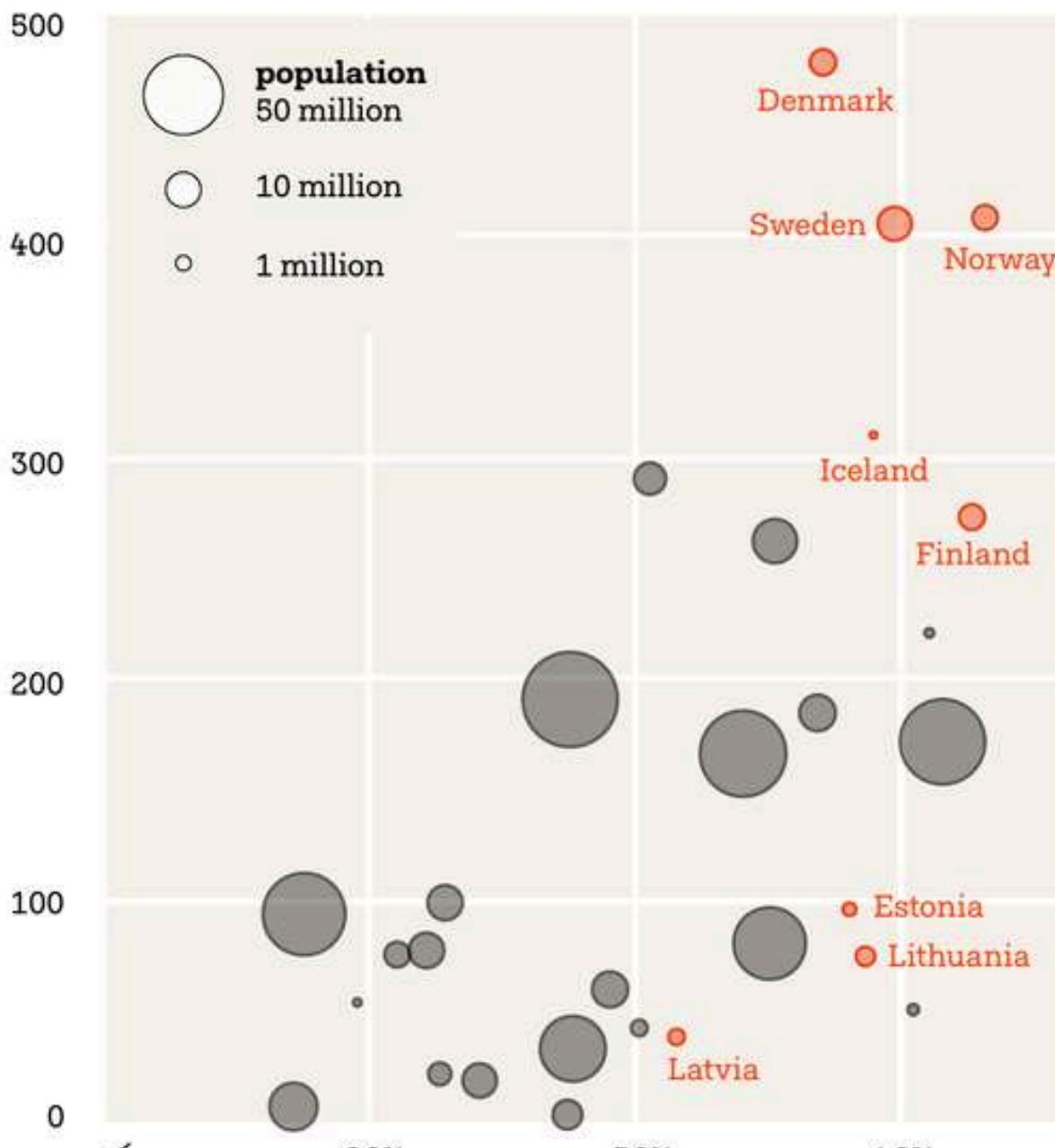
Source: Eurostat 2018 edat\_lfse\_04, rd\_e\_gerdtot, proj\_15npms,  
and Statistics Iceland.

## BUBBLE CHART

Tertiary education attainment and higher education sector spending (2015)

Euro spent per inhabitant ↑

Selected European countries



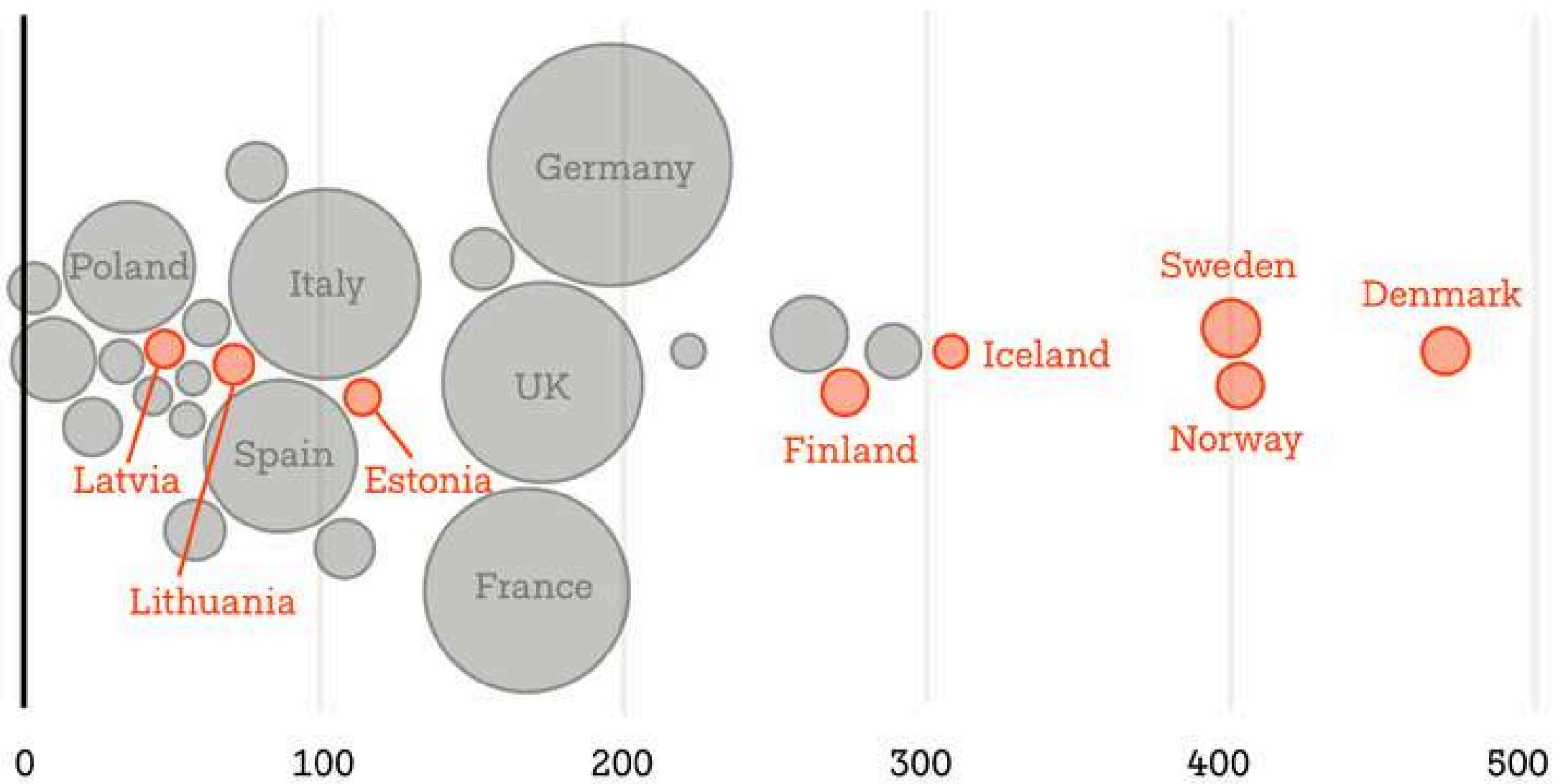
Population aged 25-64 with a university degree, % →

Source: Eurostat 2018 edat\_lfse\_04, rd\_e\_gerdtot, proj\_15npms, and Statistics Iceland.

## 1-DIMENSIONAL BUBBLE CHART

European higher education sector spending (2015)

Selected European countries



Euro spent per inhabitant →

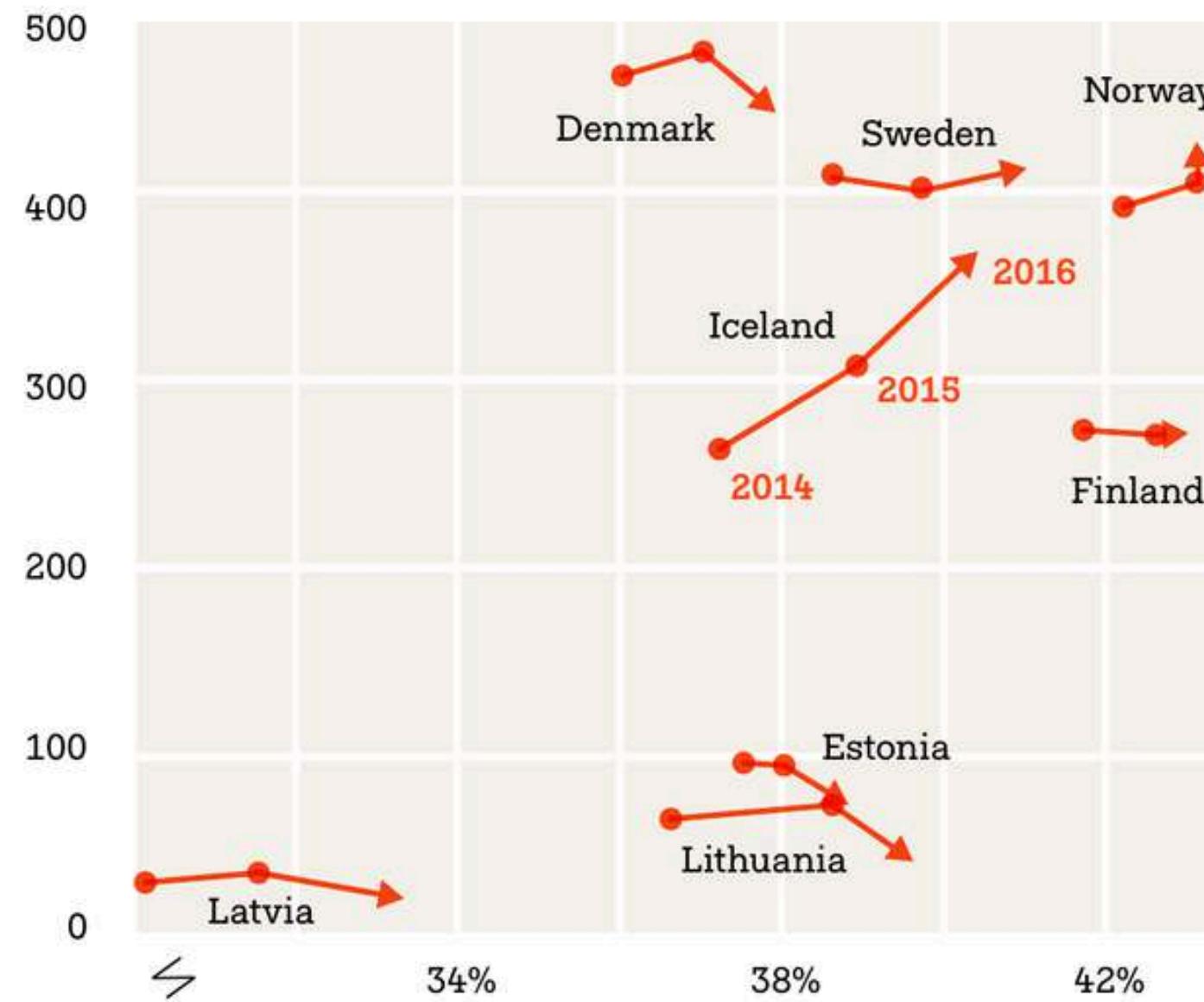
Source: Eurostat 2018 rd\_e\_gerdtot, proj\_15npms, and Statistics Iceland

population  
10 million

## LINKED SCATTERPLOT

Higher education spending and tertiary education attainment (2014–2016)

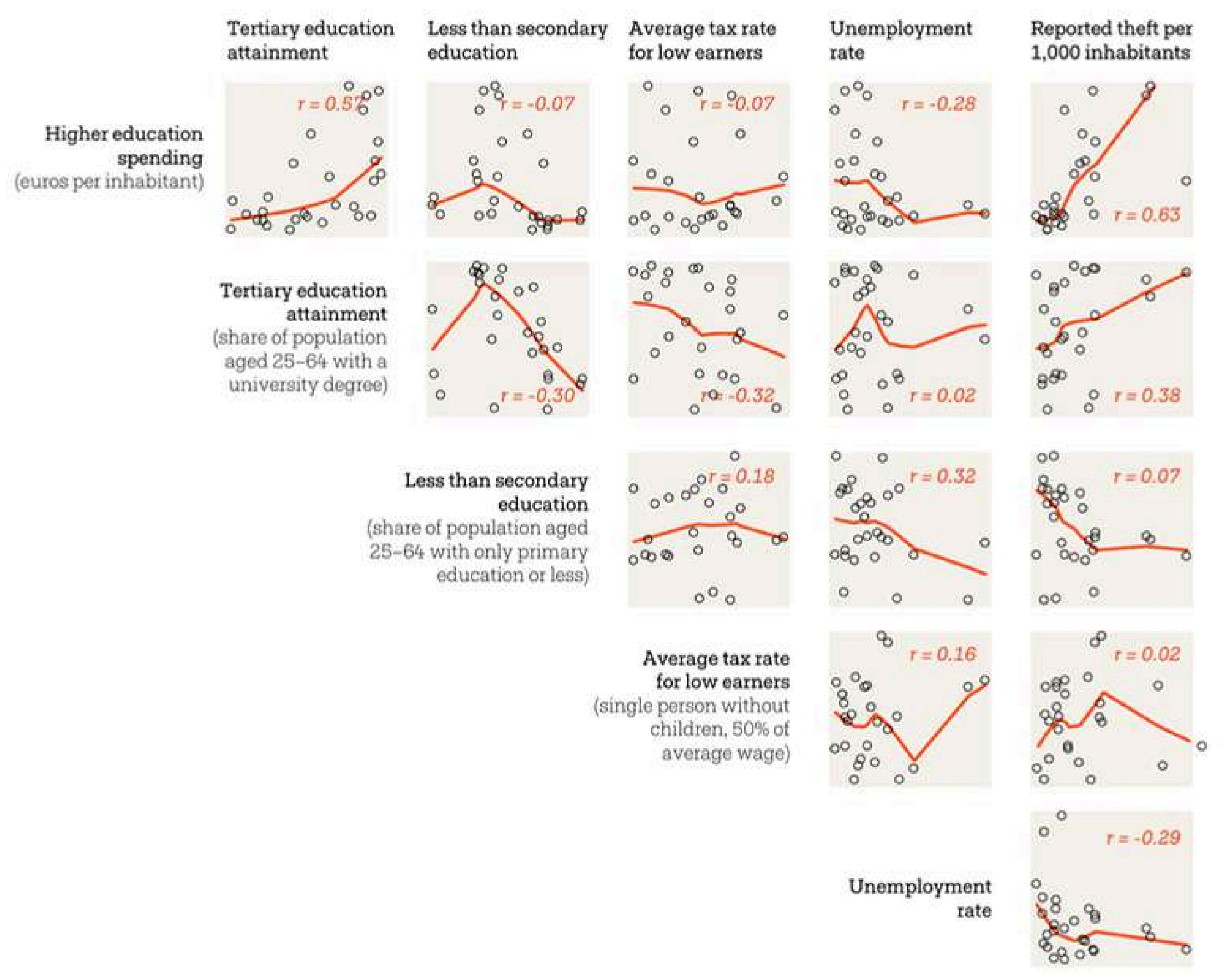
Euro spent per inhabitant ↑



Share of population aged 25-64 →  
with a university degree

Source: Eurostat 2018. edat\_lfse\_04 and rd\_e\_gertot

# scatterplot matrix

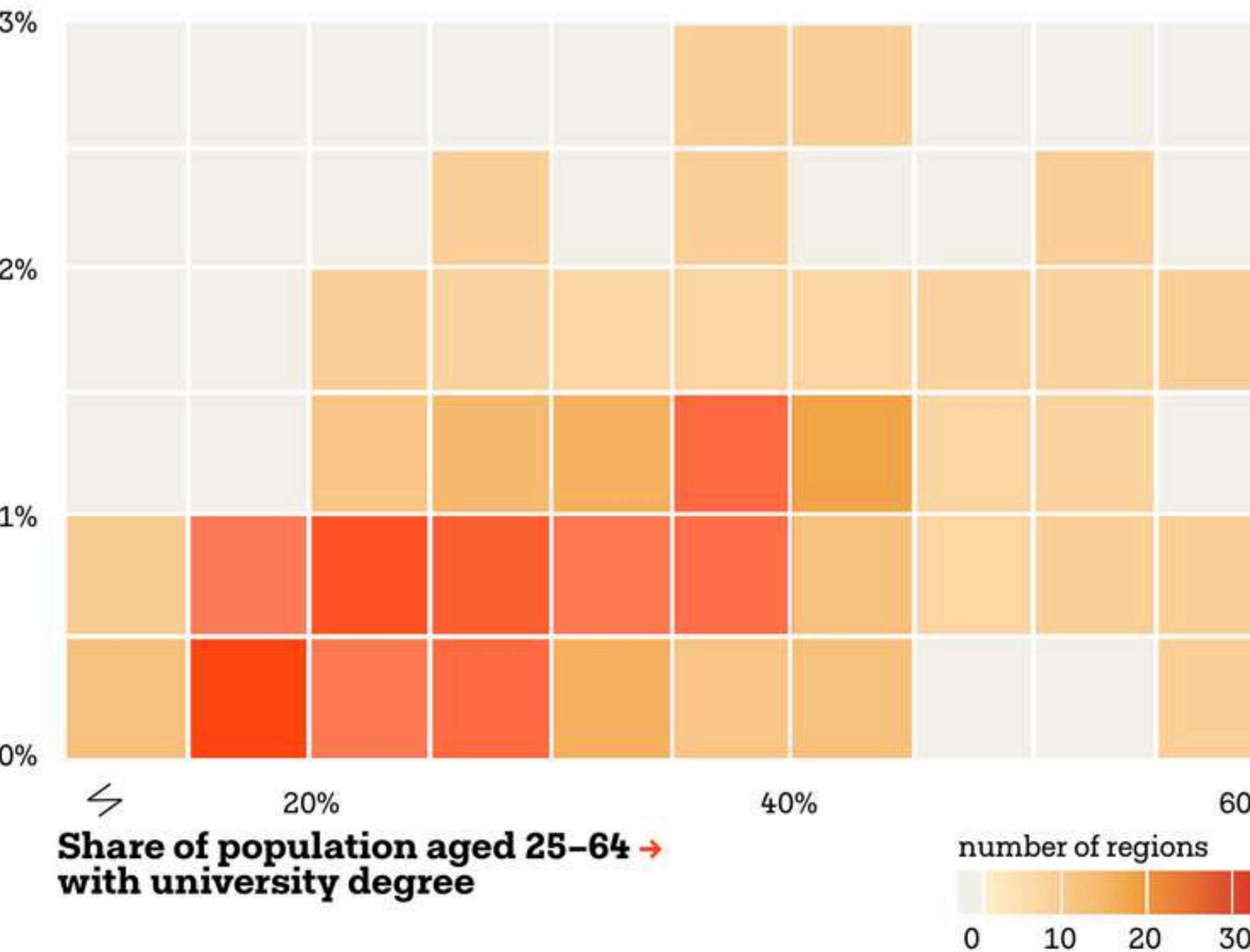


## HEAT MAP

# Employment in higher education and rate of tertiary education in Europe (2015)

Selected NUTS2 regions, 349 observations

Percentage of people employed in higher education (active pop.) ↑

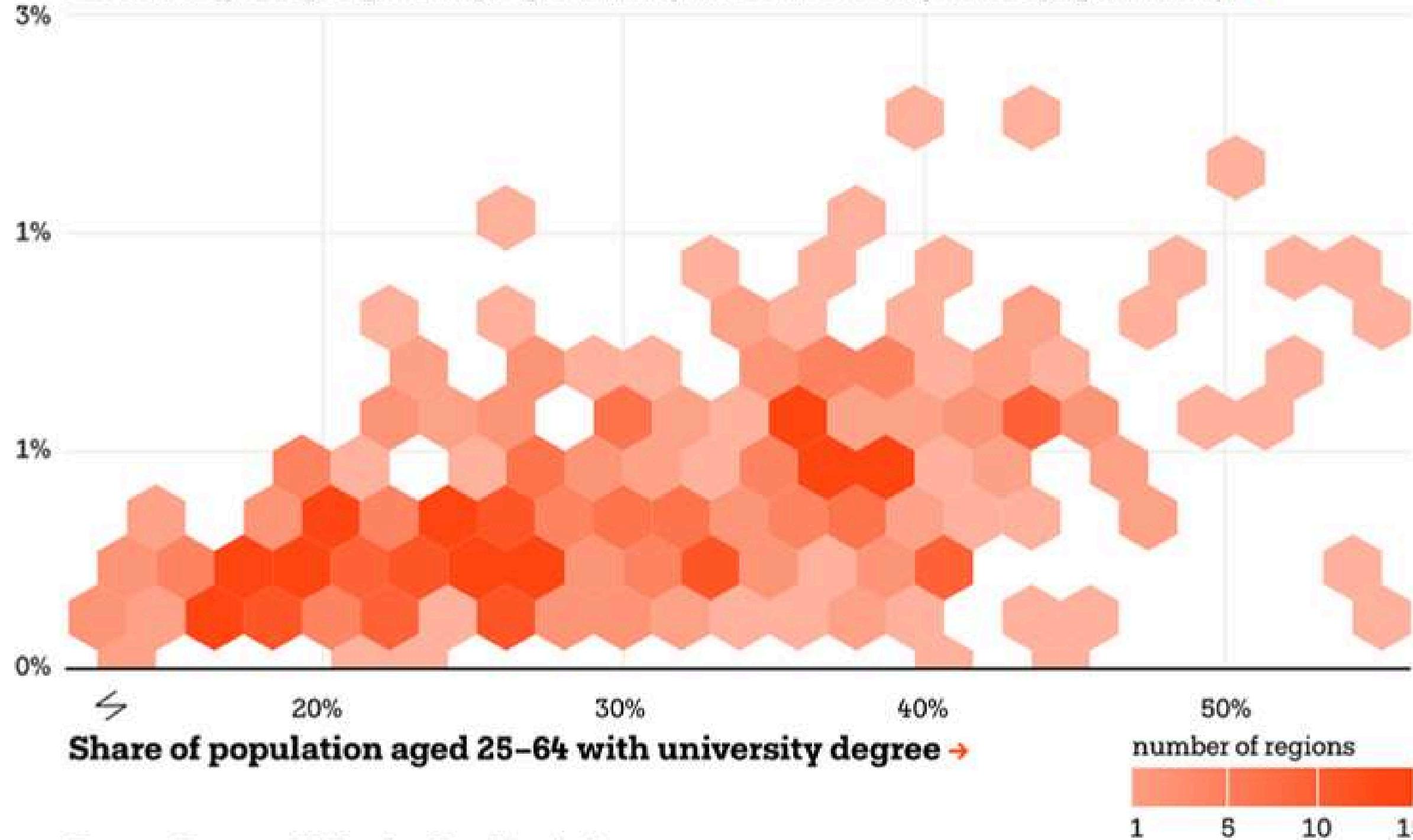


## HEXAGONAL BINNING

### Employment in higher education and rate of tertiary education in Europe (2015)

Selected NUTS2 regions, 349 observations

Percentage of people employed in higher education (active population) ↑

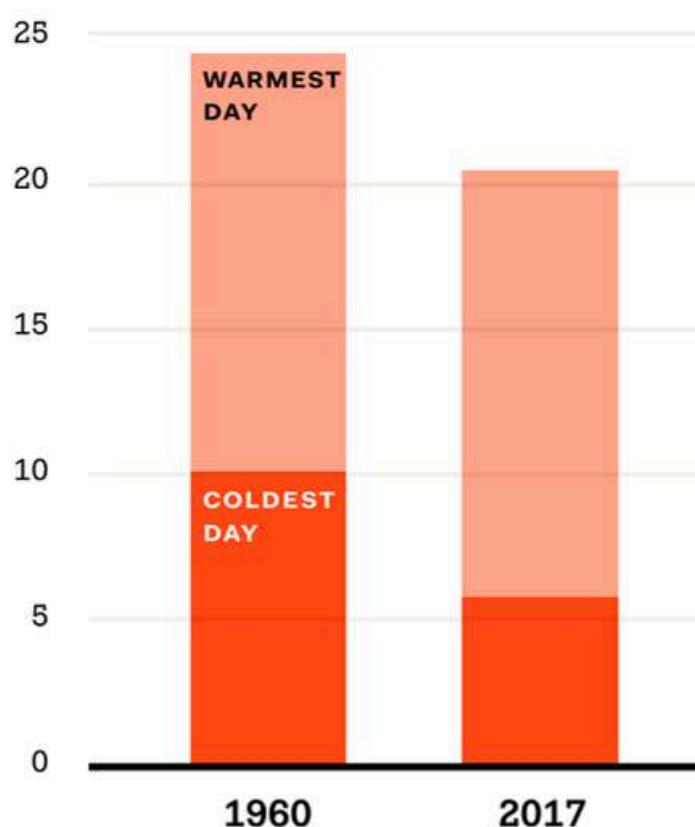


Sources: Eurostat 2018. *edat\_lfse\_04* and *rd\_p\_persreg*

## STACKED BAR RANGE

### July temperatures in Ivalo, Finland

daily average, C°

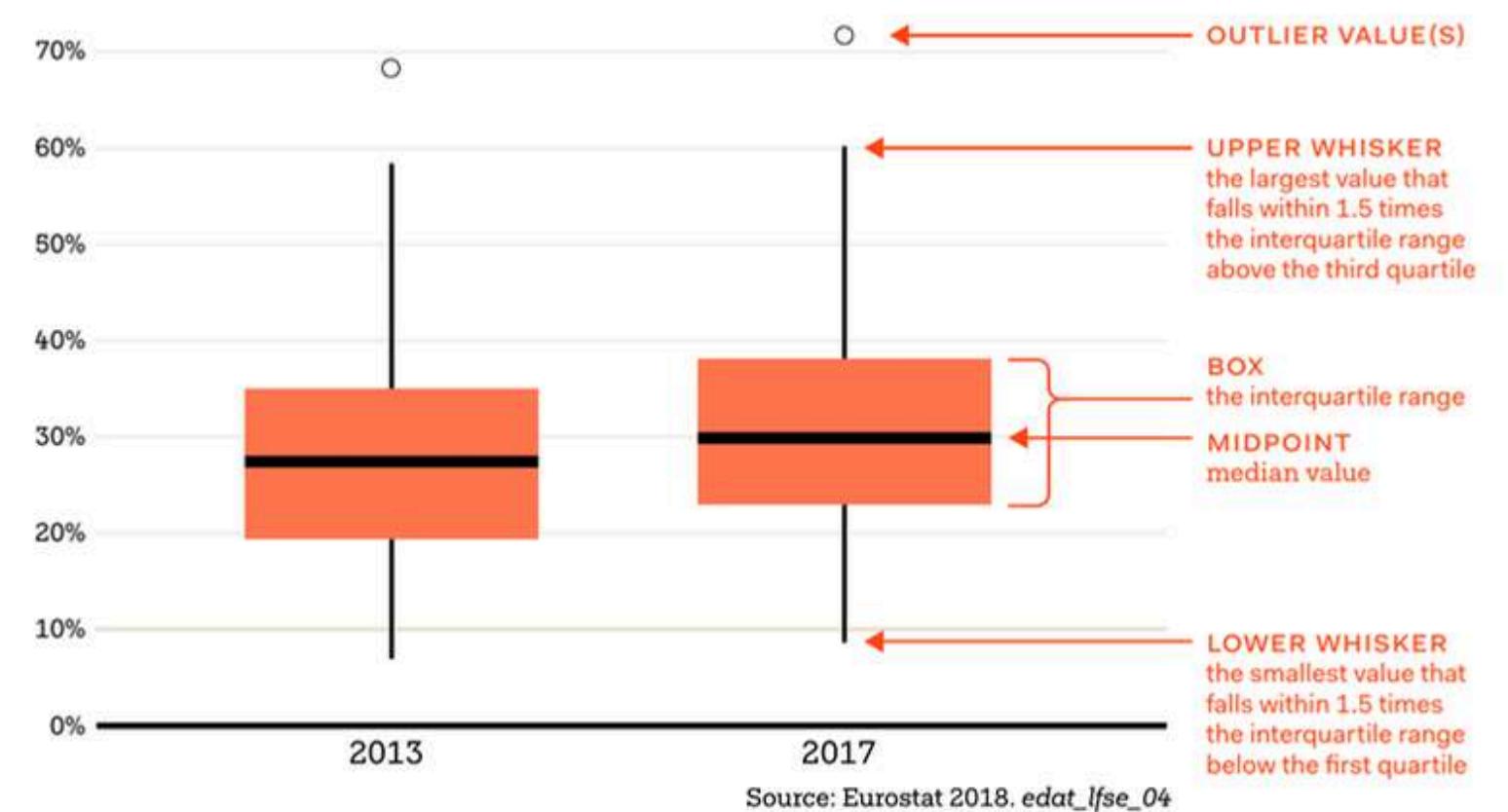


Source: Finnish Meteorological Institute (FMI)

## TUKEY'S BOX PLOT

### Regional variation in tertiary education attainment

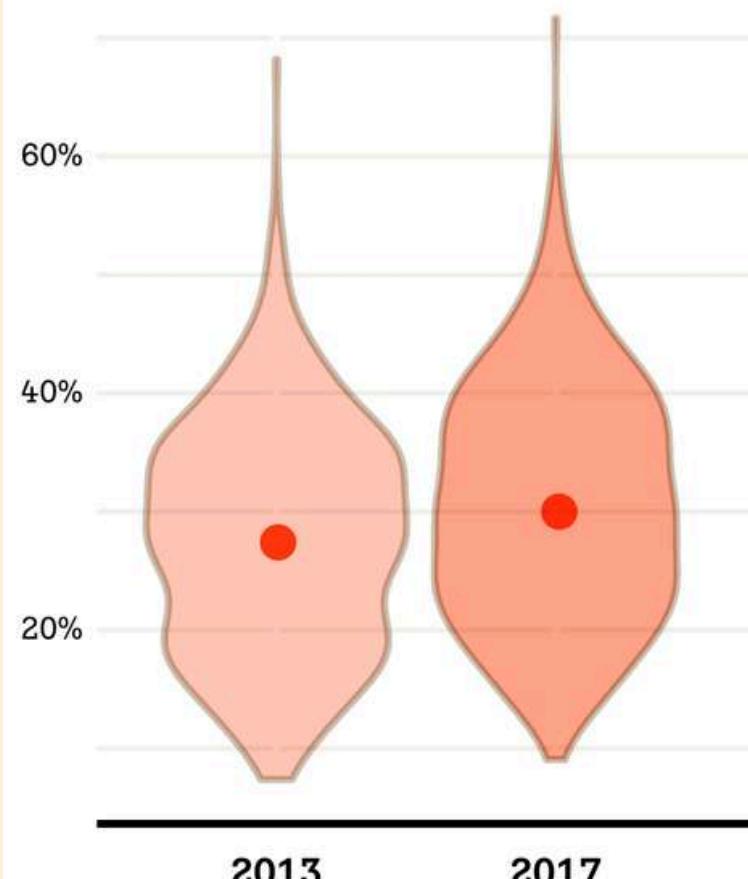
Share of population aged 25–64 with a university degree, NUTS2 areas



## VIOLIN PLOT

### Rate of tertiary education in Europe

NUTS2 areas, 2013 and 2017

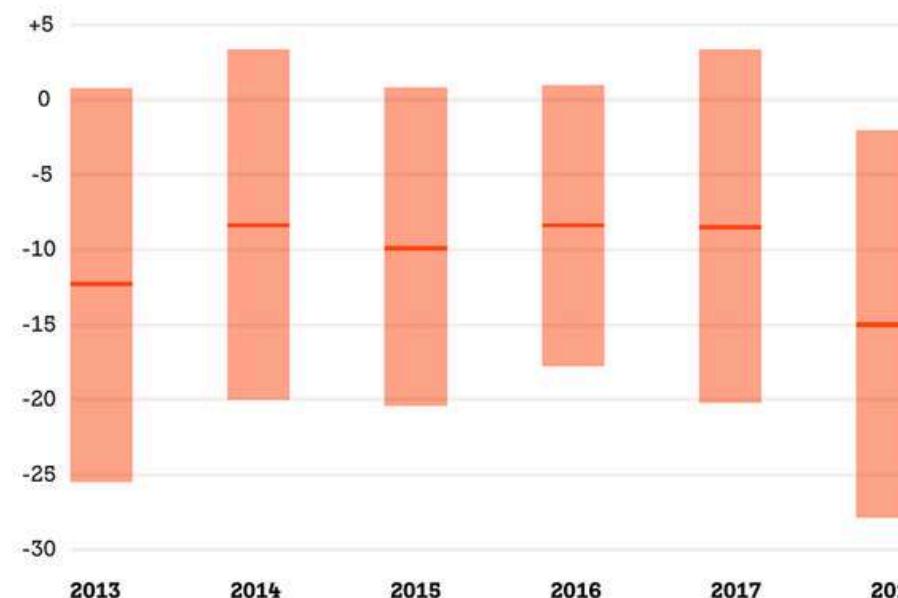


## HIGH-LOW CHARTS

### February temperatures in Ivalo, Finland (1960–2017)

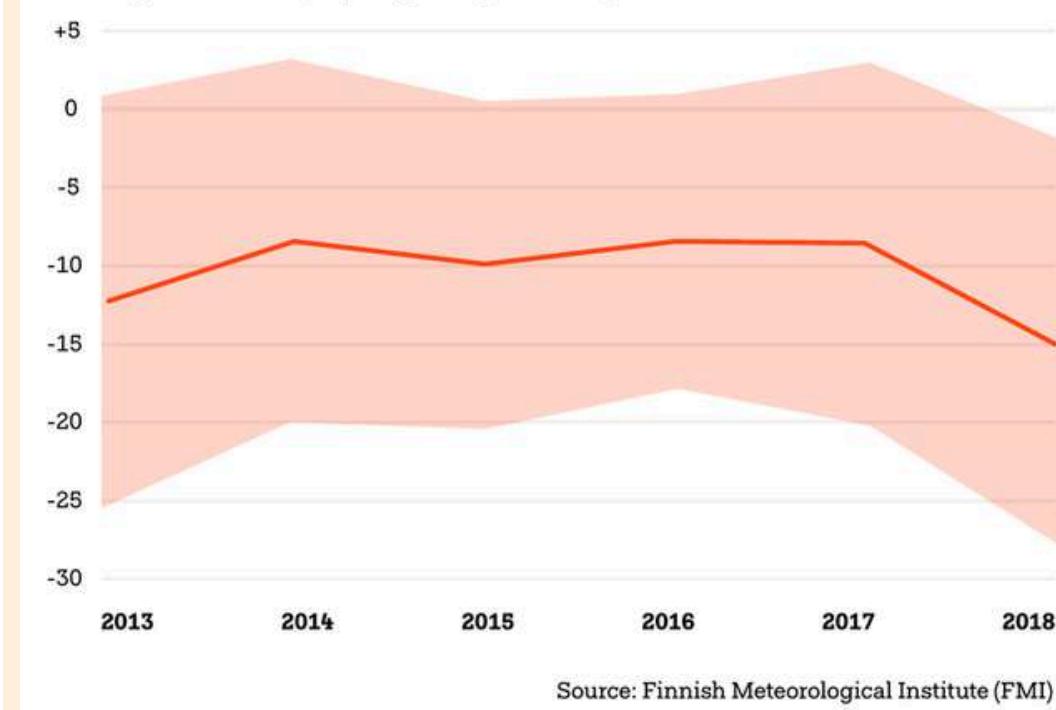
#### Range bar chart

Degrees in Celcius (C°), daily range



## Band chart

Degrees in Celcius (C°), daily averages and ranges



Statistical charts should usually include a **title**. Graphics published online in particular will almost certainly be shared and reused outside their original context. Adding a title directly to the image reduces the chances of the graphic being misinterpreted. A good chart title is like a news headline: it not only describes the content, but also summarizes key findings within the graphic.

In some chart types the axes may be truncated if necessary (see p. 216). In such cases a **truncation mark** is drawn at the base of the axis.

## Strong correlation in 2014 European Parliamentary and referendum election results in Danish precincts



Points falling **outside the plot area** can be noted in this way.

**Annotations** can be used to draw reader attention to relevant details.

**Glyphs** (also called plotting symbols) are the data-carrying elements of the chart.

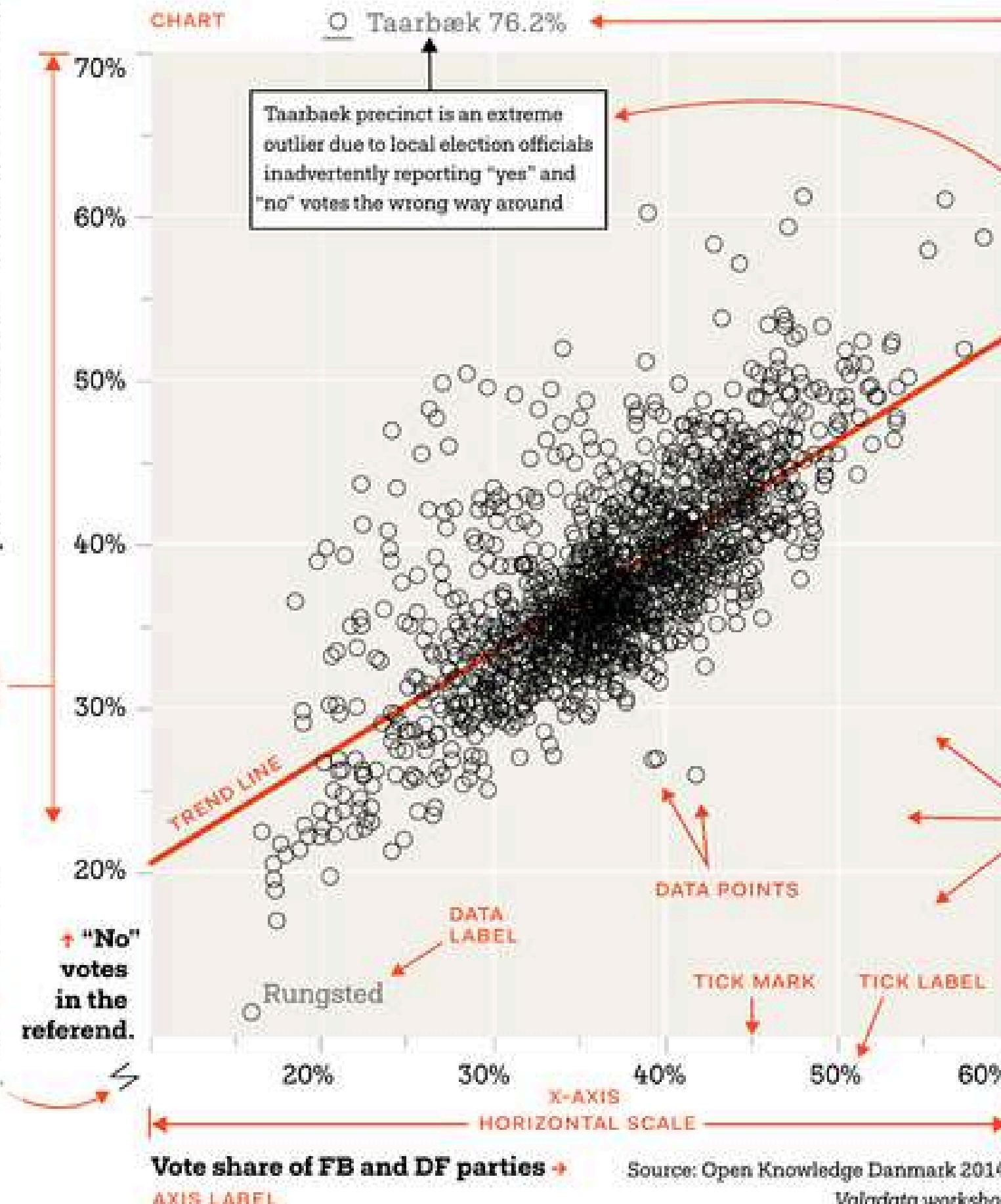
The **plot area** is where the plotting symbols of the chart are drawn

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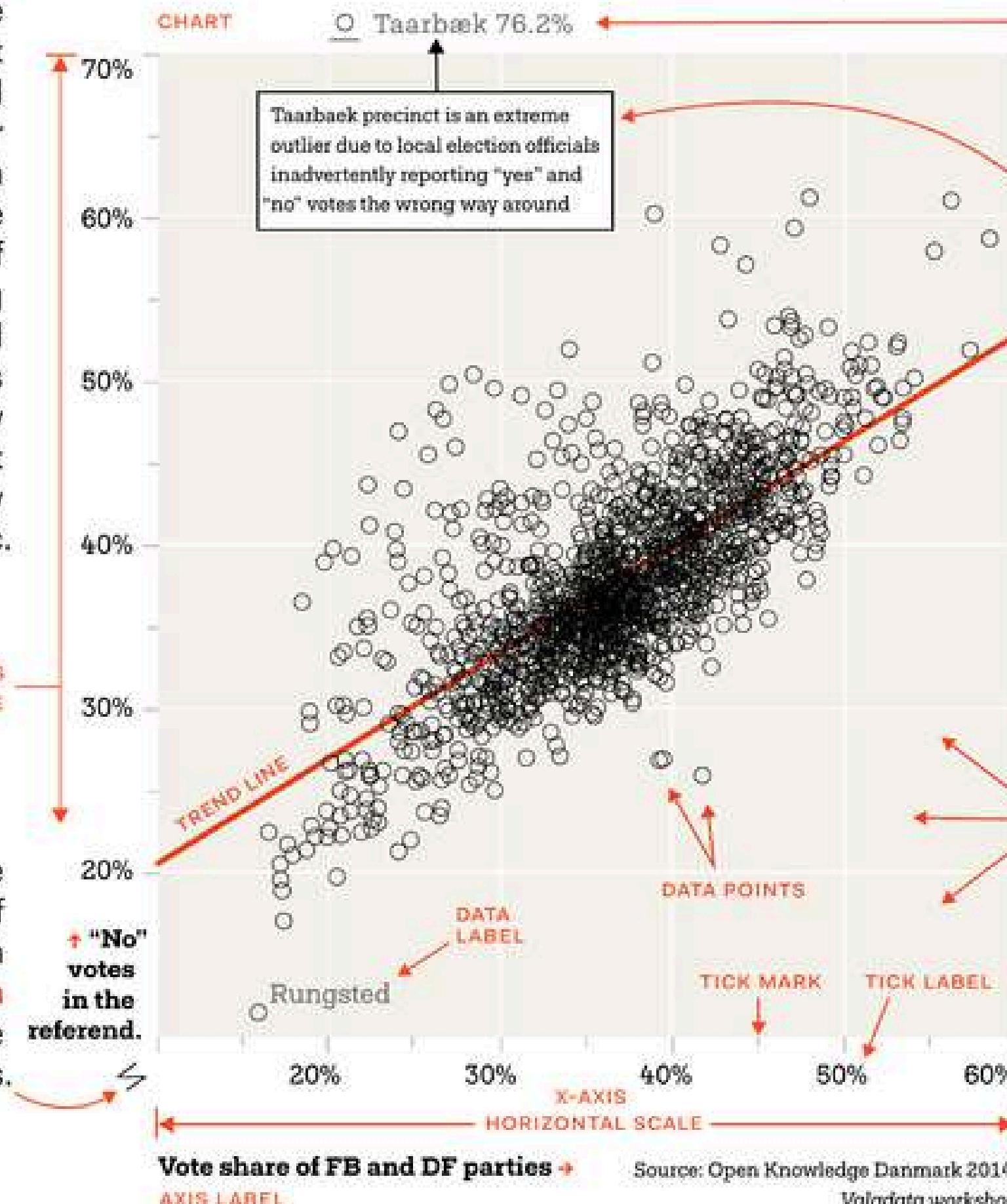
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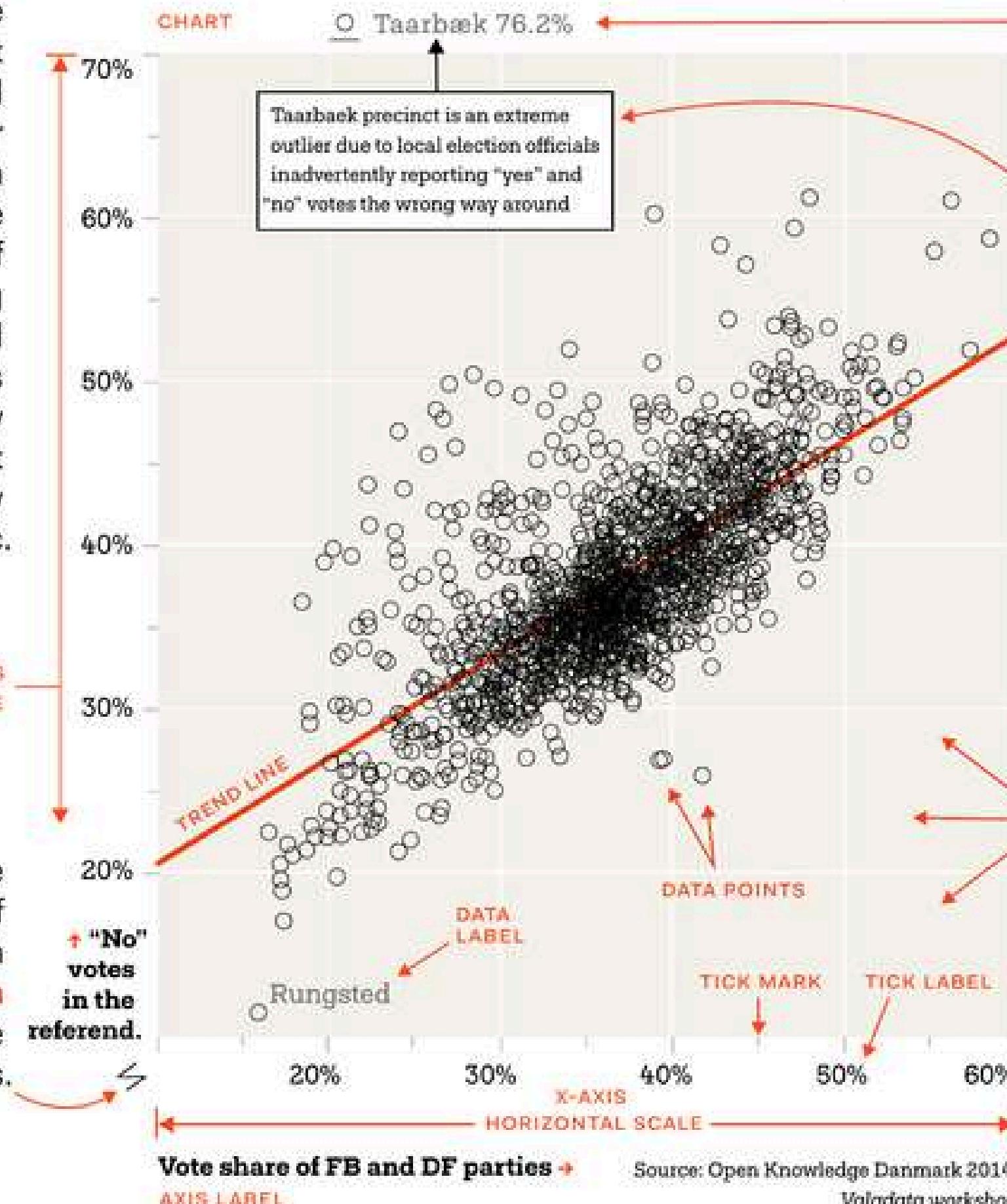
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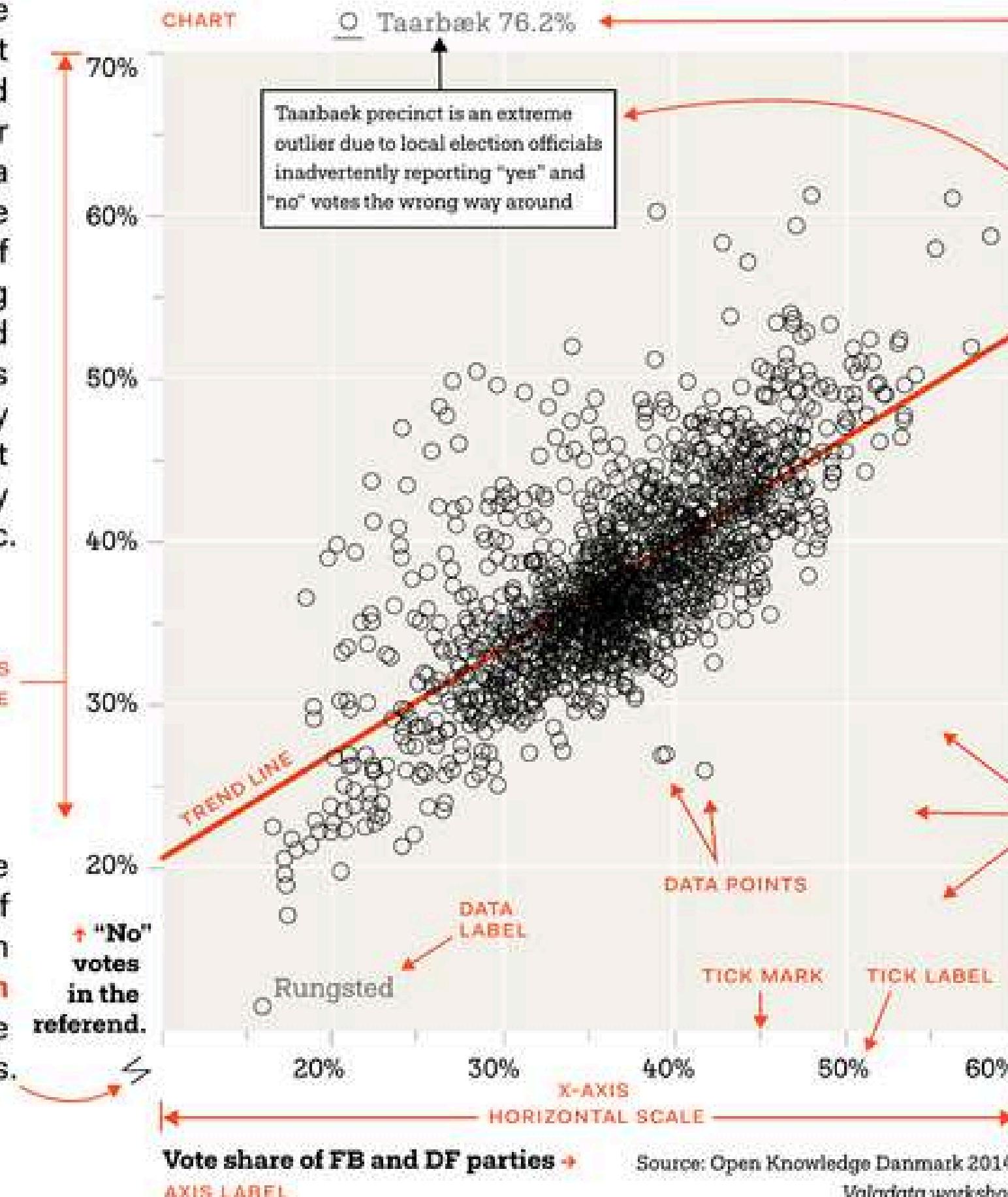
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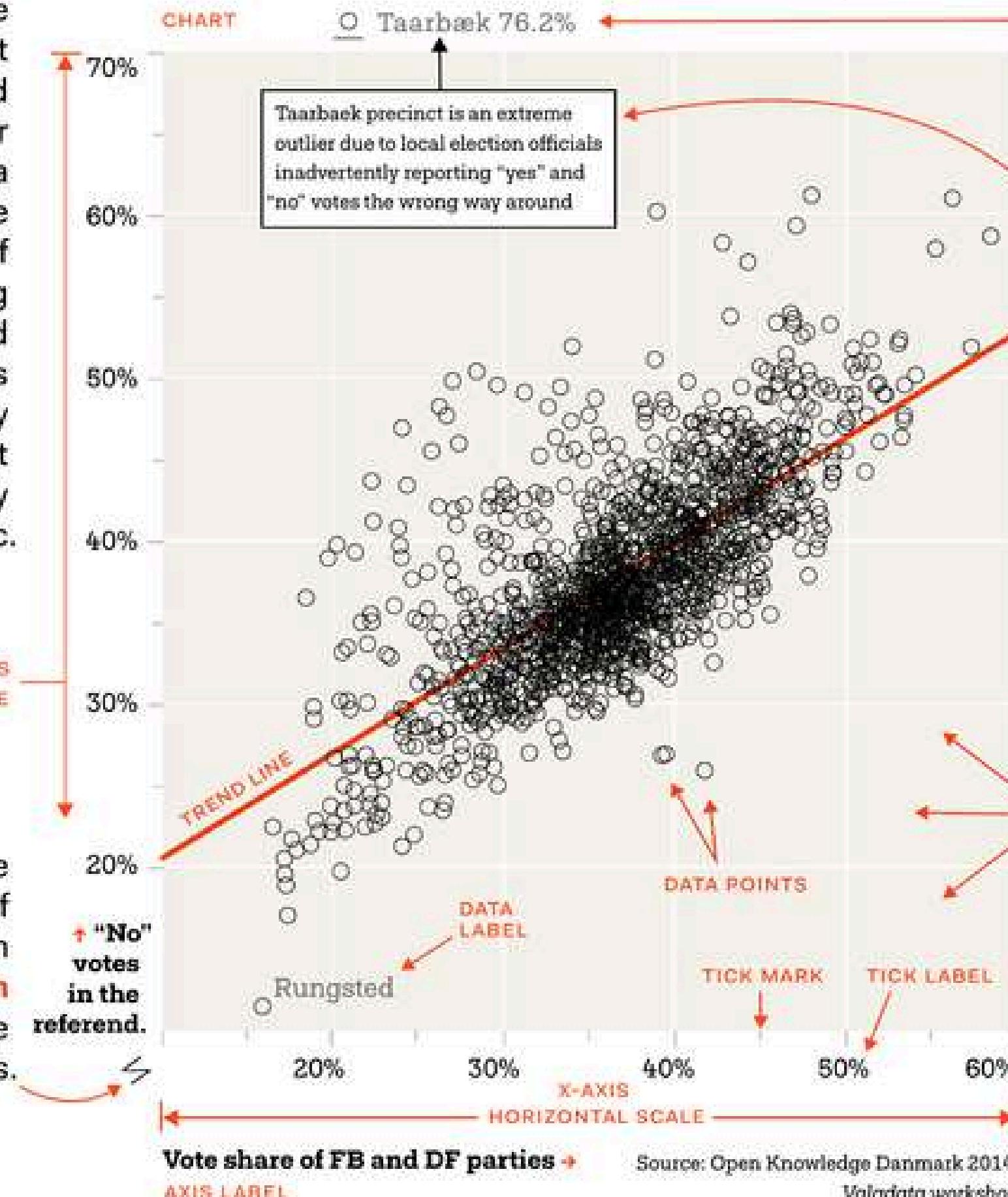
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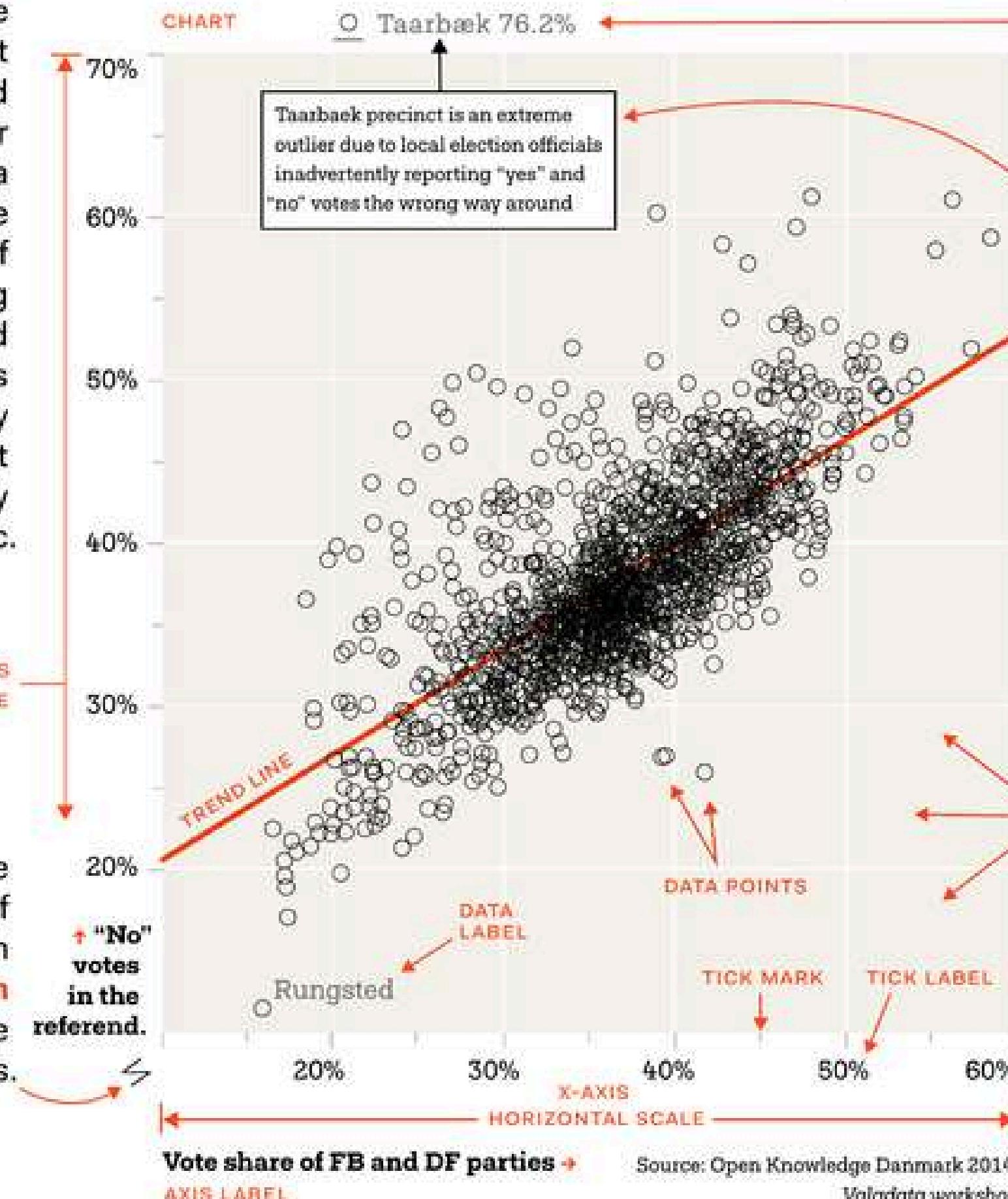
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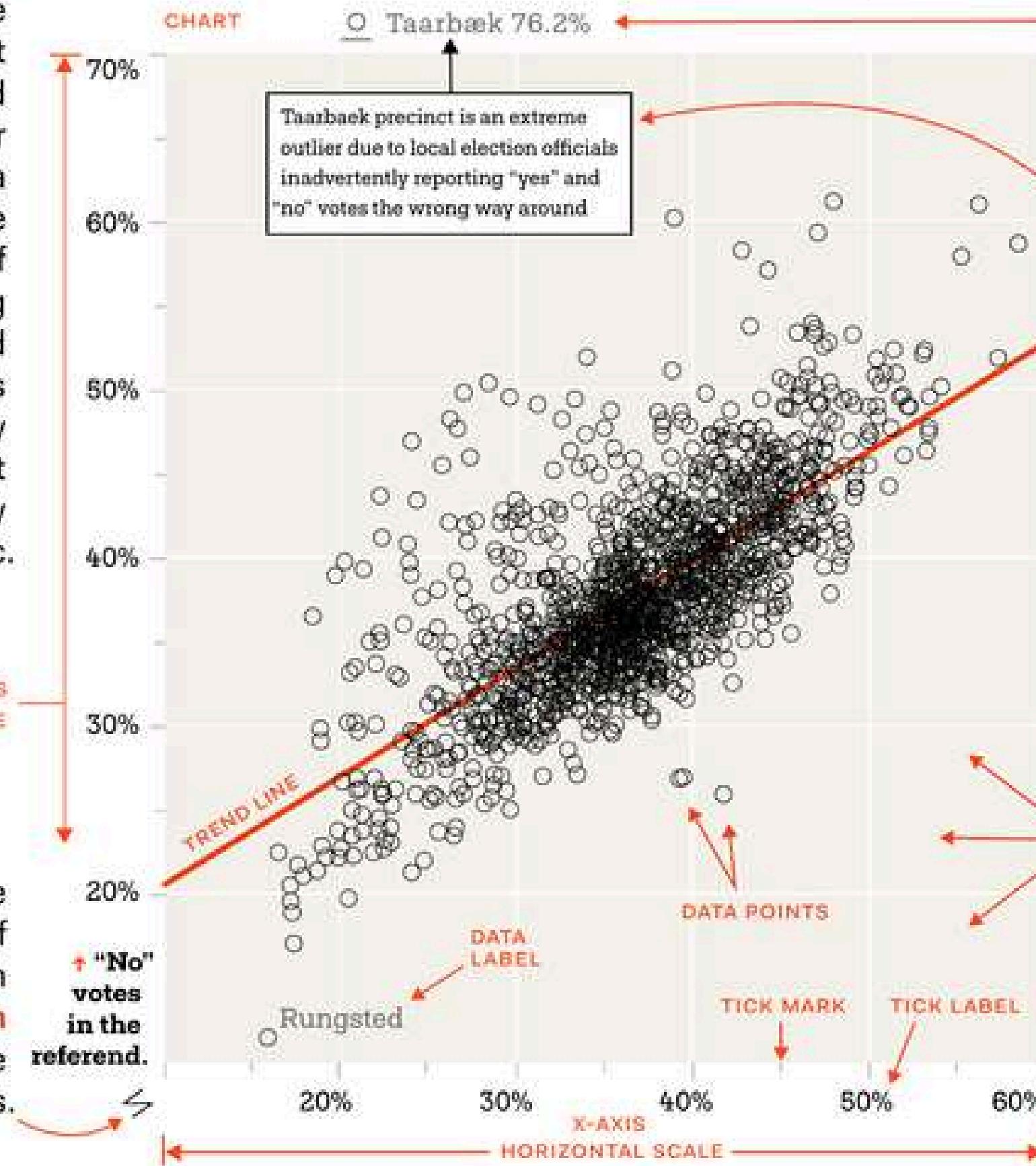
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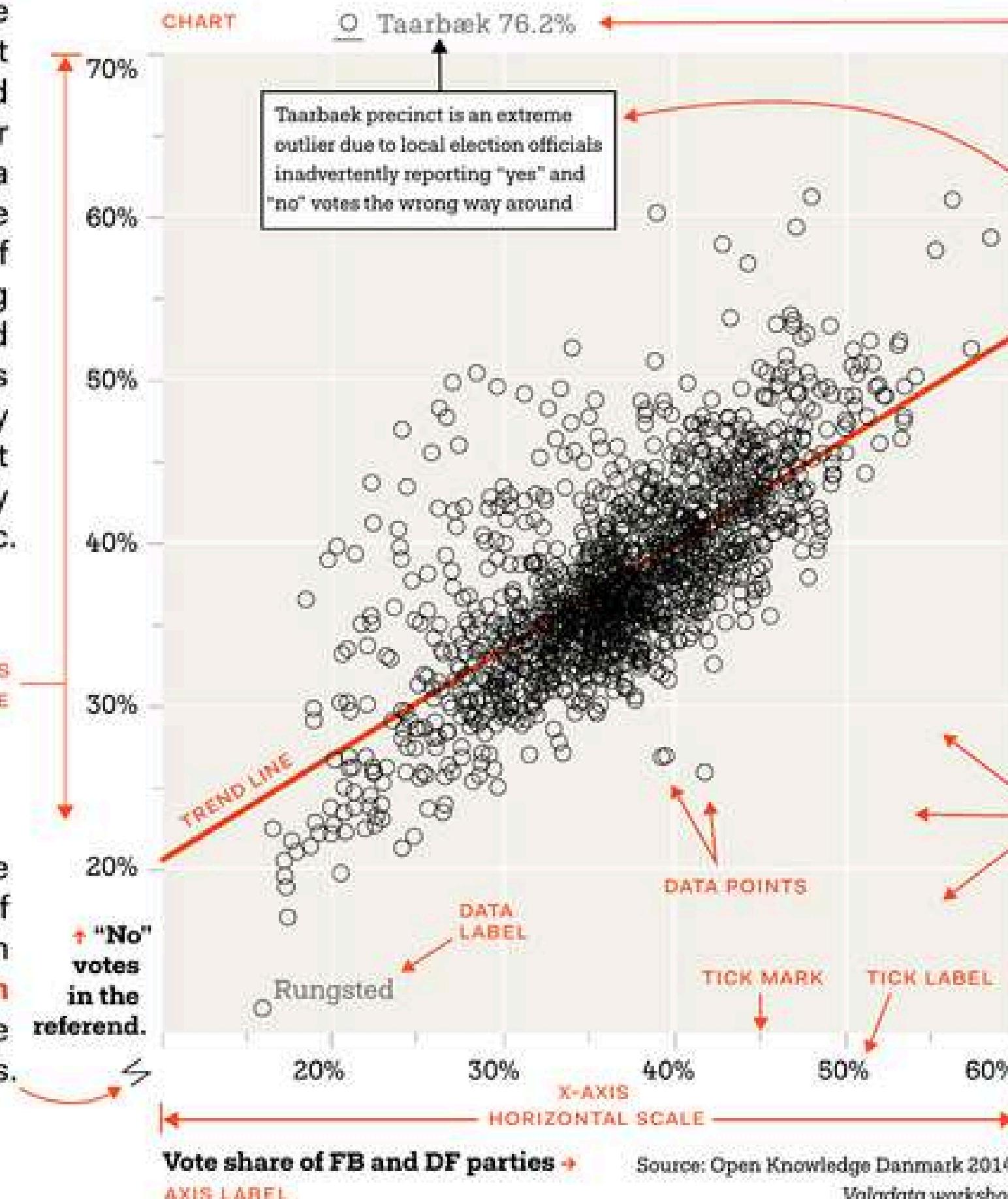
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Units of measurement units should be noted in close proximity to the **axis**.

If a chart uses two y-axes, they should share a common set of **gridlines**, that is to say, the gridlines should overlap (see p. 215).

**Data lines** should be visually stronger than the gridlines or baseline.

## Despite falling investment in tertiary education, the share of university graduates is on the rise in Estonia

### Higher education spending and tertiary education attainment

Euros per inhabitant

120

GRIDLINE

100

80

60

40

20

0

REFERENCE LINE

2010

2011

2012

2013

2014

2015

2016

projection

BASELINE

Population aged 25-64 with a university degree

39%

38%

37%

36%

35%

34%

Shading can be used to highlight an area of interest.

Future projections should be distinguished clearly from historical observations.

KEY (LEGEND)

■ Higher education sector spending (left axis)

● Tertiary education attainment (right axis)

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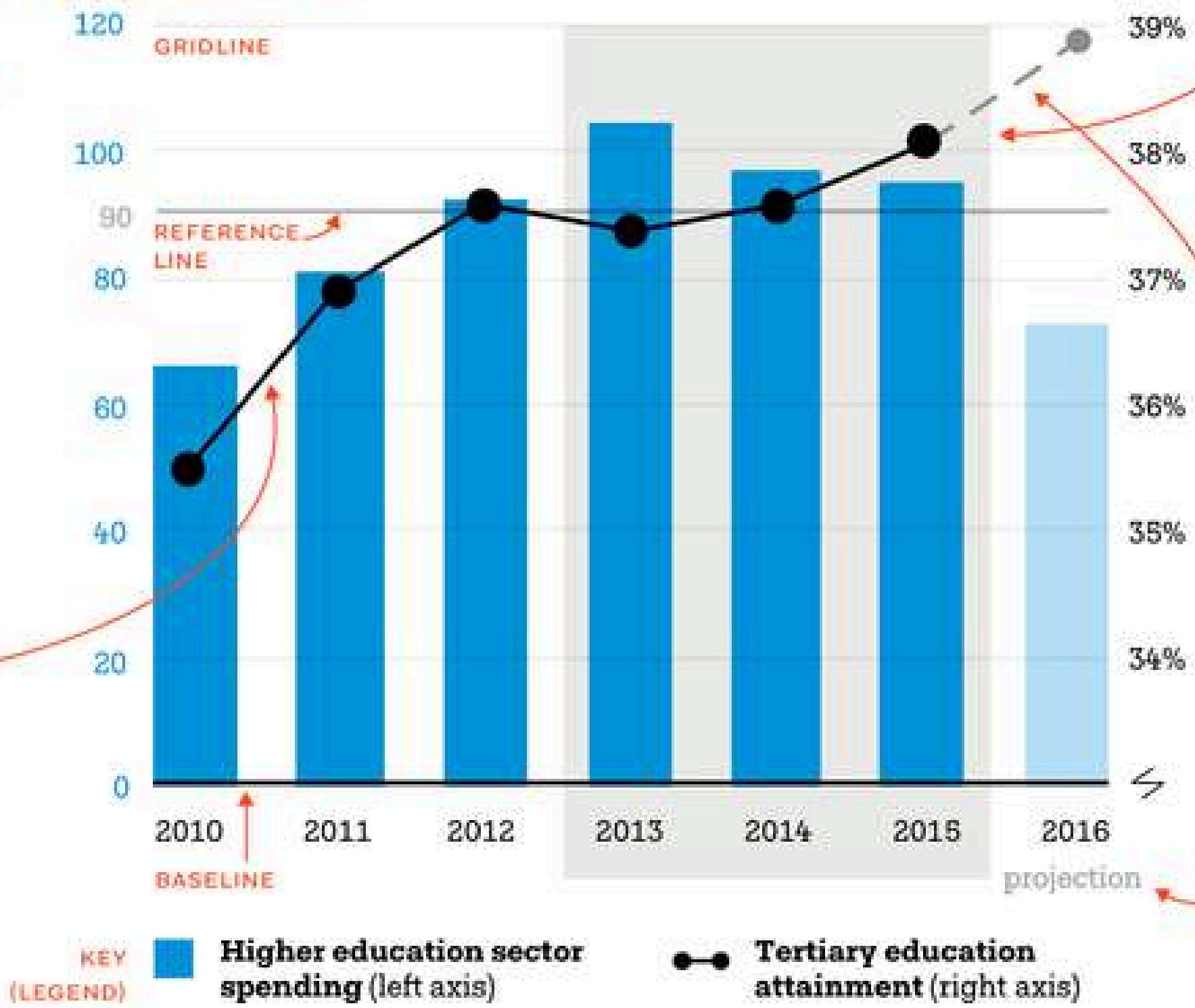
Despite falling investment in tertiary education, the share of university graduates is on the rise in Estonia  
**Higher education spending and tertiary education attainment**

Euros per inhabitant

Population aged 25-64 with a university degree

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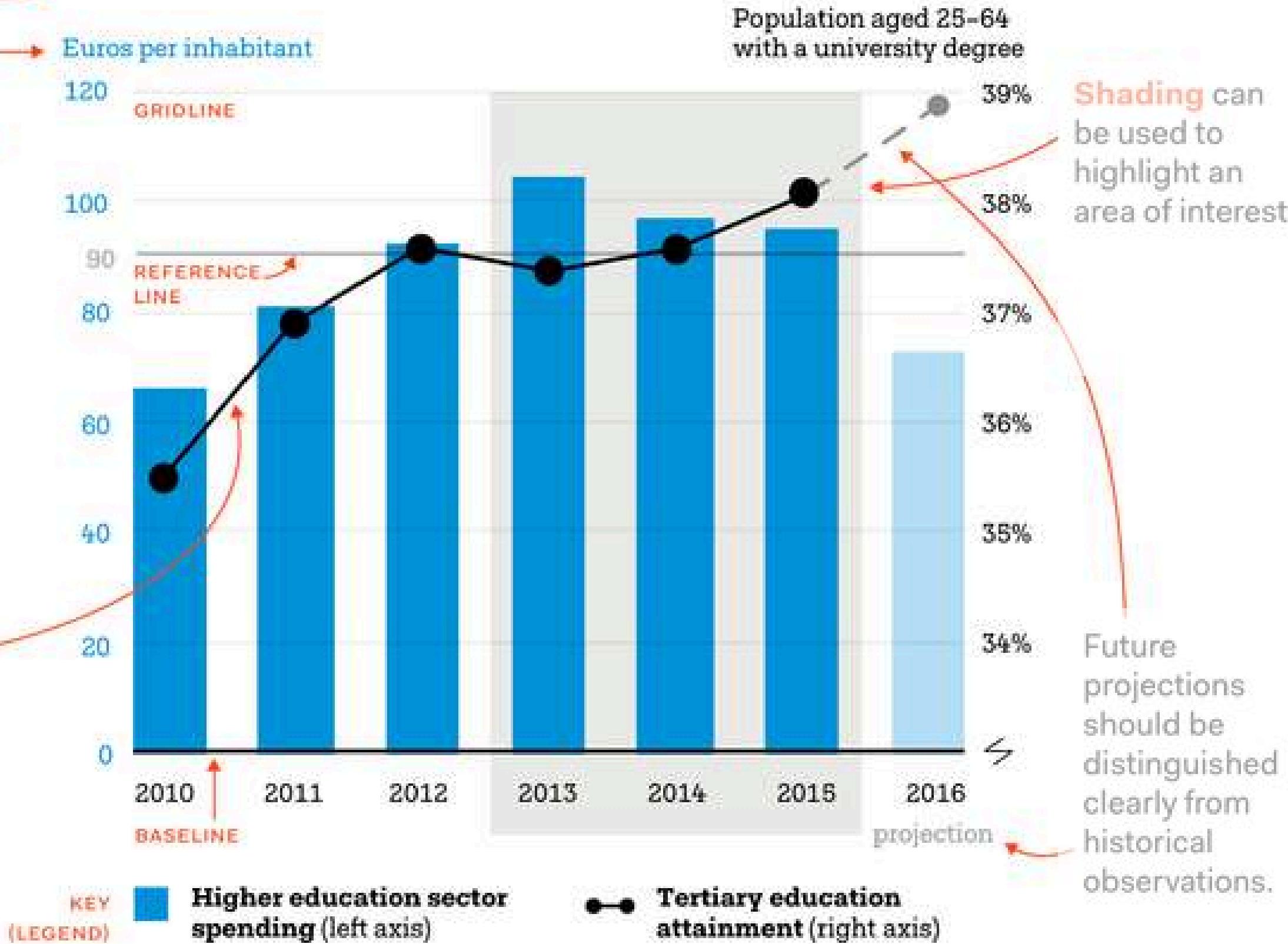
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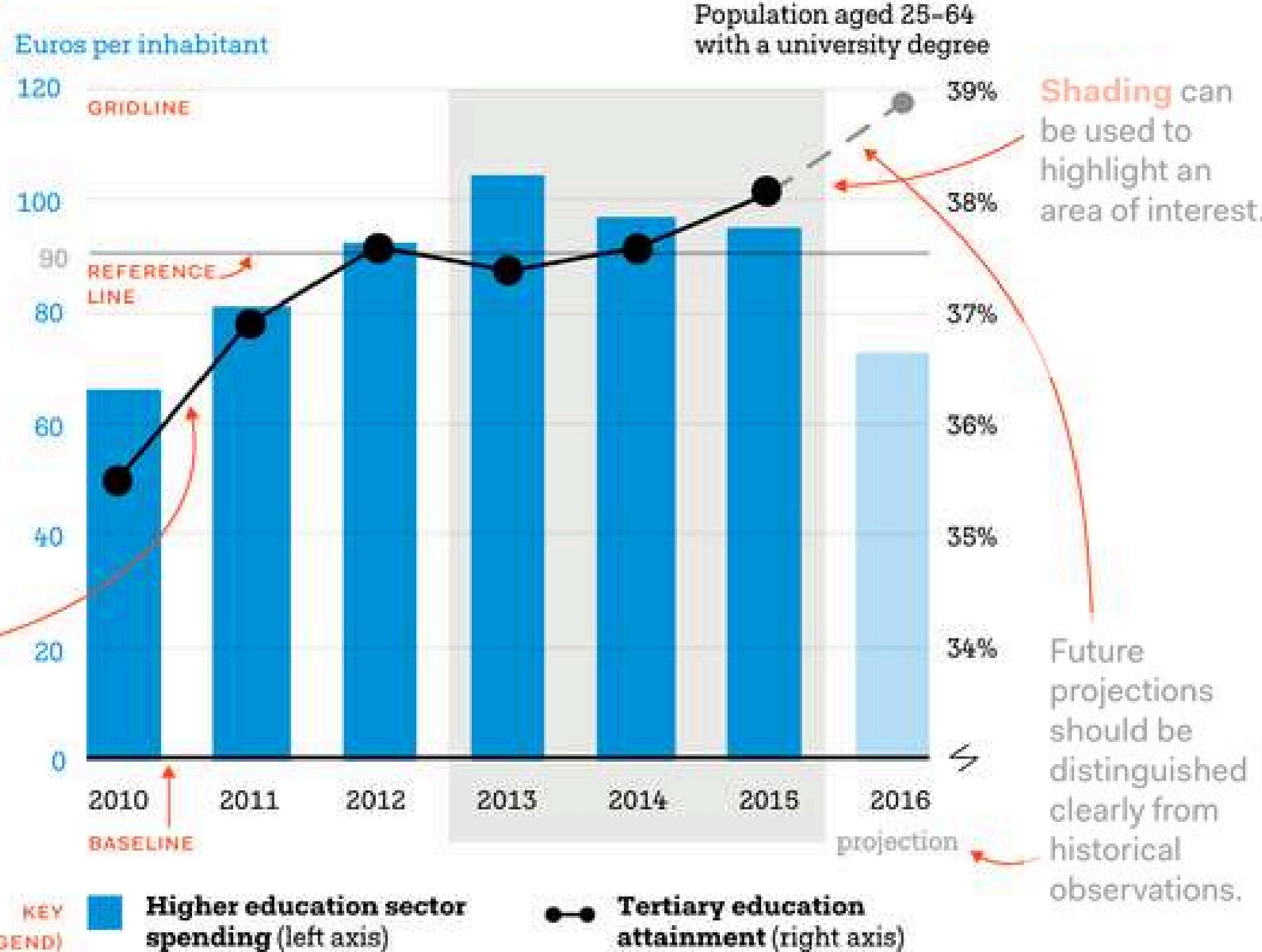
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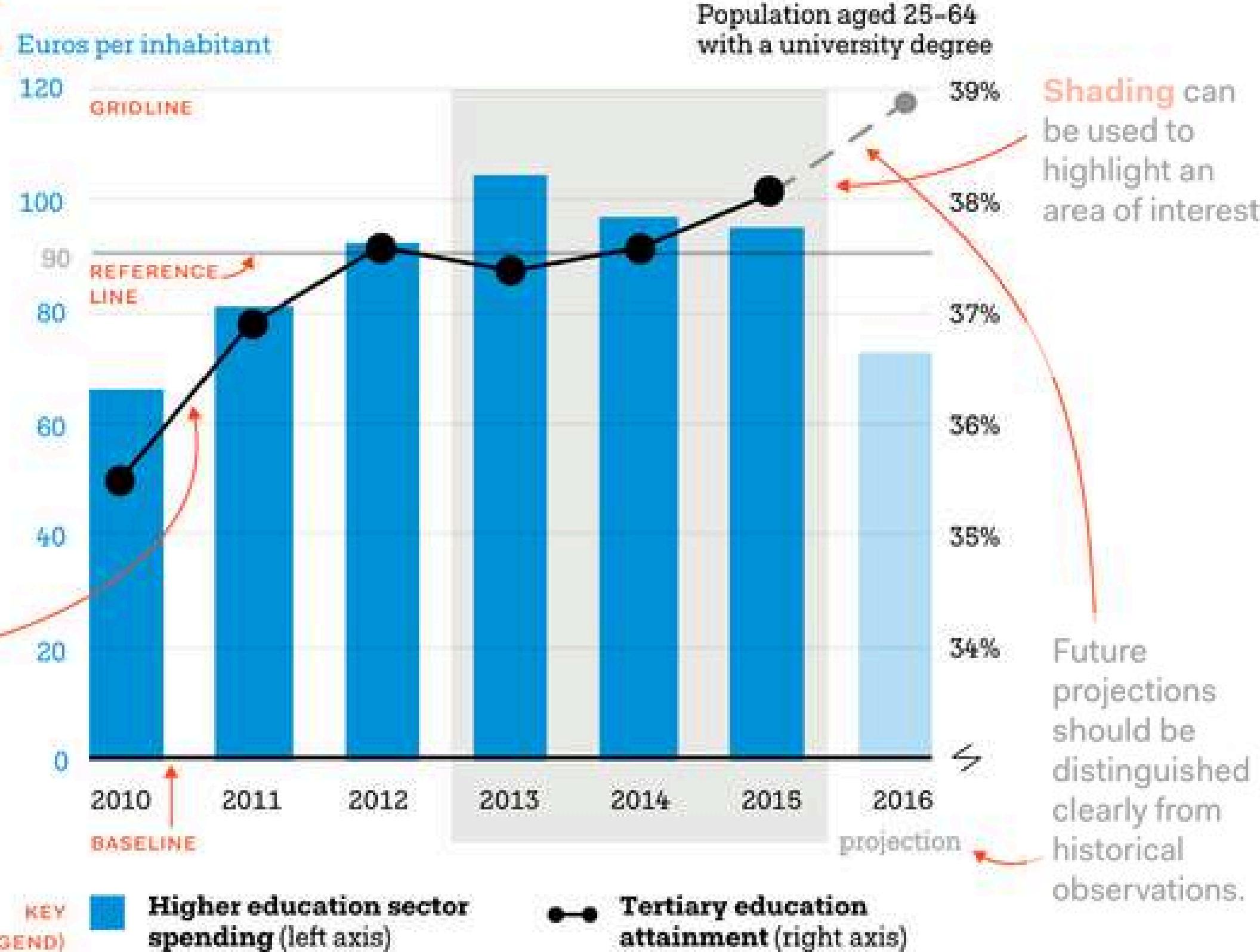
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Despite falling investment in tertiary education, the share of university graduates is on the rise in Estonia  
**Higher education spending and tertiary education attainment**



Source: Eurostat 2018: rd\_e\_gerdtot, edat\_lfse\_04

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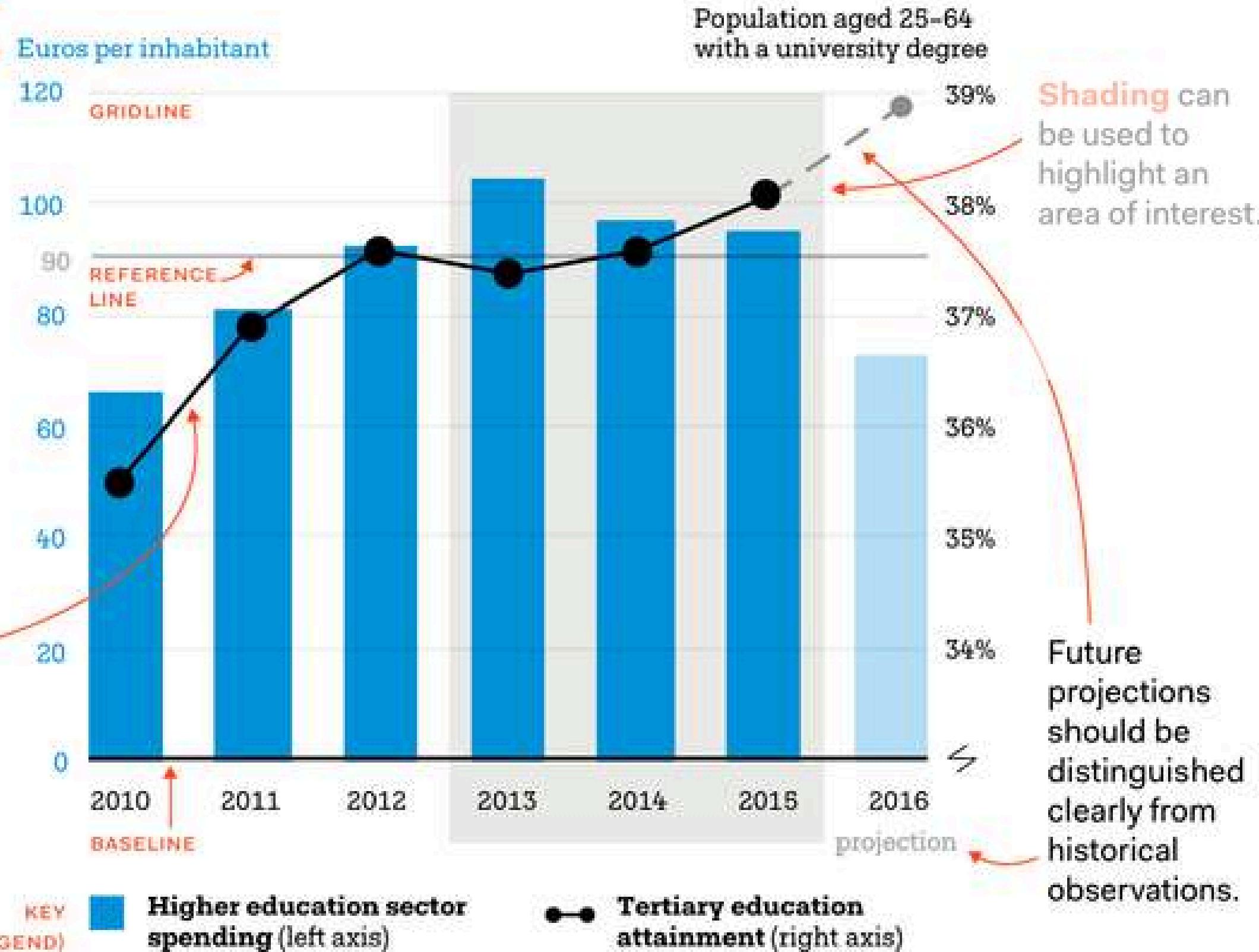
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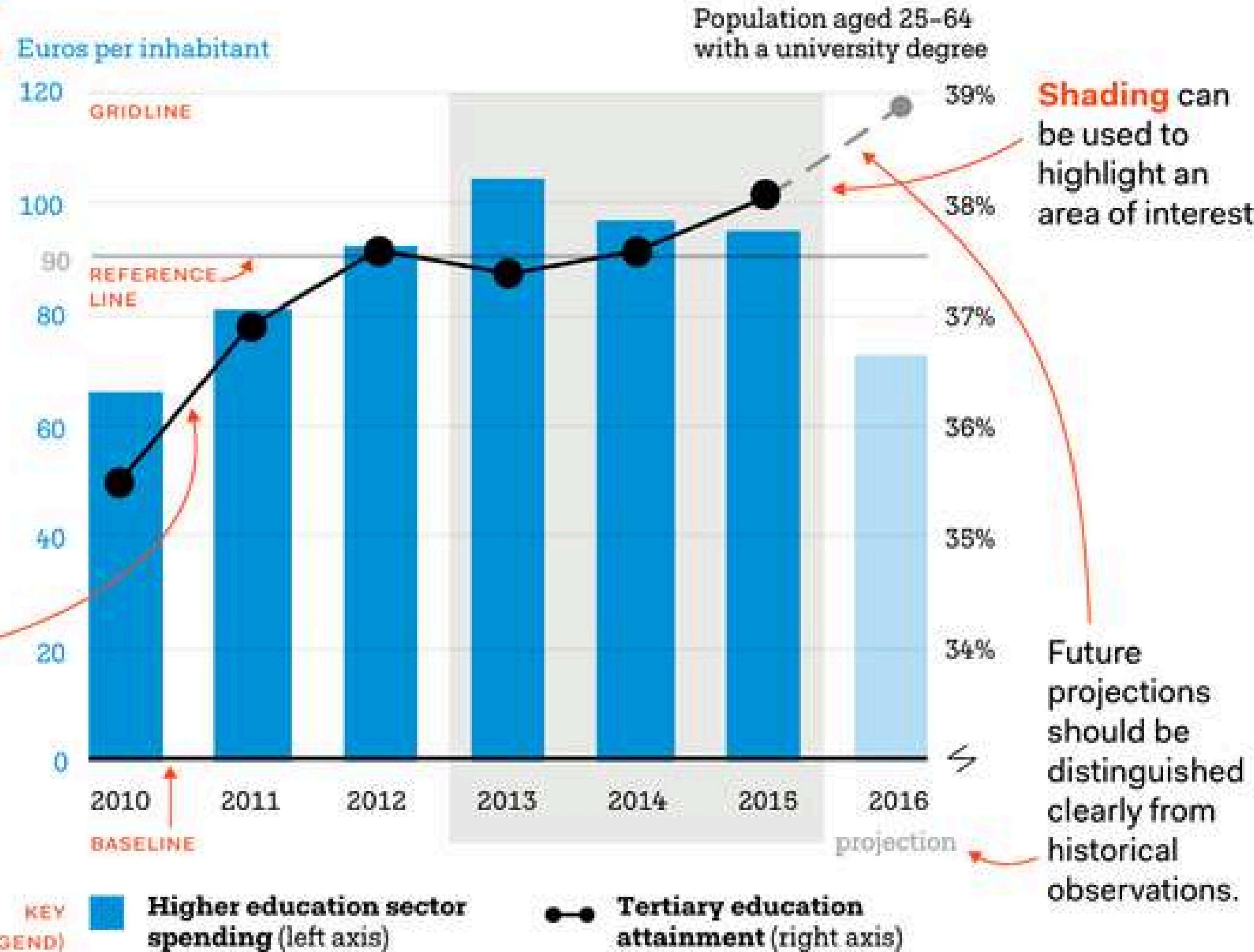
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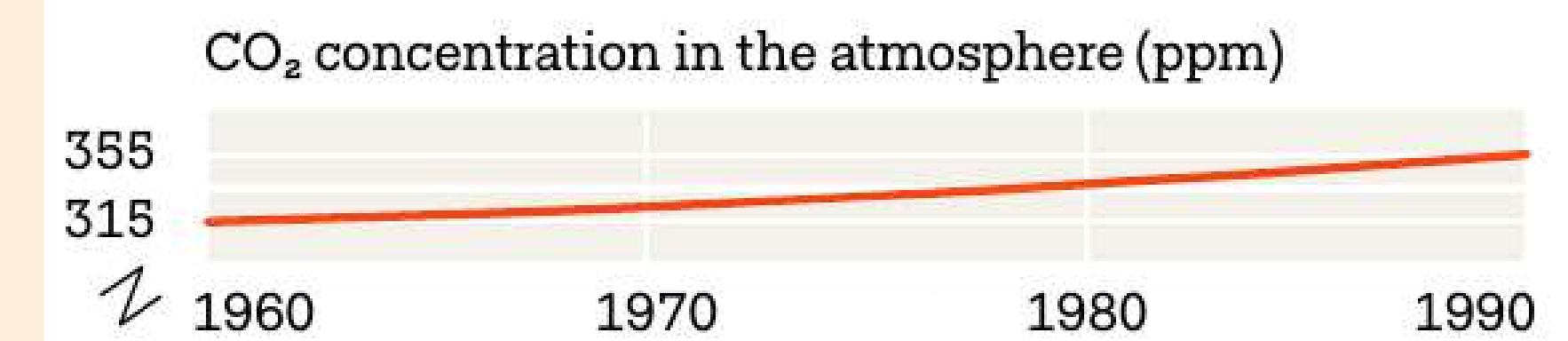
### Higher education spending and tertiary education attainment



Source: Eurostat 2018: rd\_e\_gerdtot, edat\_lfse\_04

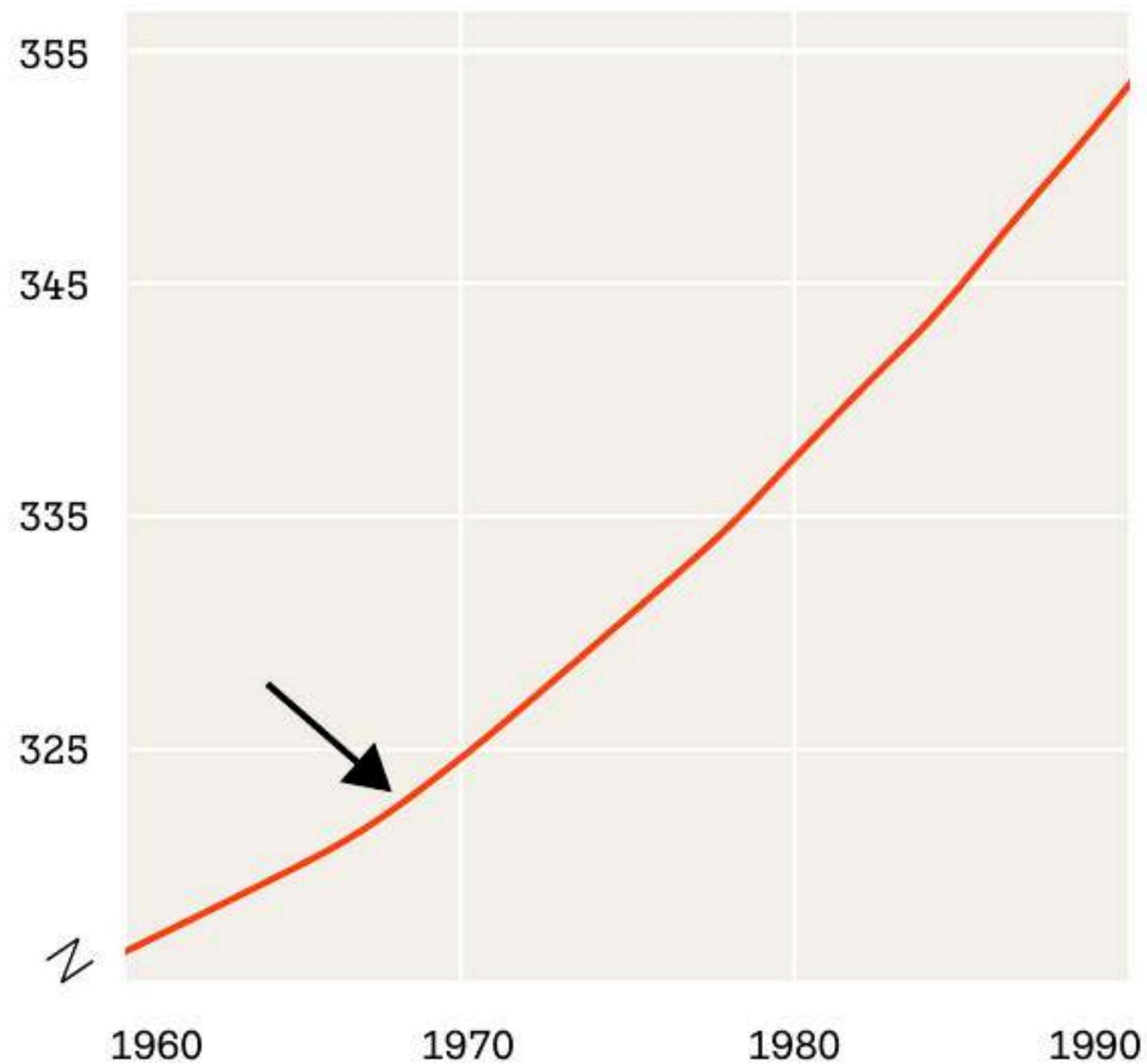
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## Atmospheric CO<sub>2</sub> levels

CO<sub>2</sub> concentration in the atmosphere (ppm)

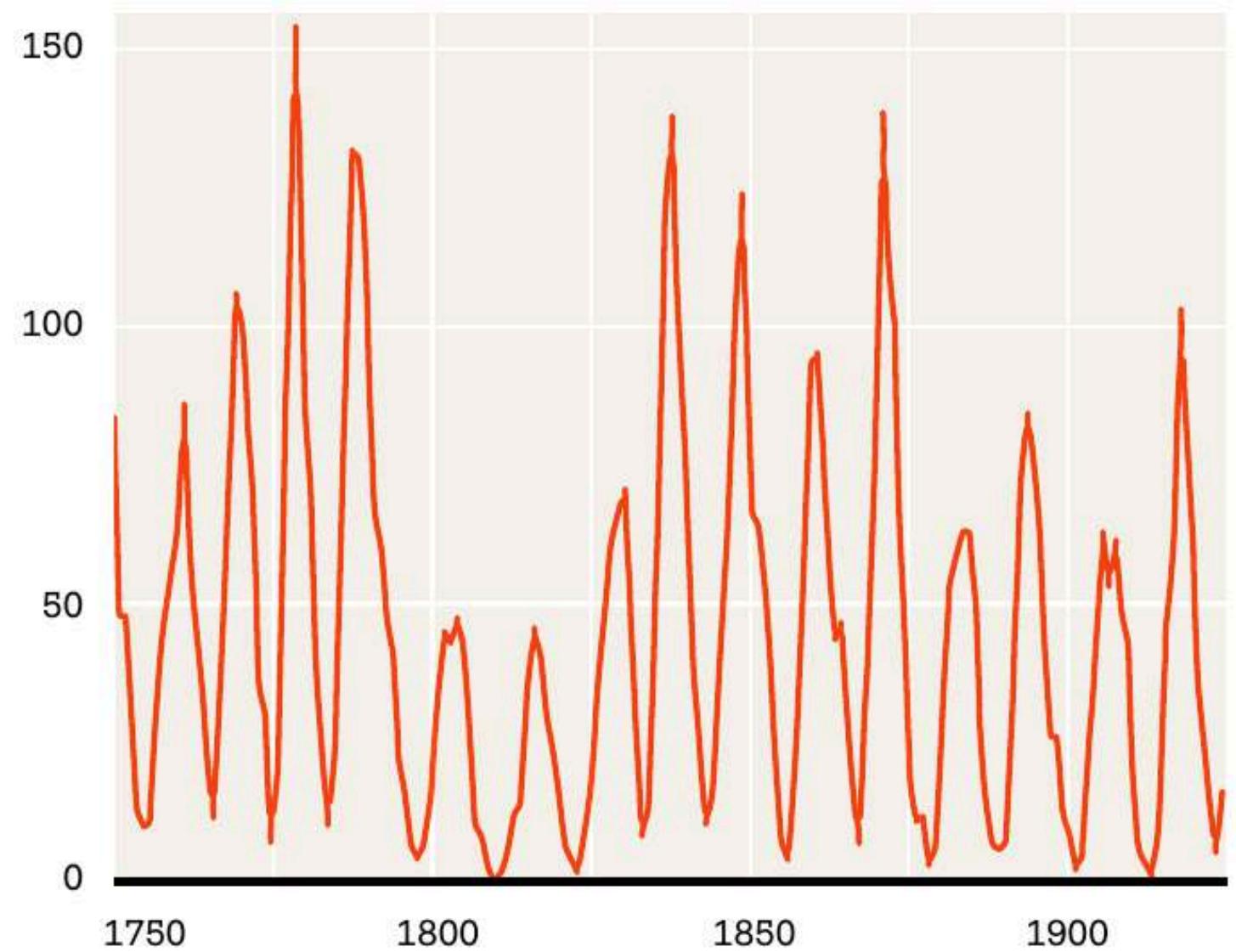


CO<sub>2</sub> concentration in the atmosphere (ppm)

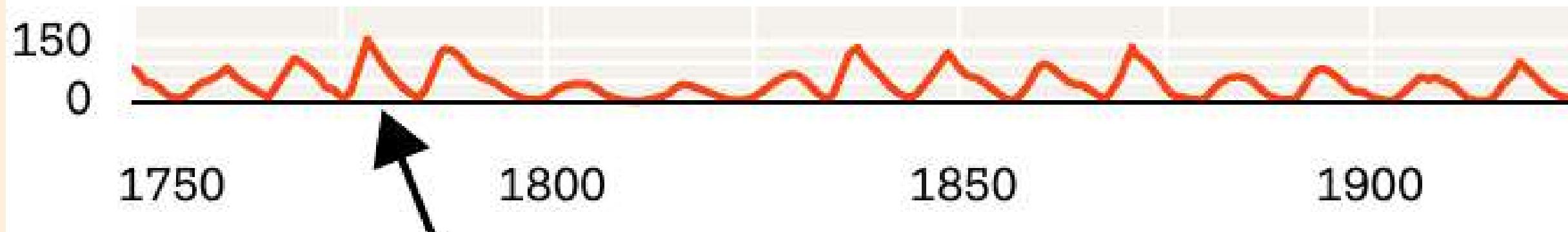


## Number of sunspots

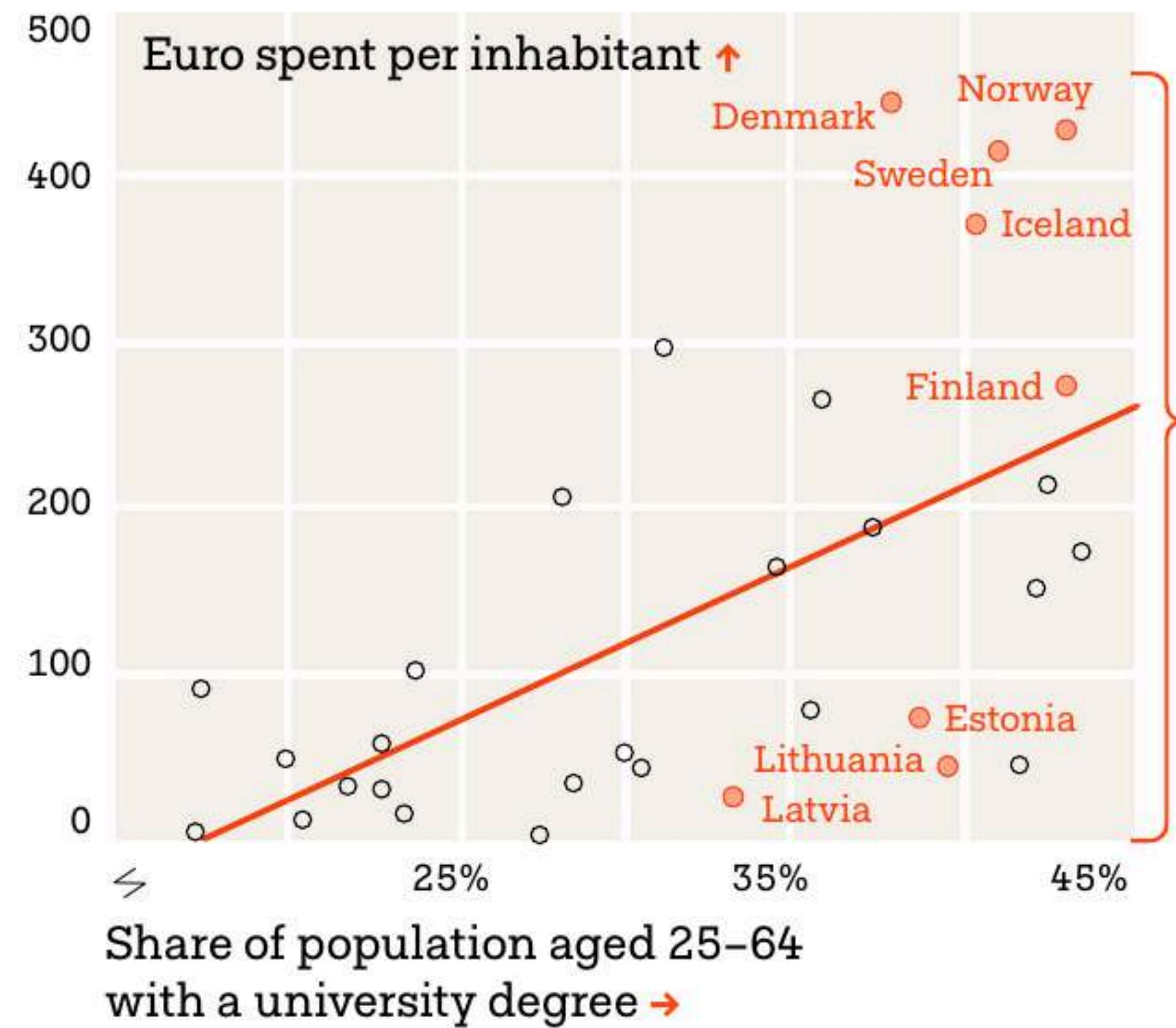
The Wolf number



## The Wolf number

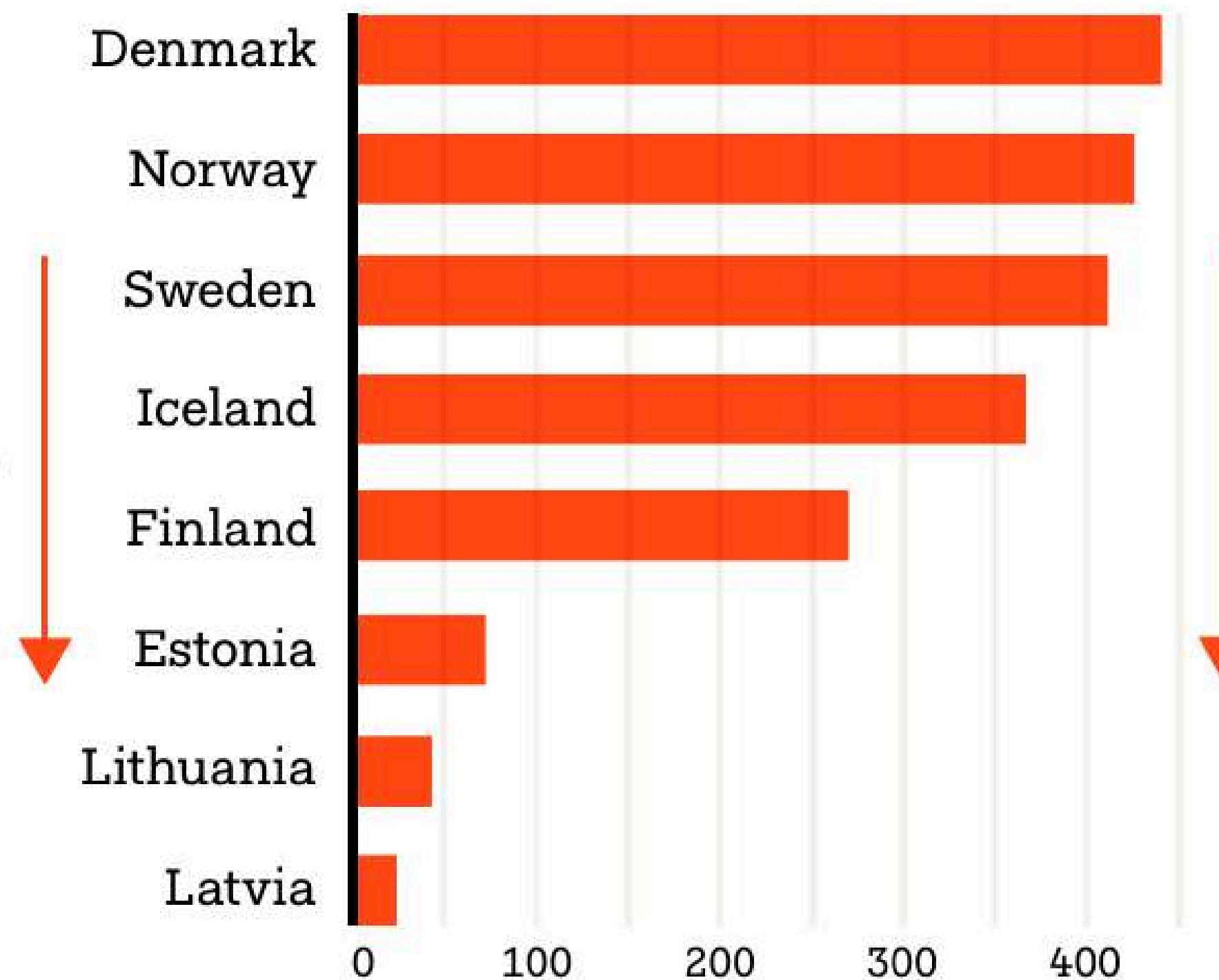


## Higher education spending and tertiary education attainment

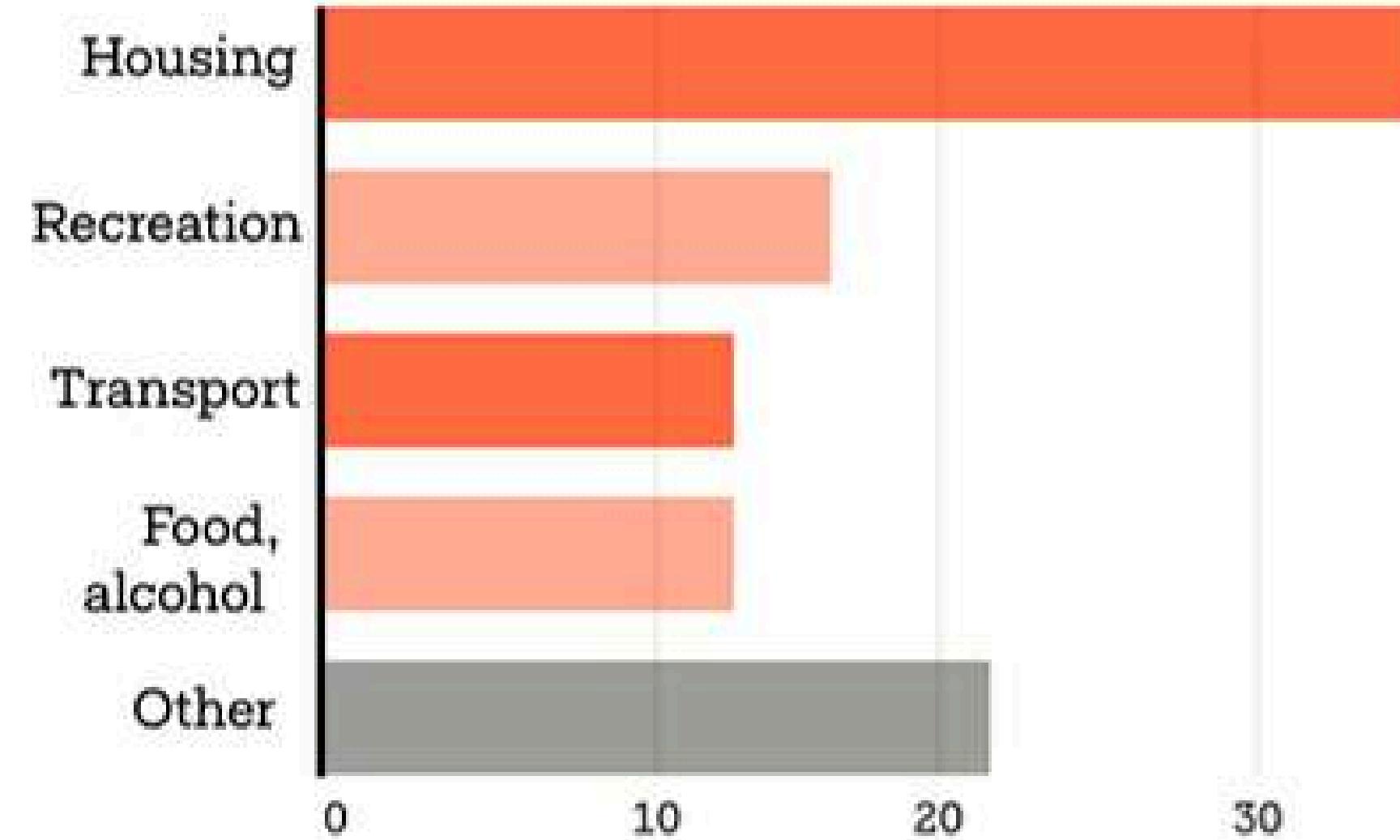
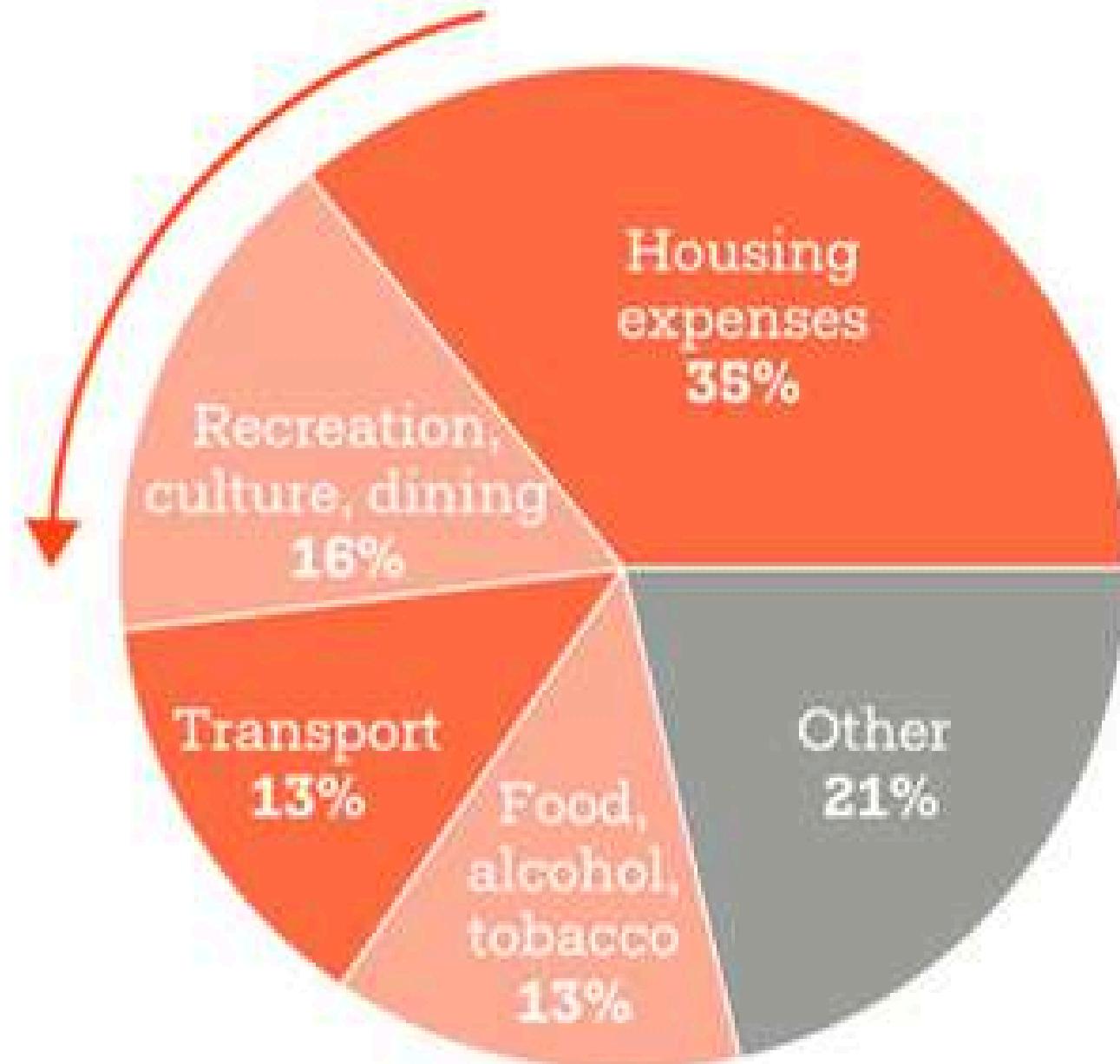


## **Higher education spending (2016)**

Euros per inhabitant



## Single-person household expenditures in Iceland (2013-2016)

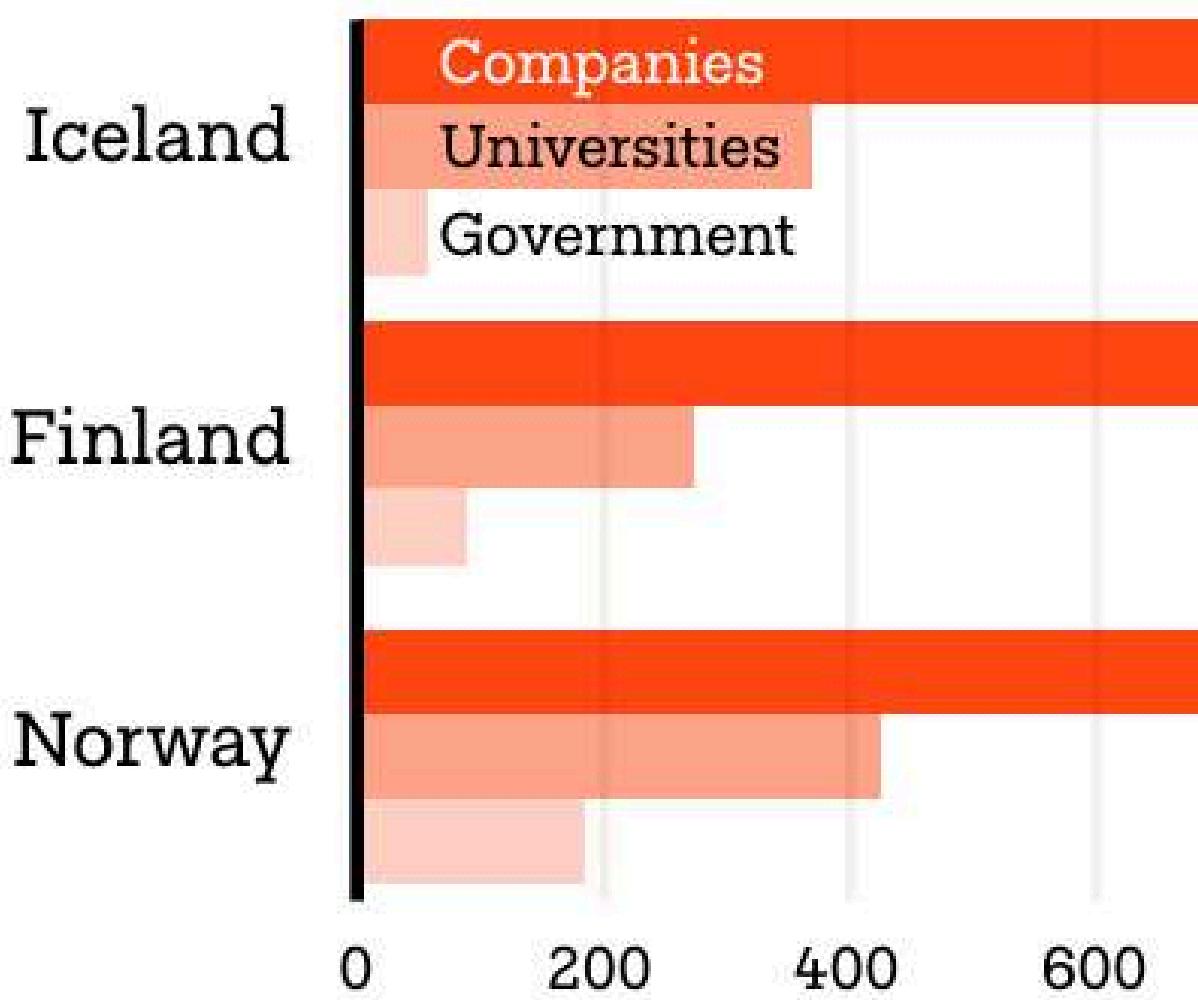


Source: Statistics Iceland (avg. 2013-2016 expenditures)

## ORDERING BY INDIVIDUAL VALUES

### R&D spending by sector

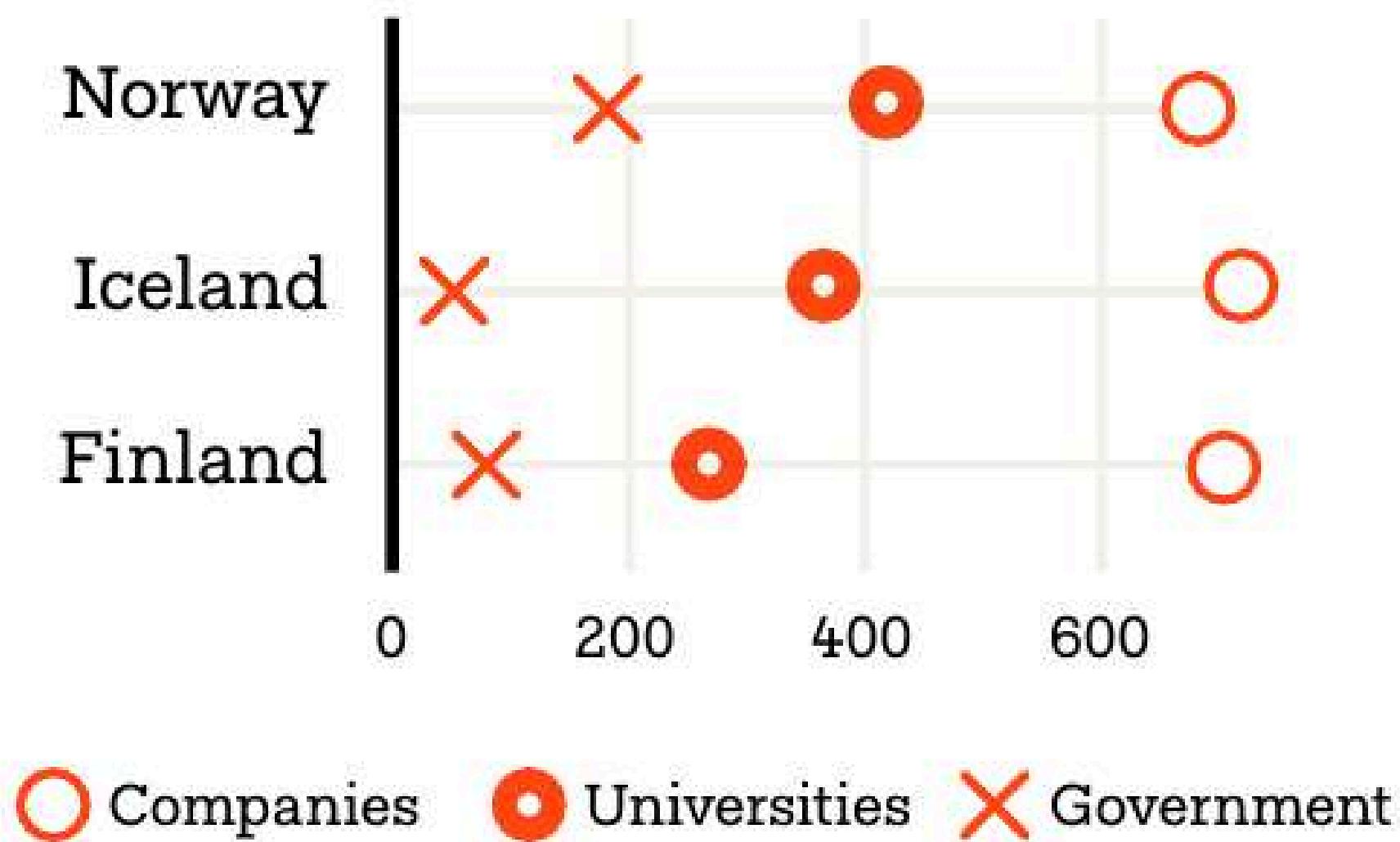
Euros per inhabitant (2016)



## ORDERING BY TOTALS

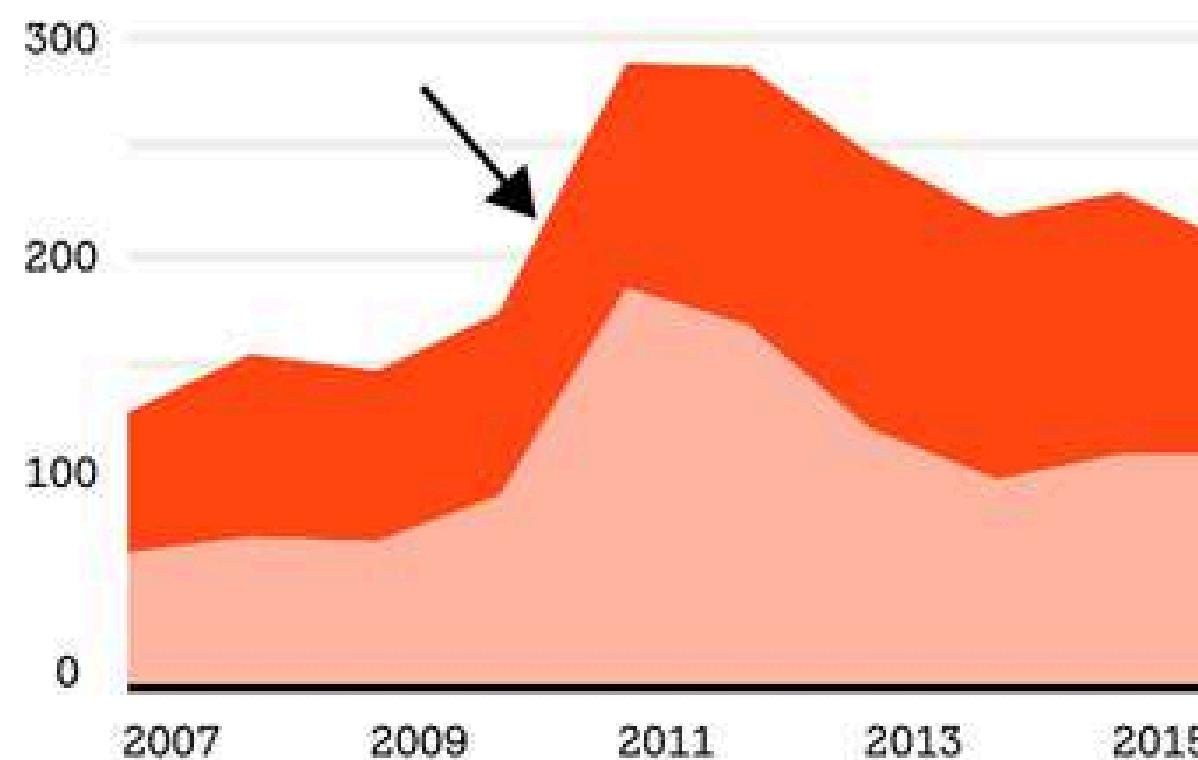
### R&D spending by sector

Euros per inhabitant (2016)



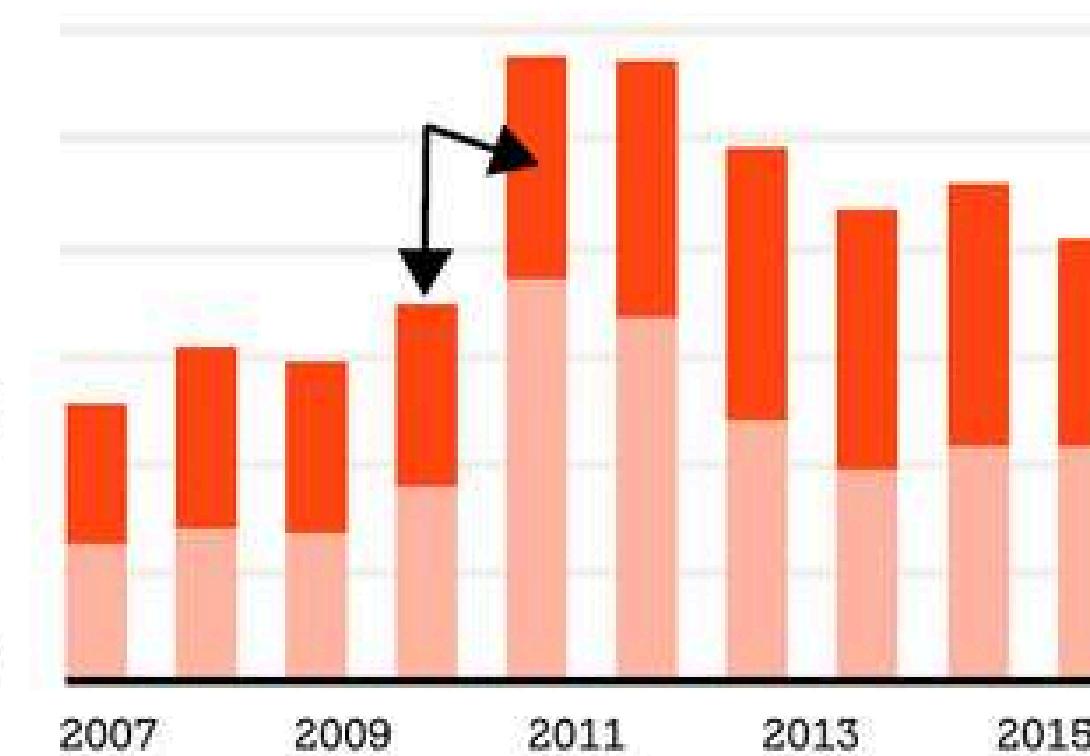
# R&D spending by sector in Estonia (2007–2016)

Euro per inhabitant



**public  
sector  
spending**

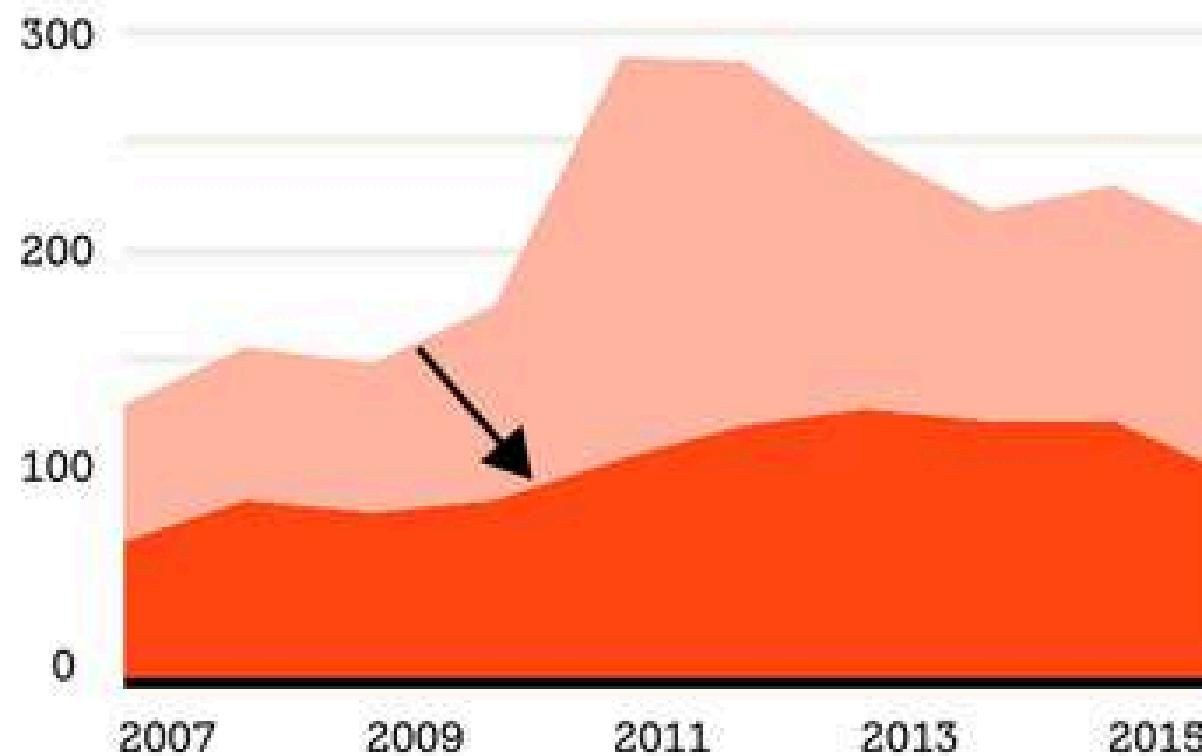
**private  
sector  
spending**



Source: Eurostat 2018. rd\_e\_gertot

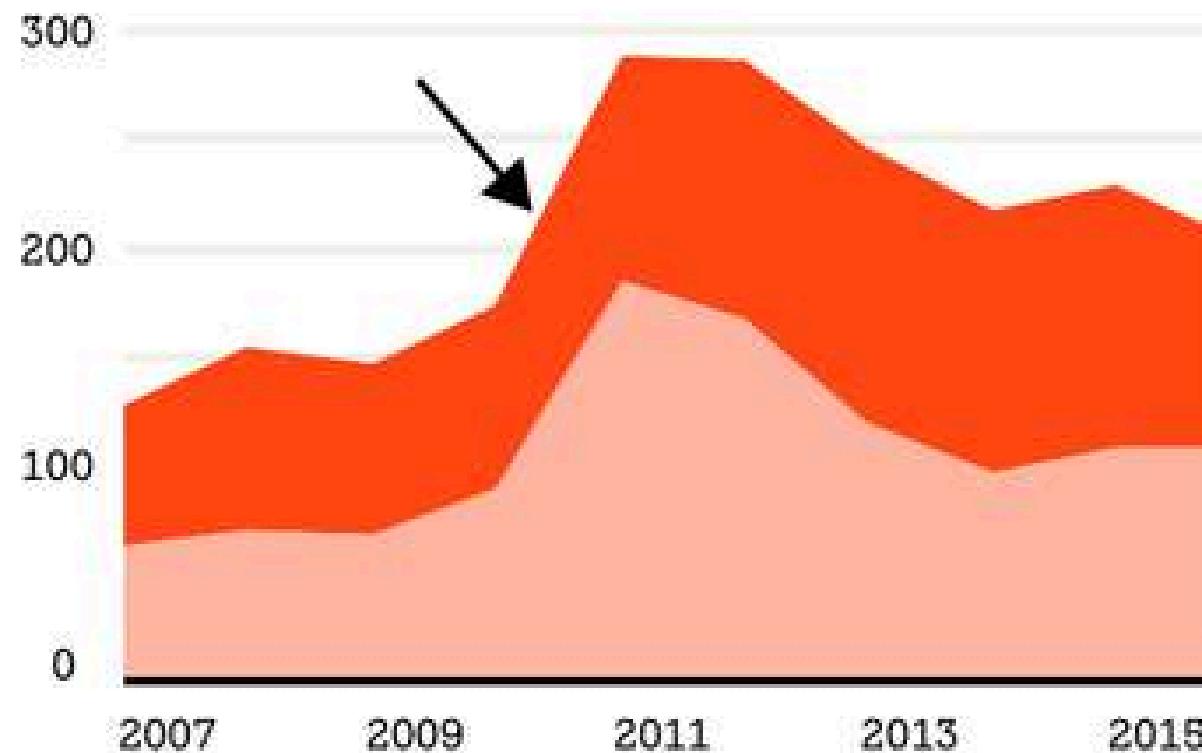
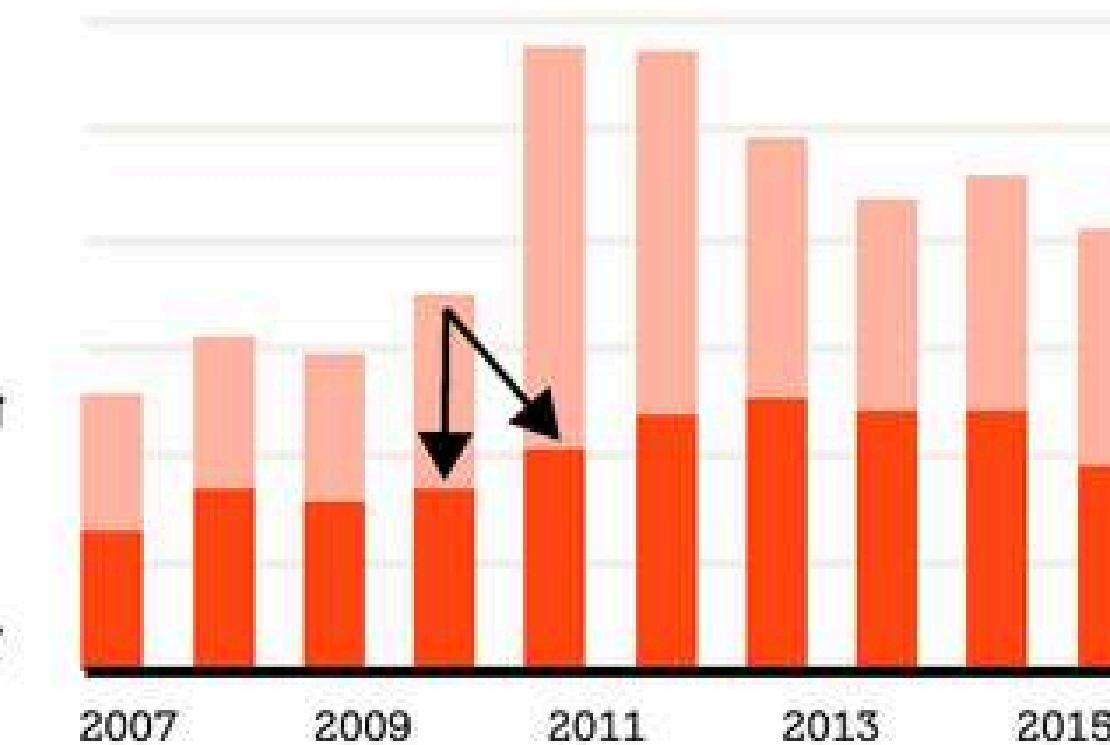
# R&D spending by sector in Estonia (2007–2016)

Euro per inhabitant



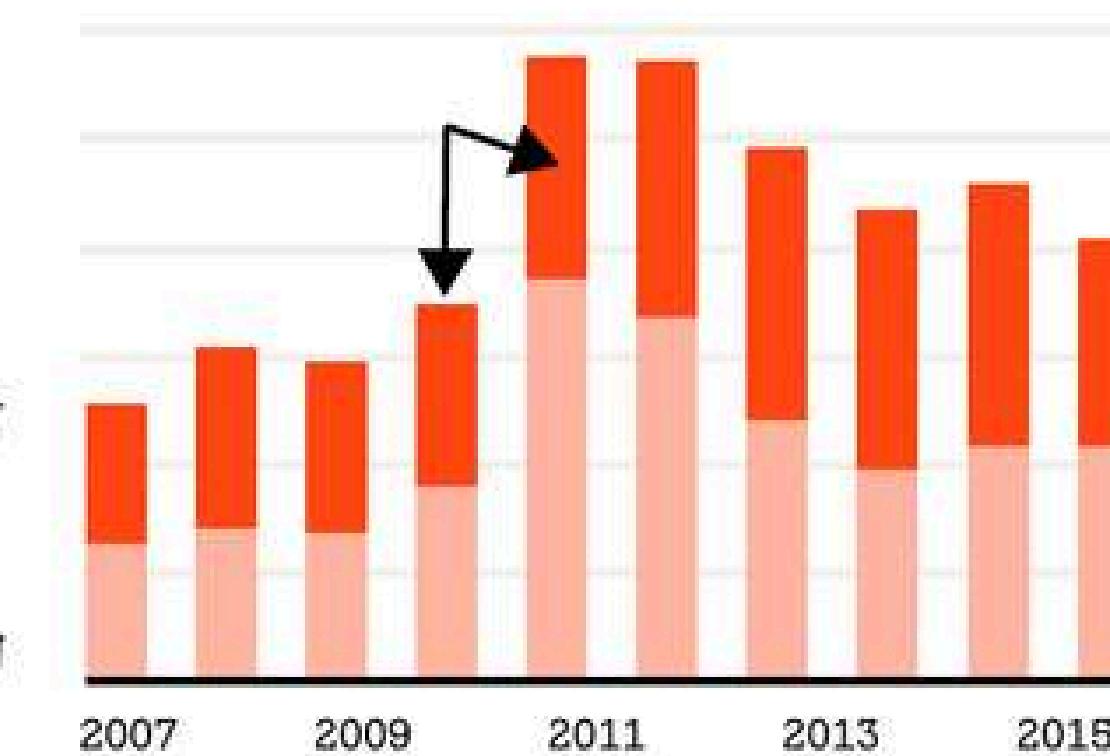
**private  
sector  
spending**

**public  
sector  
spending**



**public  
sector  
spending**

**private  
sector  
spending**

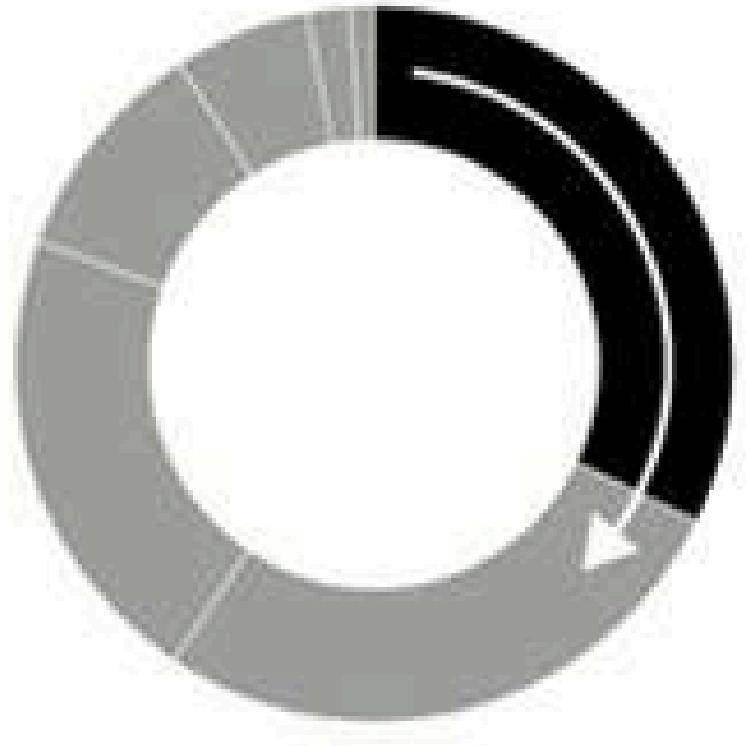


Source: Eurostat 2018. rd\_e\_gertot

## **ORDERING PIE AND DONUT SLICES**

**Default:**

**Clockwise from  
“twelve o’clock”**



## ORDERING PIE AND DONUT SLICES

Default  
Clockwise from  
"twelve o'clock"



Recommended methods  
Counter-clockwise  
from "three o'clock"



## ORDERING PIE AND DONUT SLICES

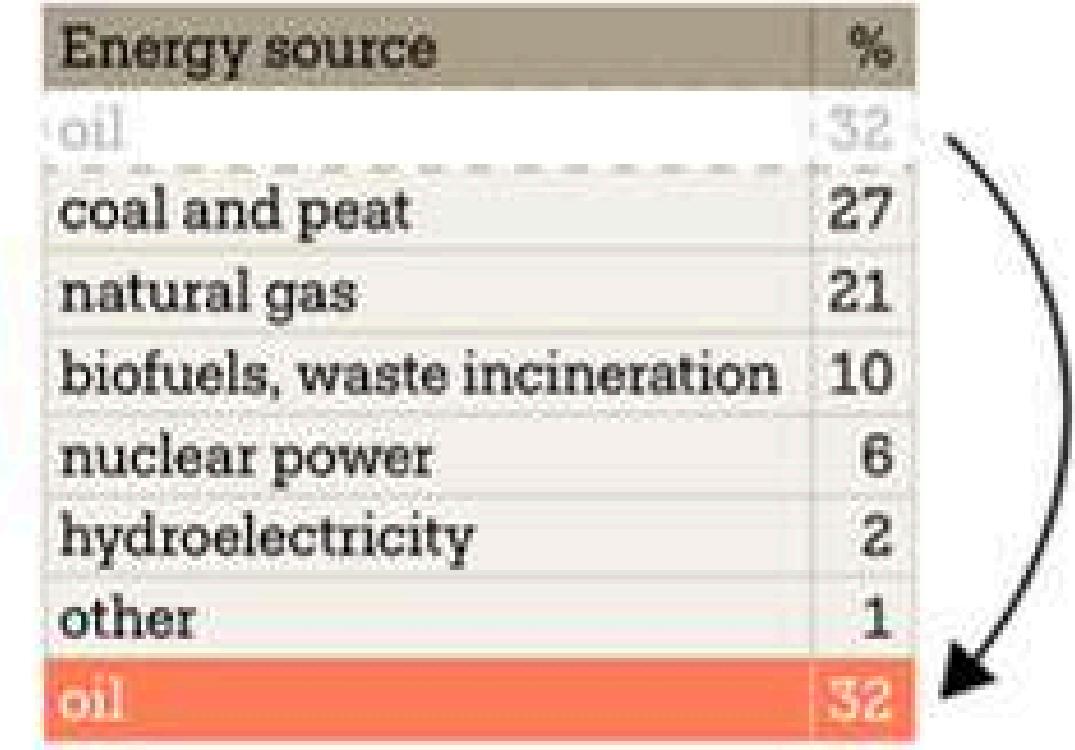
Default  
Clockwise from  
"twelve o'clock"



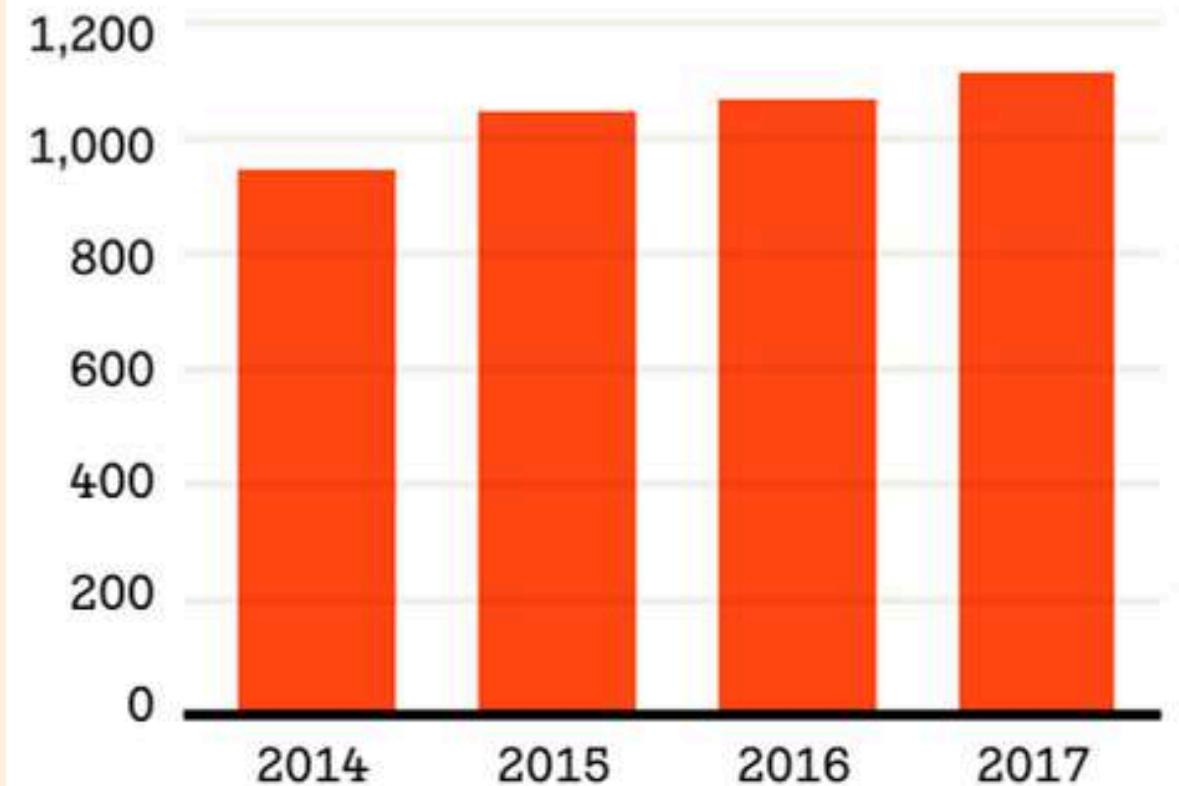
Recommended methods  
Counter-clockwise  
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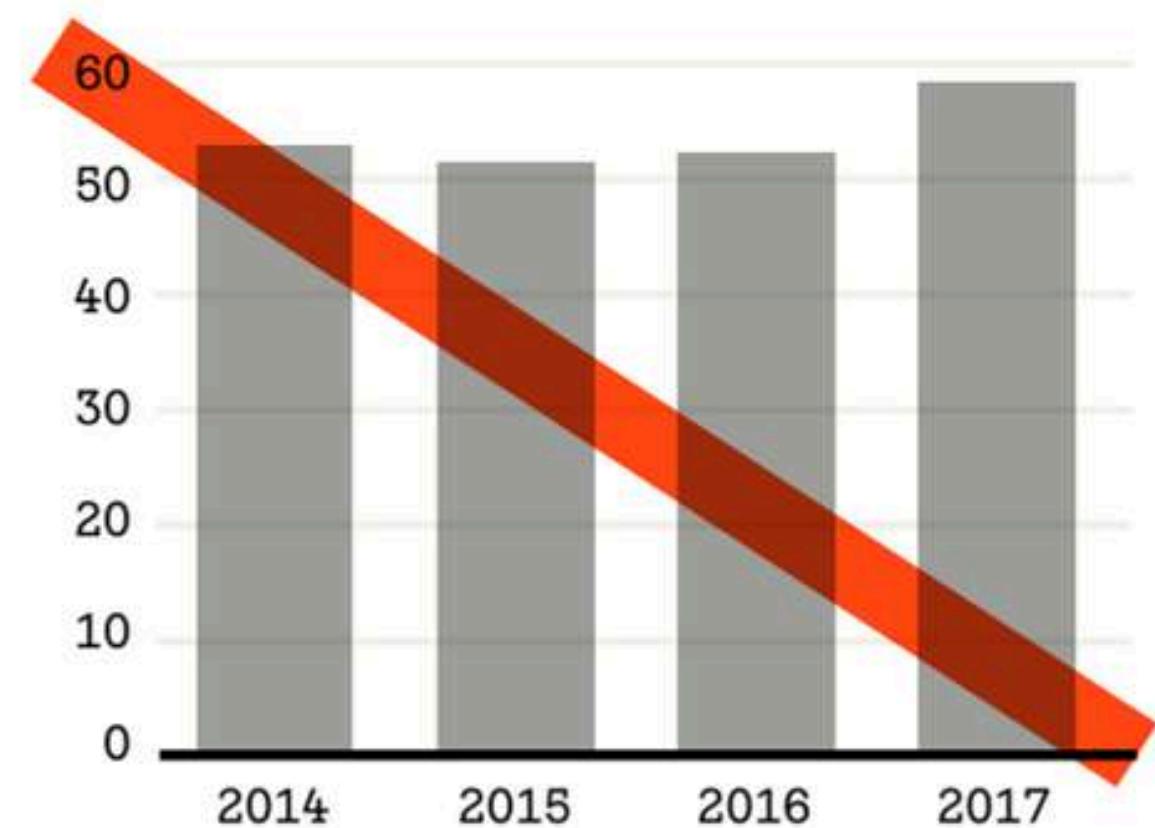
or  
Moving the first  
slice last



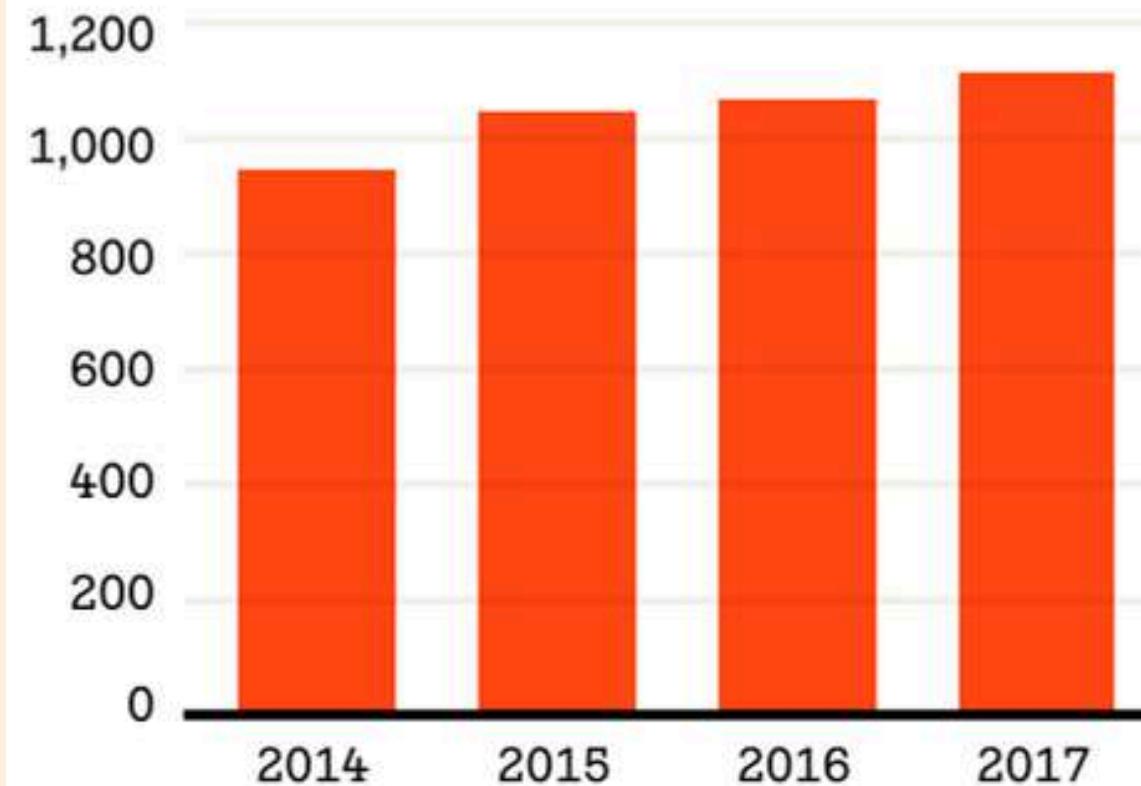
### BUSINESS SPENDING



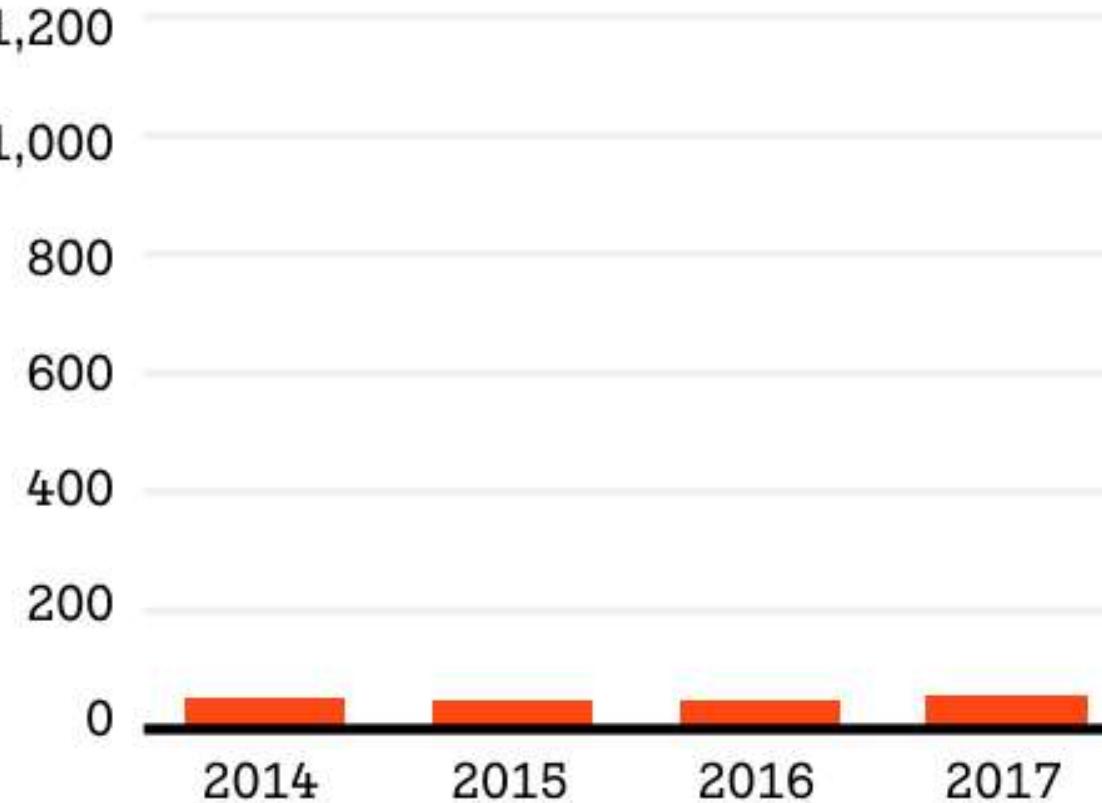
### GOVERNMENT SPENDING



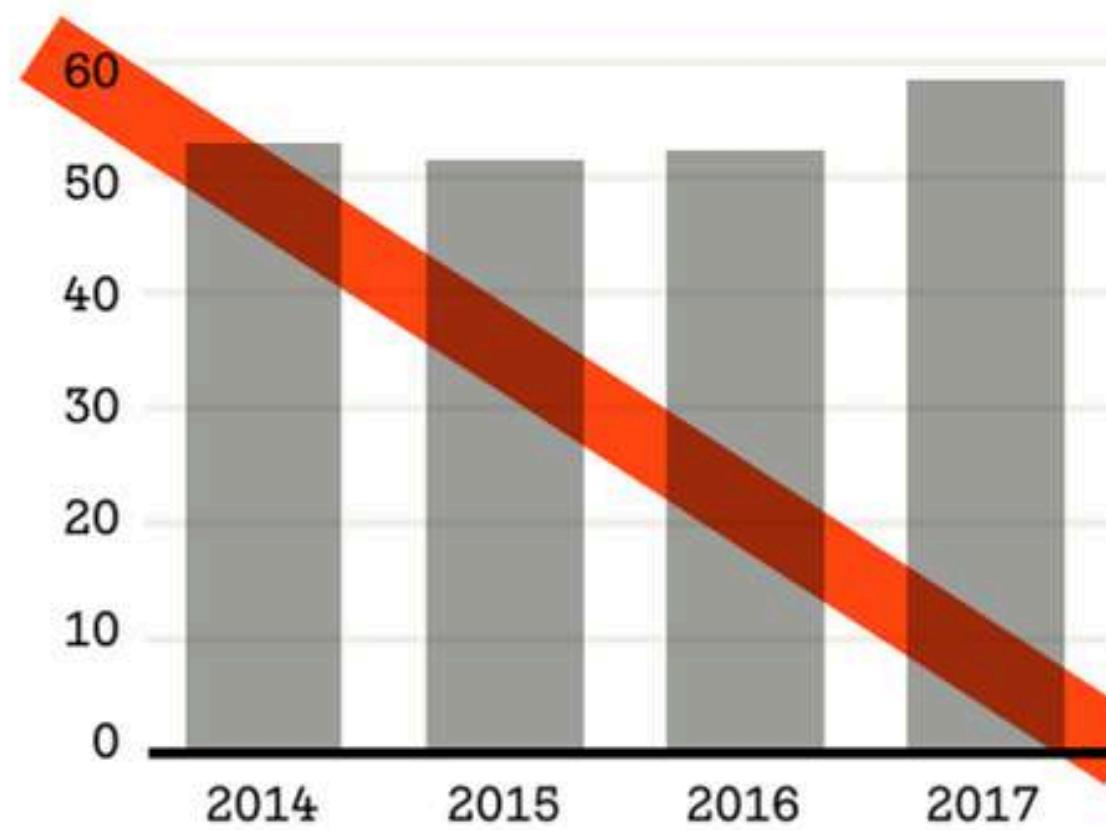
### BUSINESS SPENDING



### GOVERNMENT SPENDING



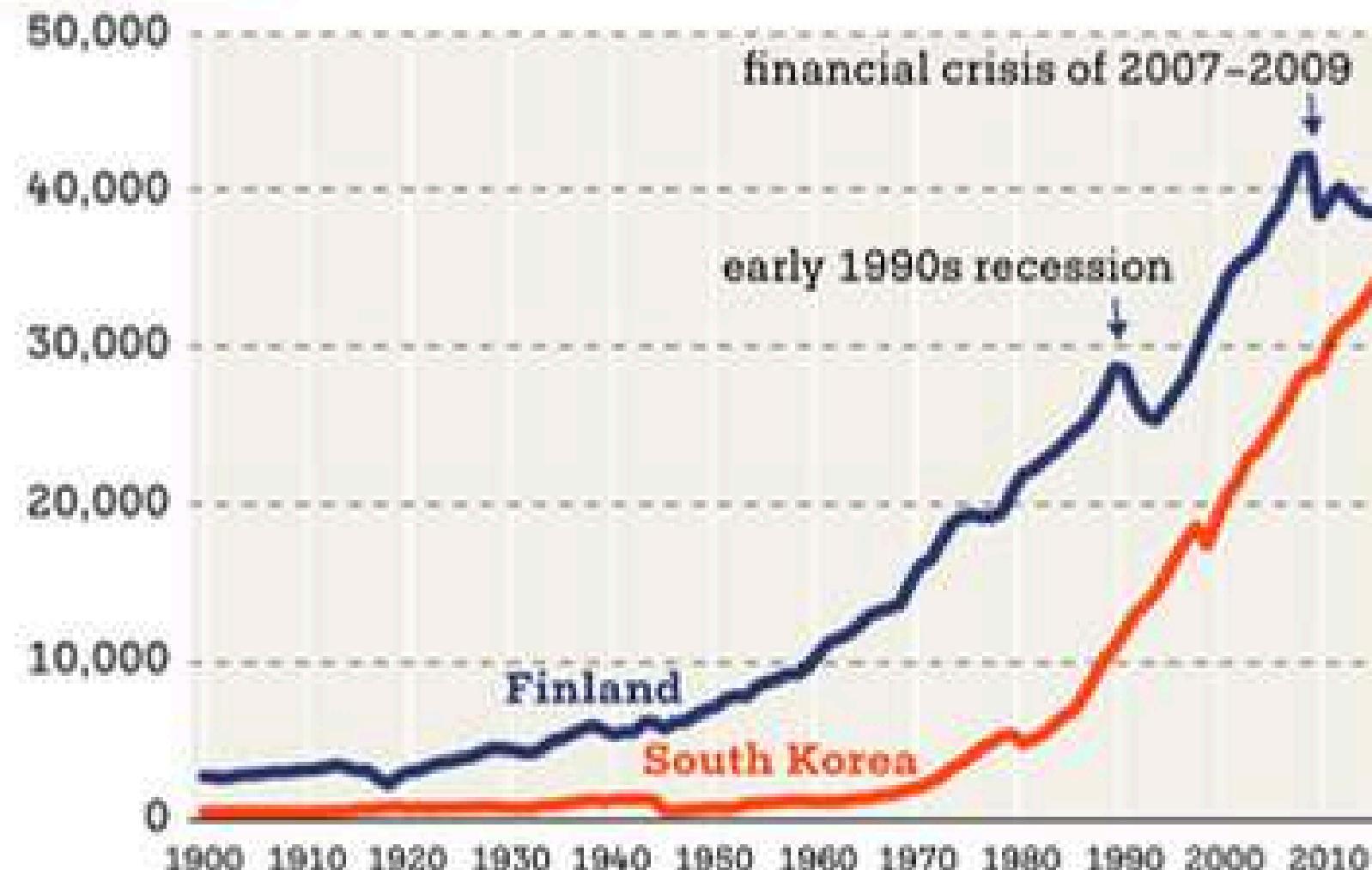
### GOVERNMENT SPENDING



## Gross domestic product (GDP) per capita in Finland and South Korea 1900–2015

GDP adjusted for purchasing power parity and inflation; international dollars

LINEAR SCALE



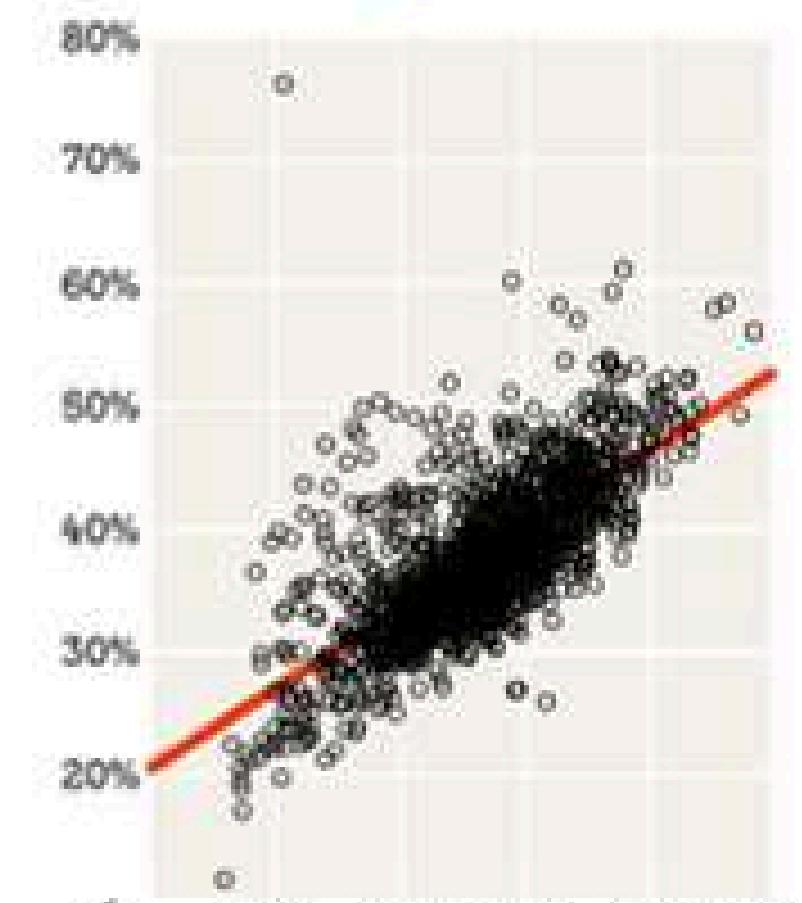
LOGARITHMIC SCALE



Source: Gapminder, 2016

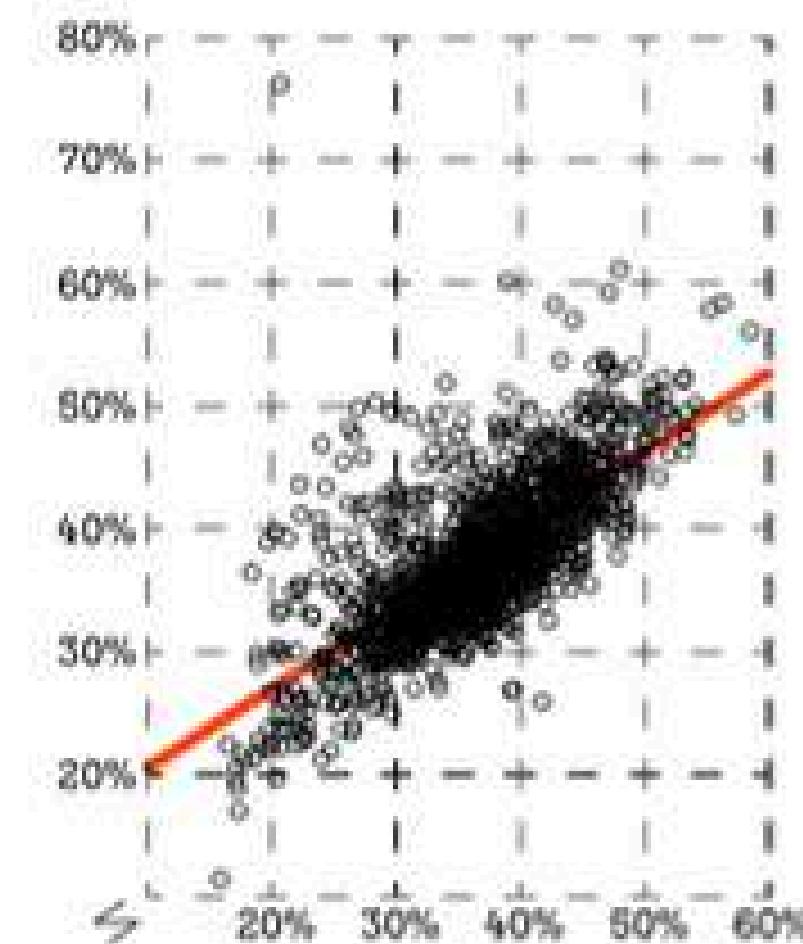
### Negative grid

"No" votes in  
the referendum ↗

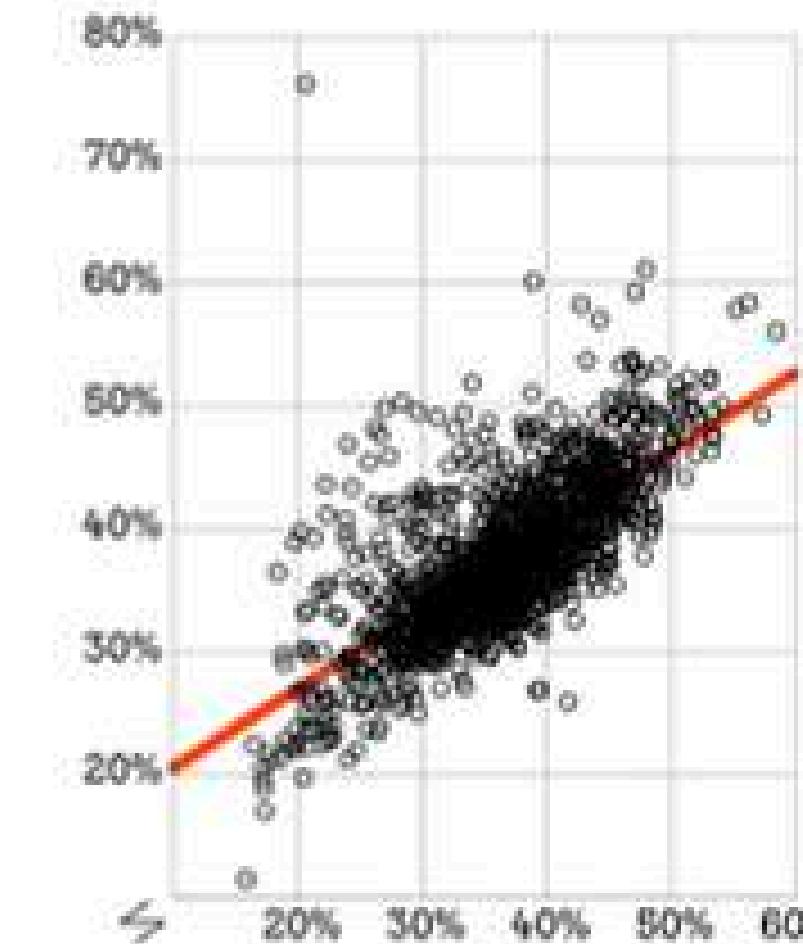


Vote share of FB  
and DF parties ↗

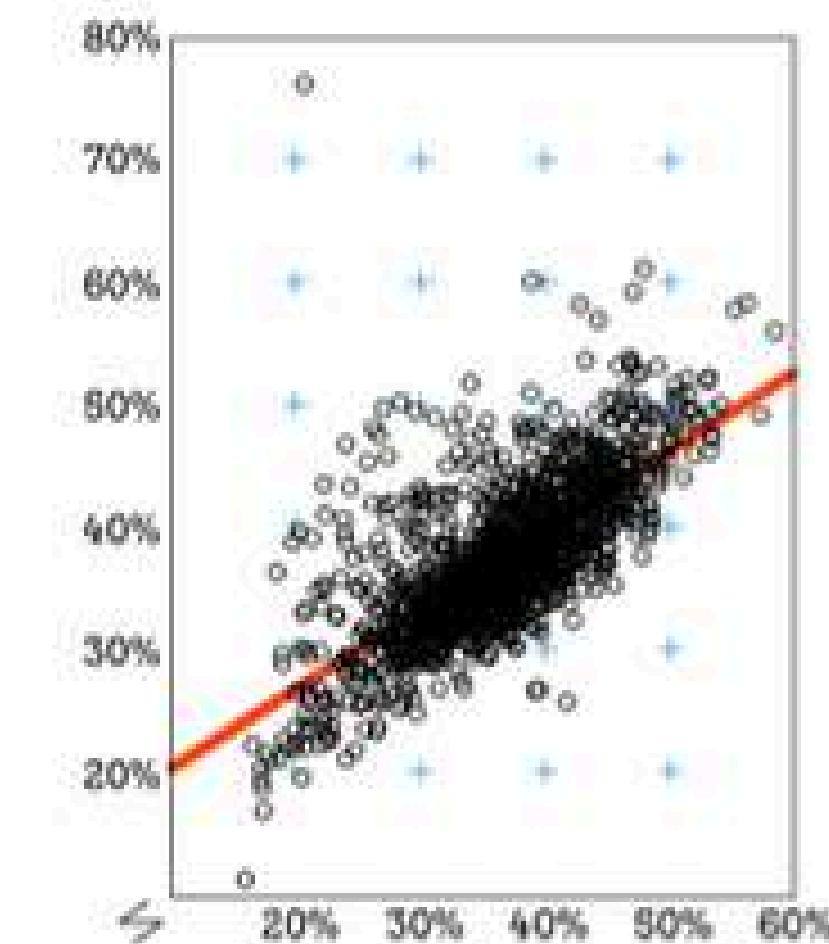
### Dashed line grid



### Gray gridlines



### Only intersections marked

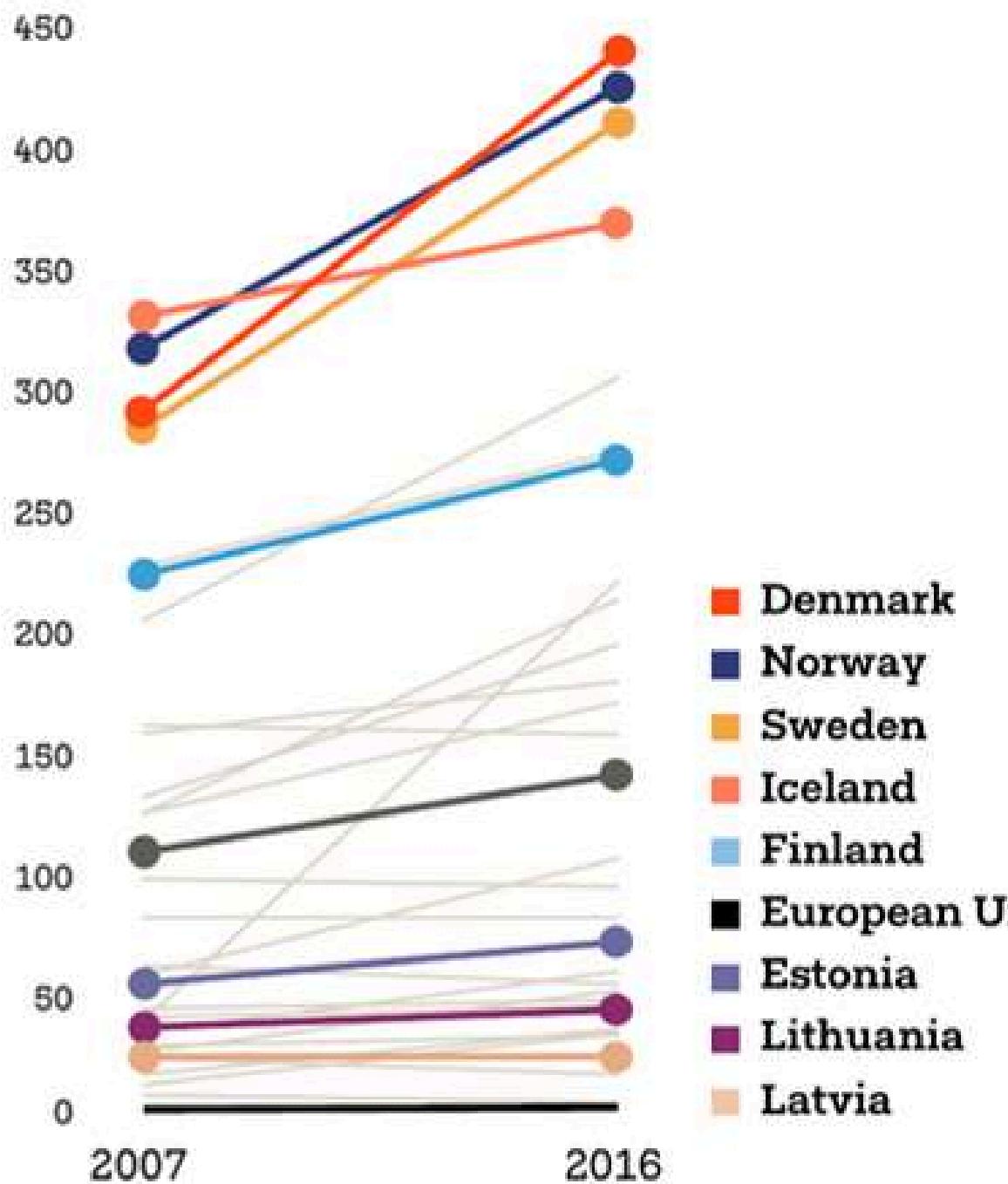


Source: Open Knowledge Denmark 2014.  
Valgdata workshop

### SEPARATE LEGEND

#### Higher education spending in Europe (2007–2016)

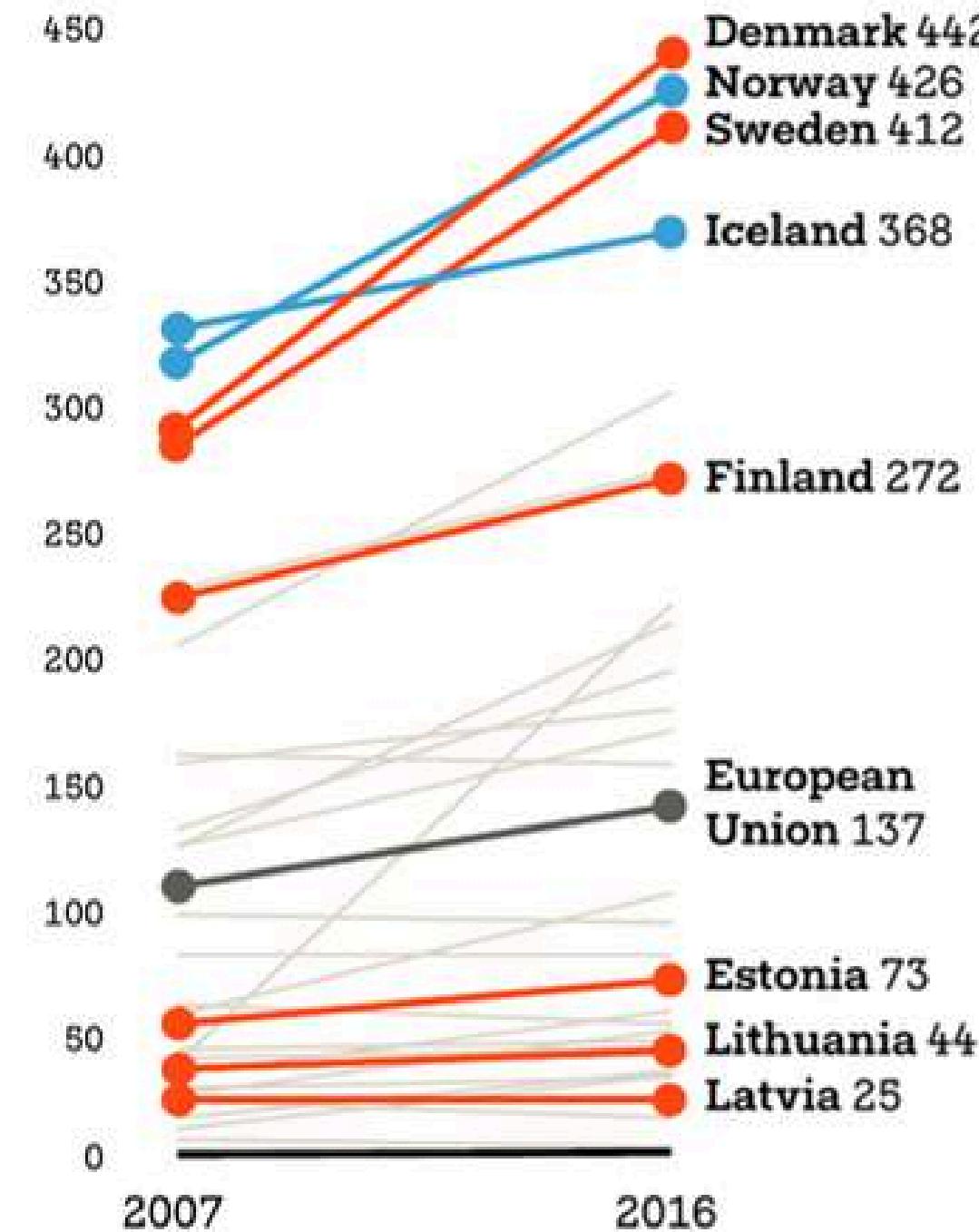
Euros per inhabitant



### DIRECT LABELING

#### Higher education spending in Europe (2007–2016)

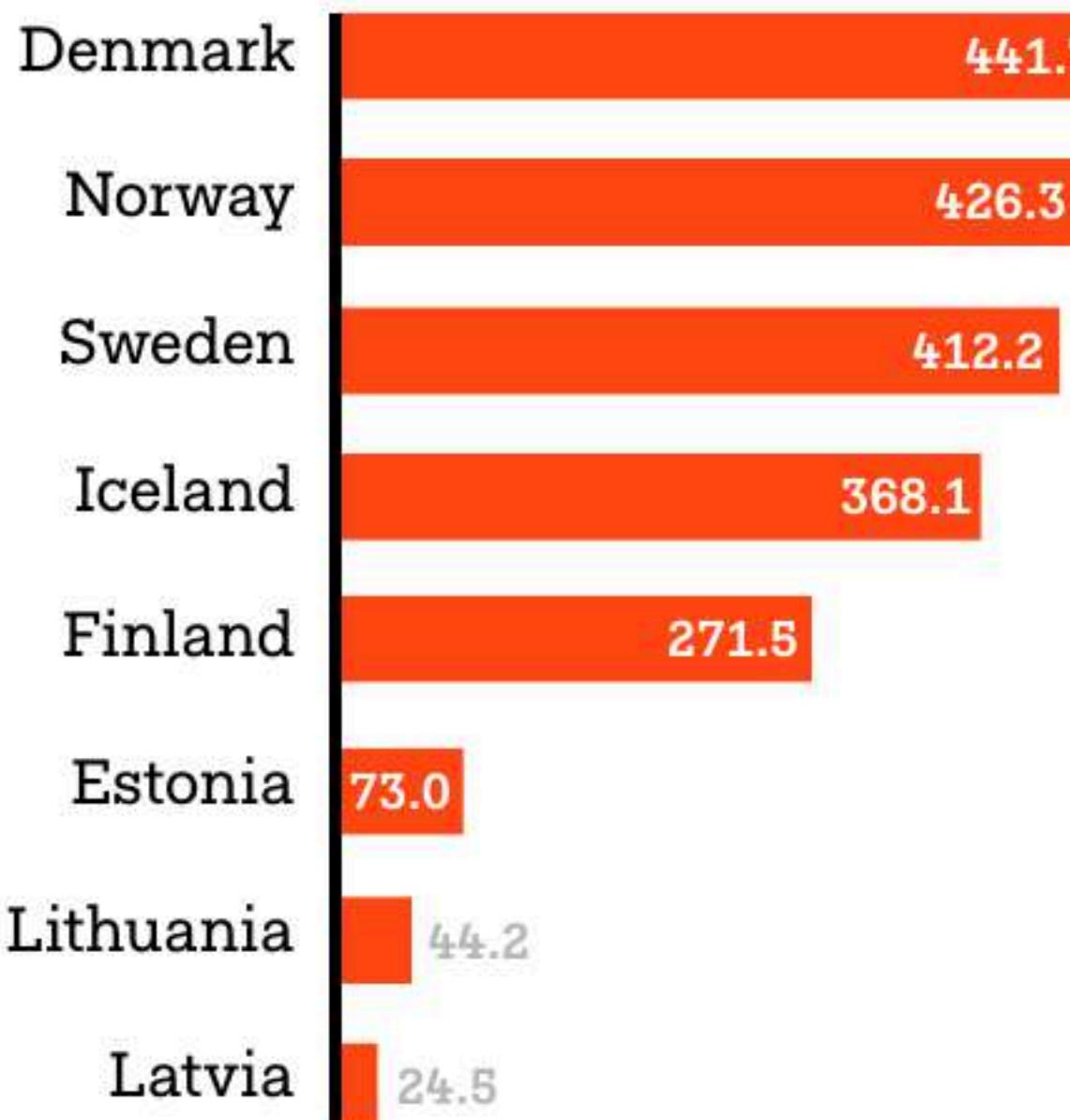
Euros per inhabitant



Source: Eurostat 2018. [rd\\_e\\_gerdtot](#)

# Higher education spending

Euros per inhabitant (2016)

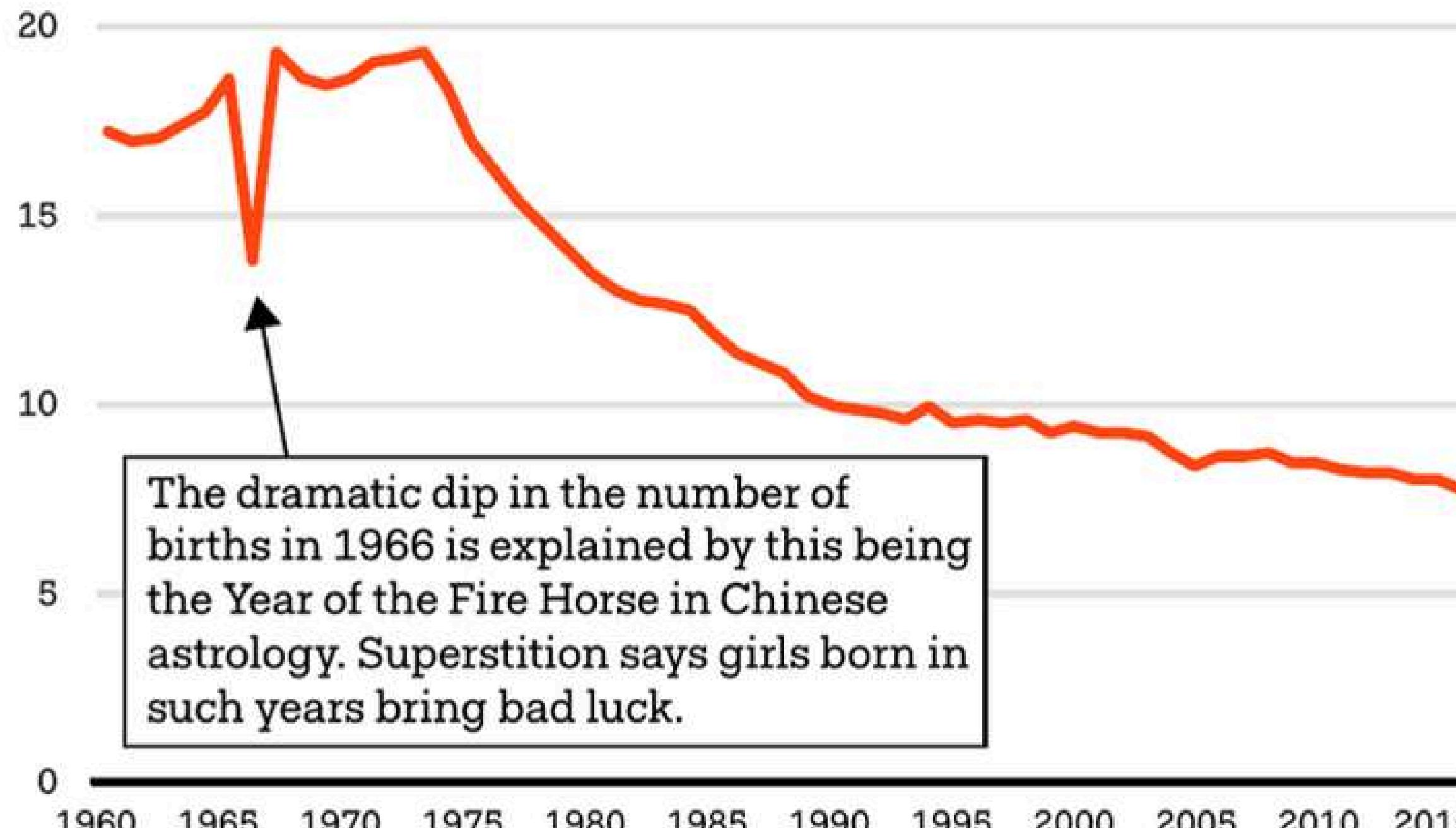


Source: Eurostat 2018. rd\_e\_gerdtot

Placing value labels inside bars is an alternative to using a grid, especially in bar charts, when the number of data points is small. Small bars might not have room for labels, in which case they can either be left out or placed outside, suitably de-emphasised.

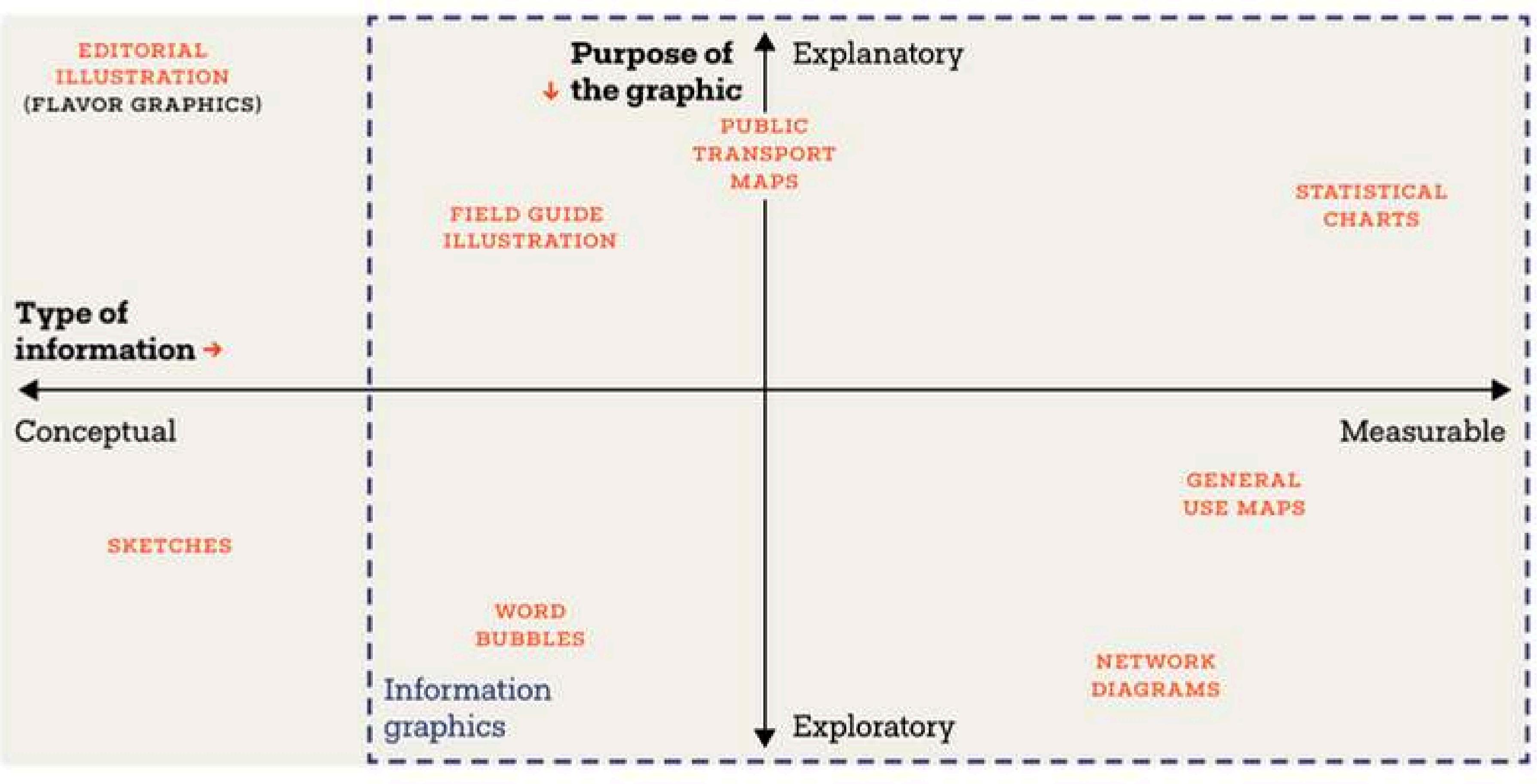
## Japan's birth rate has been in decline since 1973

Births per 1,000 people

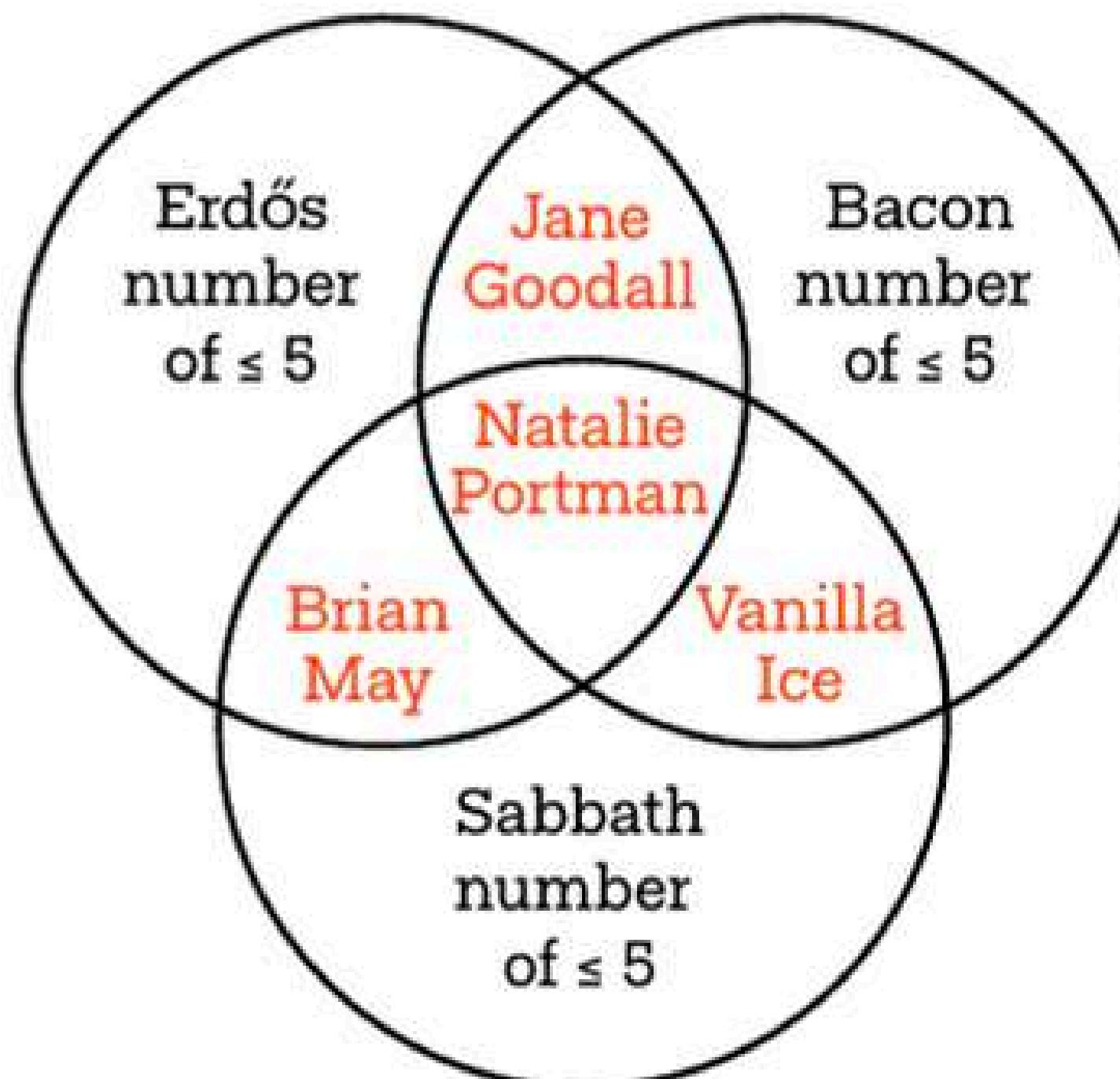


Source: World Bank

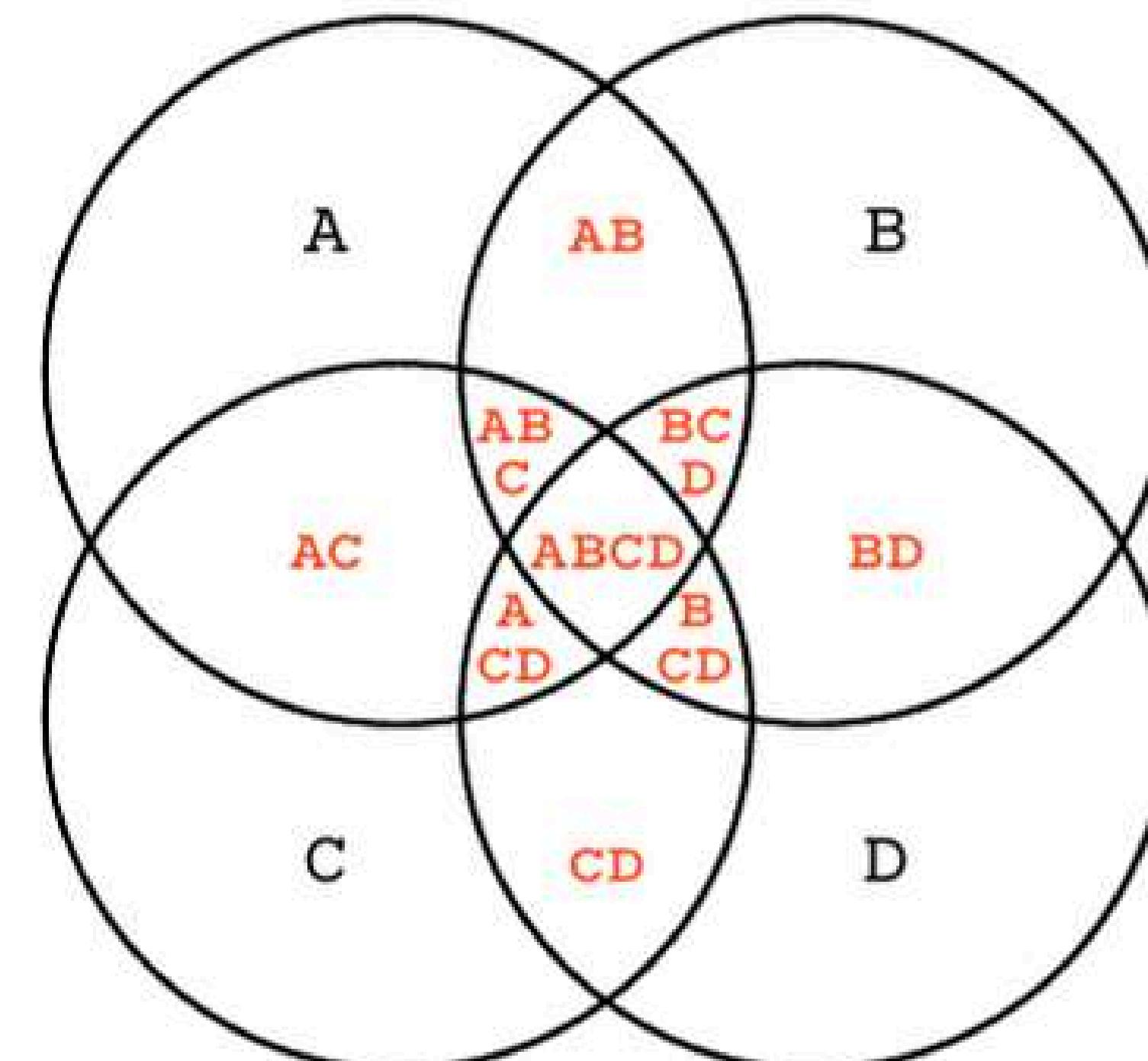
| PRODUCT COMPARISON MATRIX             |        | CITY BICYCLES |              |                       |        |                                 |
|---------------------------------------|--------|---------------|--------------|-----------------------|--------|---------------------------------|
| Model                                 | Price  | Material      | Speeds       | Brakes                | Wheels | Weight                          |
| Tunturi Lumo <small>cheapest!</small> | 349€   | Steel         | Single-speed | Coaster brake         | 28"    | 16.2kg                          |
| Helkama Jopo 24"                      | 435€   | Steel         | Single-speed | Coaster brake         | 24"    | 14.9kg                          |
| Stålhästen Delux Herr                 | 559€   | Aluminum      | 7-speed      | Coaster / rim brake   | 28"    | 17.0kg                          |
| Pelago Brooklyn                       | 650€   | Steel         | 3-speed      | Coaster / rim brake   | 28"    | 15.2kg                          |
| Cannondale Hooligan 1                 | 999€   | Aluminum      | 3-speed      | Disc brake            | 20"    | 11.4kg                          |
| Castro Bikes M1C                      | 1,095€ | Aluminum      | 3-speed      | Coaster / rim brake   | 20"    | 10.5kg <small>lightest!</small> |
| WorkCycles Fr8 City                   | 1,209€ | Steel         | 3-speed      | Coaster / drum brakes | 26"    | 24.0kg                          |



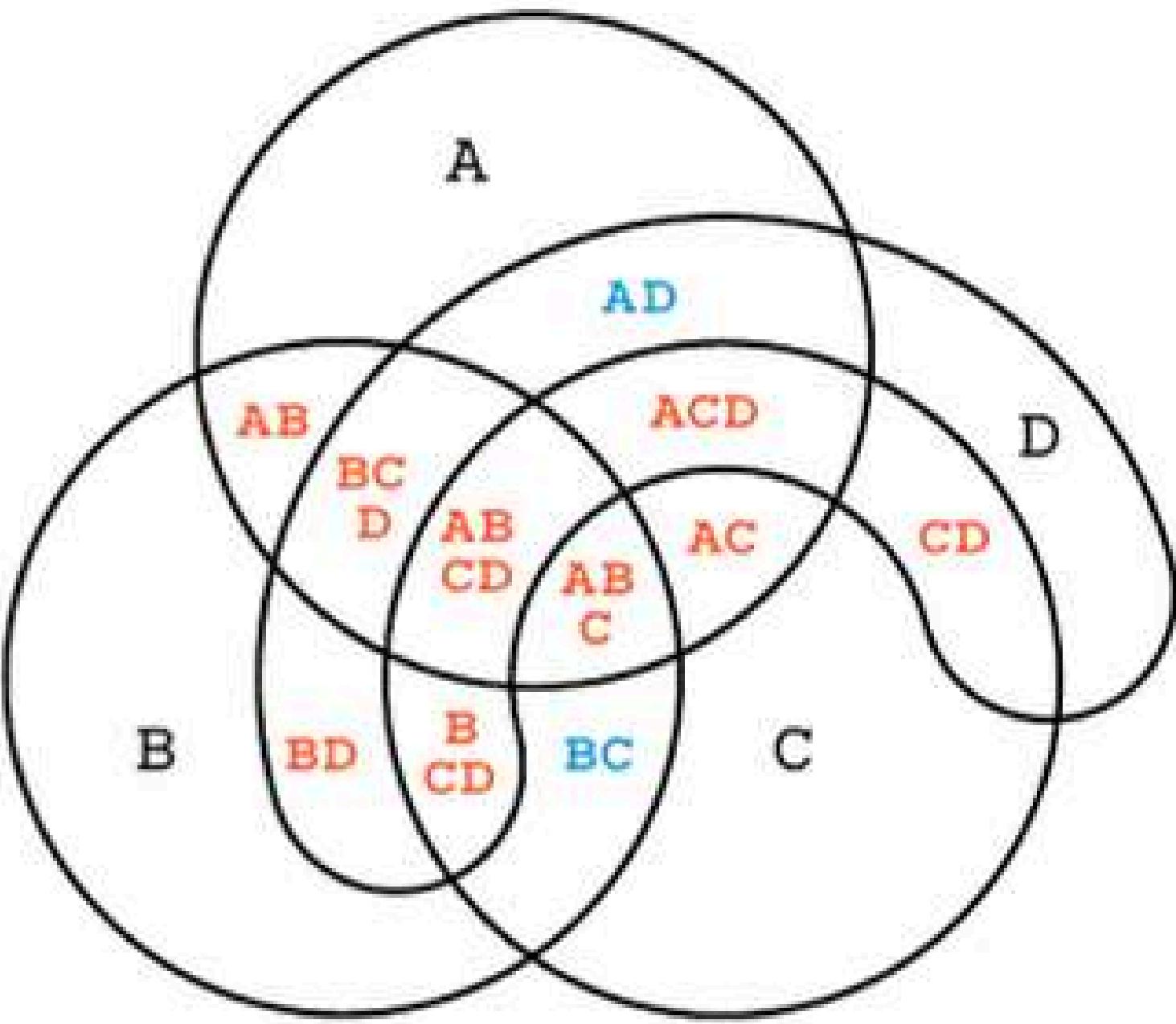
## VENN- OR EULER DIAGRAM, 3 SETS



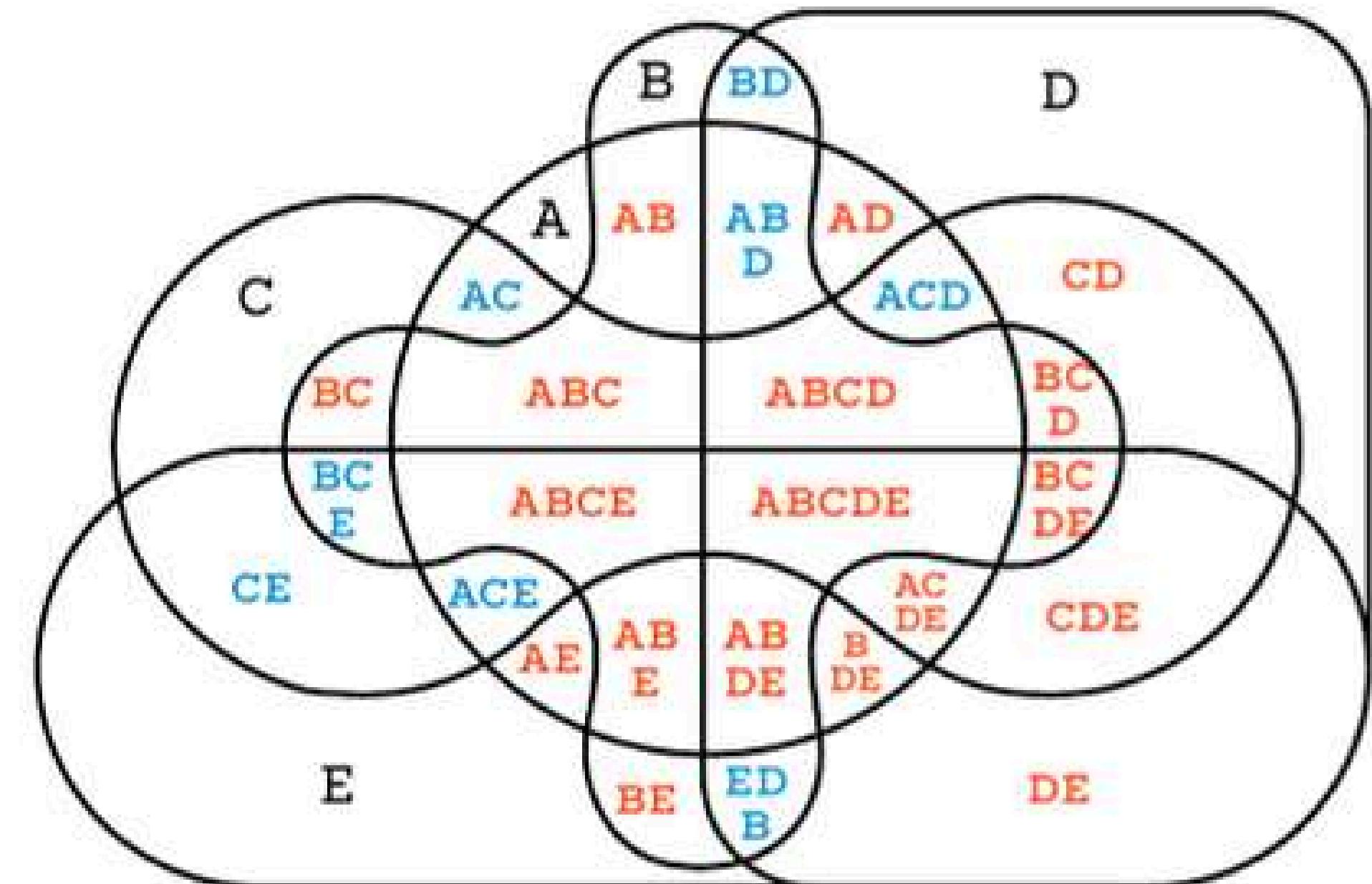
## EULER DIAGRAM 4 SETS



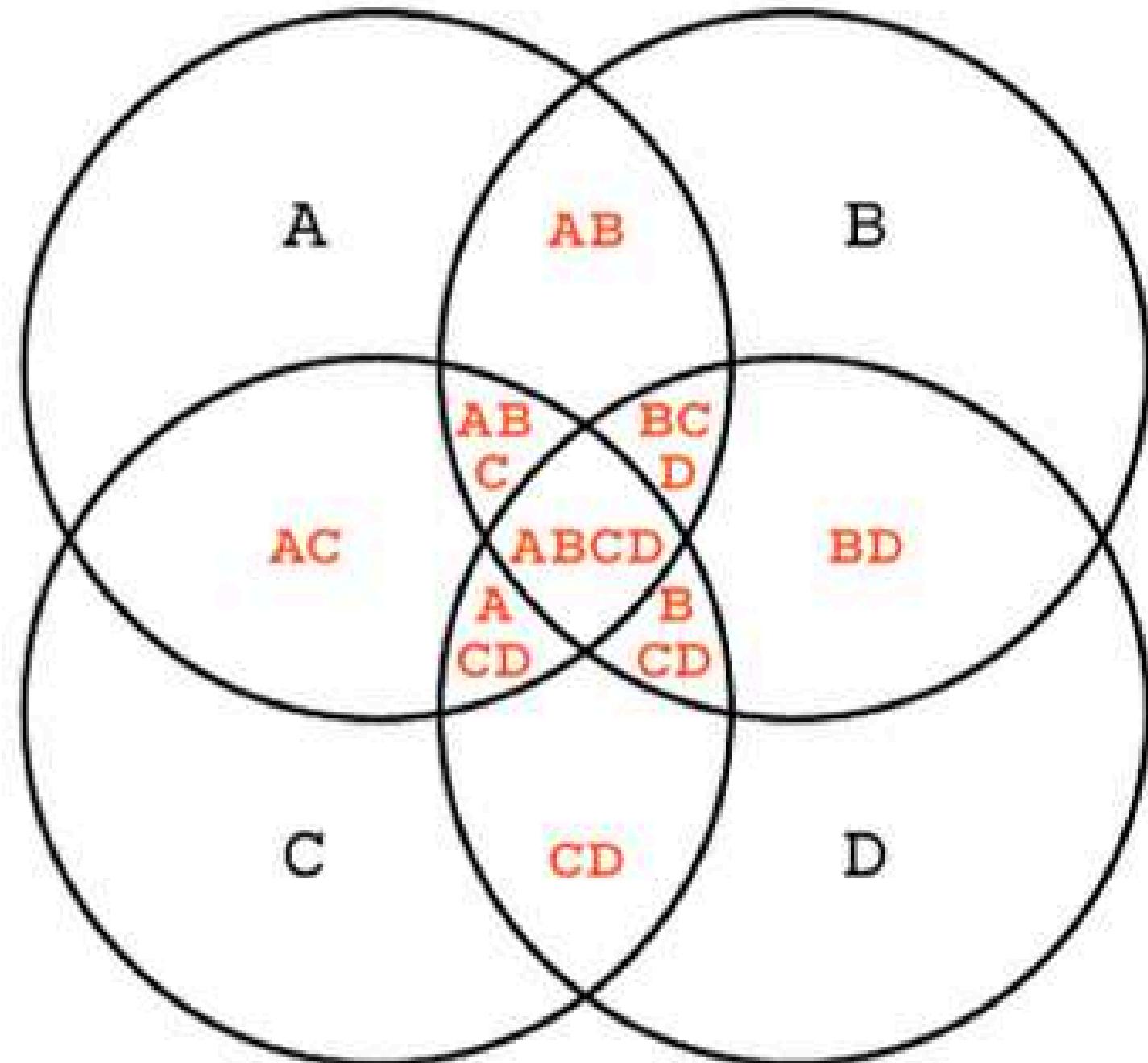
# VENN DIAGRAM 4 SETS



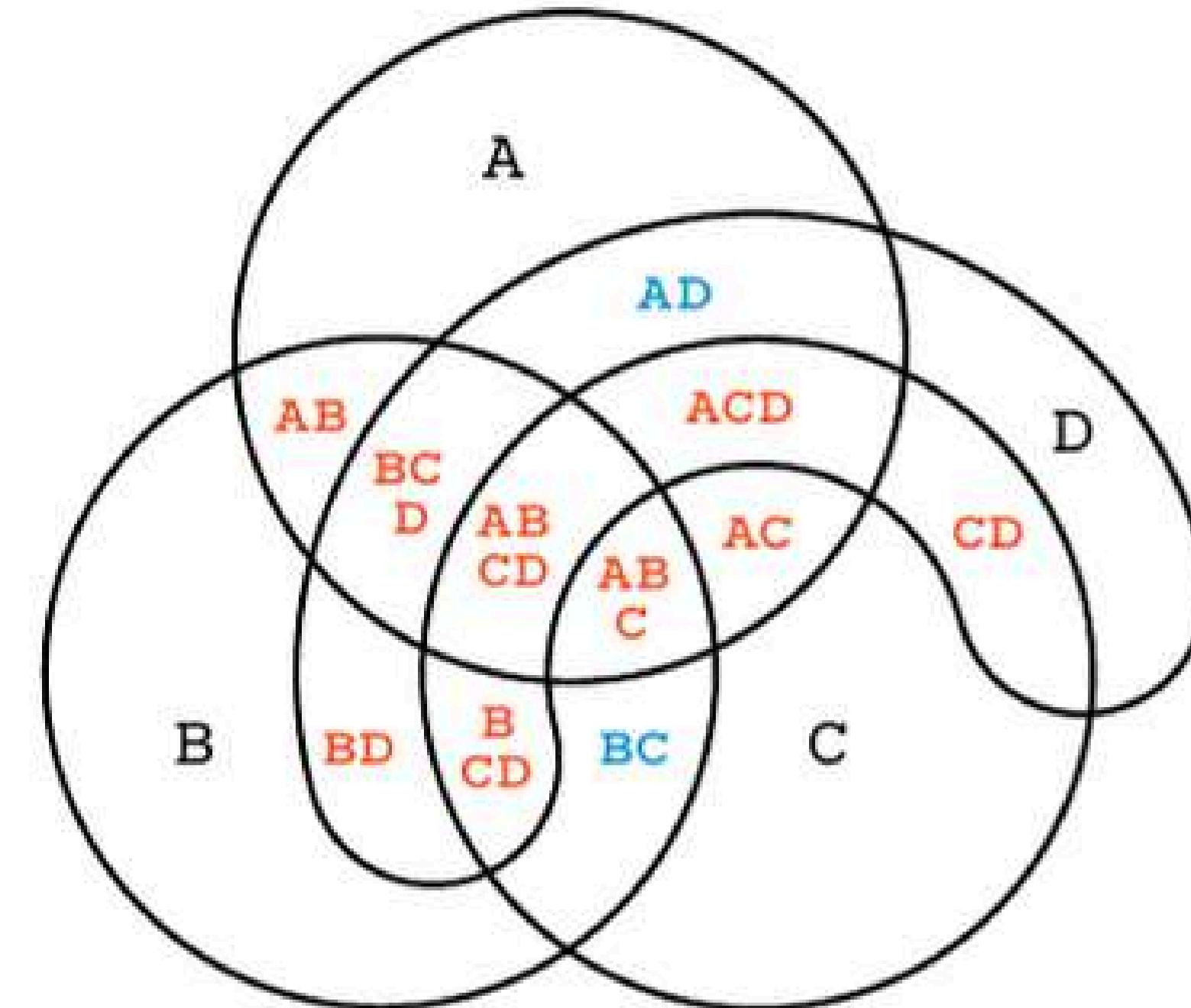
# VENN DIAGRAM 5 SETS



**EULER DIAGRAM**  
4 SETS



**VENN DIAGRAM**  
4 SETS



## TIMELINE

### History of the European Union

**1949**

Founding of the Council of Europe

**1952**

Founding of the European Coal and Steel Community

**1979**

European Currency Unit introduced

**1990**

Schengen Convention  
German unification

**1992**

Maastricht Treaty, start of the European Union

**2002**

Euro bank-notes

**2007**

Lisbon Treaty

**2016**

Brexit vote

1950

1960

1970

1980

1990

2000

2010

2015

2016

**1957**

Treaty of Rome, start of the European Economic Community

**1973**

Denmark  
Ireland  
United Kingdom

**1981**

Greece

**1986**

Portugal  
Spain

**1995**

Austria  
Finland  
Sweden

**2004**

Bulgaria  
Romania

**2013**

Croatia

Cyprus  
Estonia  
Latvia  
Malta  
Slovakia

Czech Republic  
Hungary  
Lithuania  
Poland  
Slovenia

Source: Wikipedia

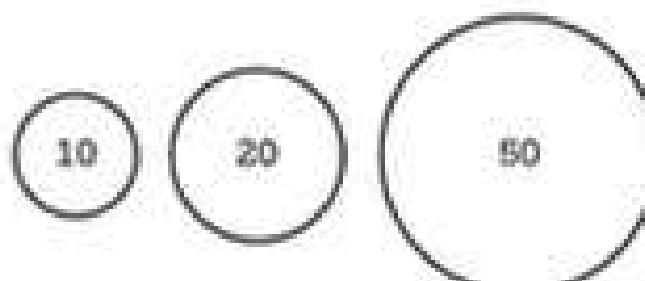
## WORD CLOUD

make dignity online correction  
journalists intended without practice professional  
**content question published person**  
used **public editorial personal**  
his/her **information annex**  
office **right**  
media guidelines **MUST** may  
material **journalist publication**  
**journalistic incorrect principles reply**  
interest good highly identity individual manner  
party also possible forums human  
concerns clear privacy news facts

USED MORE  
BY MEMBERS  
OPPOSED

To add  
Euro  
To review  
Rantatie  
(name of the street)  
Expensive  
According  
to  
Car traffic  
Year  
Attention  
Opportunity  
Plan  
Land  
To look  
Congestion  
Million  
To approve  
Sensible  
Money

Number of mentions



← USED EQUALLY BY ALL MEMBERS →

Significant  
Important  
To support  
Preferably  
To think  
Situation  
Must  
To want  
To make  
Car  
Public transit  
Tunnel  
Area  
Human  
Traffic  
Kalasatama  
(name of the district)  
Non-binding  
resolution  
To build  
Driving  
Project  
To send  
back

Source: Helsinki city council transcript, 29.8.2018

USED MORE  
BY MEMBERS  
IN FAVOR