# descriptive statistics 1

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this version: Wednesday 11th September, 2024 12:43

# outline

basic concepts

summarizing one variable (Wheelan, 2013, ch2): central tendency and dispersion [2 vars next week]

application: income

# edu data (edu is most common interest this year)

- US https://nces.ed.gov/
  - NJ https://www.nj.gov/education/data/
- compare test scores across countries:
  http://www.oecd.org/pisa/
- diversity and disparities:
  https://s4.ad.brown.edu/projects/diversity/index.htm
- what is college worth:
  https://www.bls.gov/ooh/

  http://www.payscale.com/college-education-value-2013

# misc

- looking ahead: some stats today and next wk
  - practicing in 2 wks
- then one tough class on probability
- and relax in second half of the course
- How's Wheelan and Trochim?
- as we cover concepts,
  let's discuss ex from Wheelan! 10%participation!

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## if can't measure it, then it's not science

- When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind: it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science, whatever the matter may be. [Lord Kelvin 1824-1907]
- don't say large, increased etc, give numbers!
- but just because got a number, doesn't mean it's right!
  - GIGO, triangulate, bias, validity, etc

## basic definitions

- observation (U/A) v variable
  (property, attribute of U/A; eg age, price)
  - extCre: say I study your grades, what's U/A?
- variable (varies) v constant (constant)
- central tendency v dispersion
  - eg [1,3] v [0,4]: same $\mu$, different $\sigma$
- representativness/external validity: population (students) v
  sample (this class)
- data: observational (hard (eg gdp) v
  survey (eg happiness)) v
  experimental (eg drug trial)
  (elaborate later in res_des.pdf)

## correlation $\neq$ causality is important!

- `http://www.tylervigen.com/`
- fundamental knowledge: correlation $\neq$ causation
  - need experiment; otherwhise a good design; can start with enumerating key IVs for DV exDraw
- at policy drafting stage–easy to mistake correlation for causation and draft unnesessary or wrong policies
- at evaluation stage–easy to see positive effect of policy (sunk cost, groupthink,etc) while there is none!
-
- evol/beh: humans see causes where there are none

# level of measurement

- important! determines stat, eg mean v mode
- real continuous: interval/ratio (price, weight, temp)
- continous/categorical: ordinal (rank of faculty, grades)
- real categorical: nominal (many) or binary (two)
  (eg mode of transportation, gender)
- extCre: education variable?

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# definitions of basic summary stats

- start with central tendency, not dispersion:
  - mean $\frac{1+2+2+3+12}{5}=4$ (affected by extremes)
  - median: middle value: 2
    (if even take the mean of the middle two)
  - mode: most frequent value: 2
  -
- 1, 2, 2, 3, 12 is right skewed (dispersion, draw)
  - Wheelan: ex with few middle class guys at a bar
  - then comes Bill Gates and skewes income distribution

# dispersion or distributions

- draw both freq tab or tabulations and histograms:
  - grades in this class (bimodal)
  - incomes of Hilary, Donald, Bernie, Ted (right skewed)
- can also have class interval or bin:

| | |
|---|---|
| under 35 | 9% |
| 36-45 | 41% |
| 46-64 | 30% |
| above 65 | 20% |

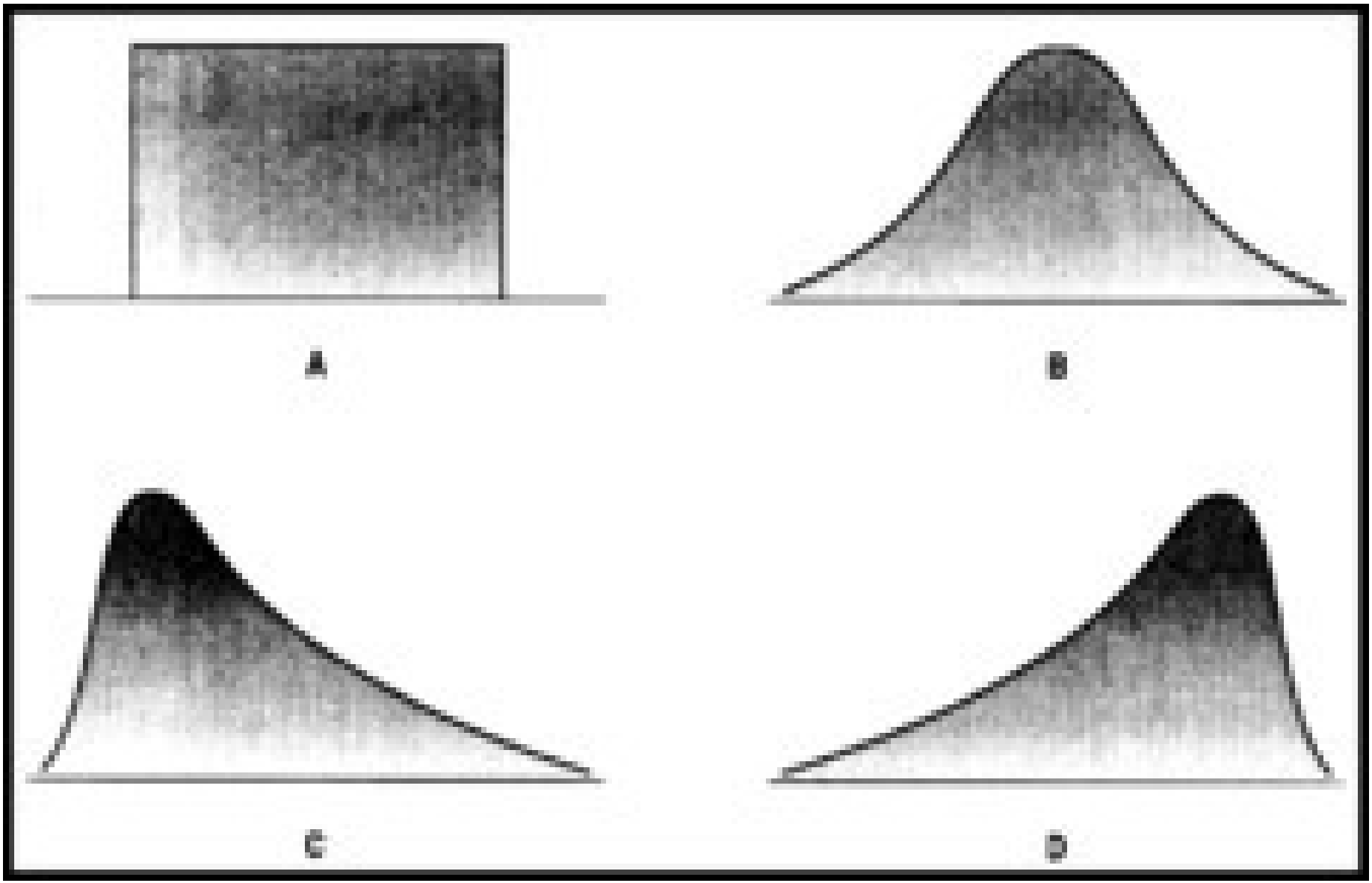
  - `http://www.socialresearchmethods.net/kb/statdesc.php`: tab1, fig1

also (Wheelan, 2013, p20-21)

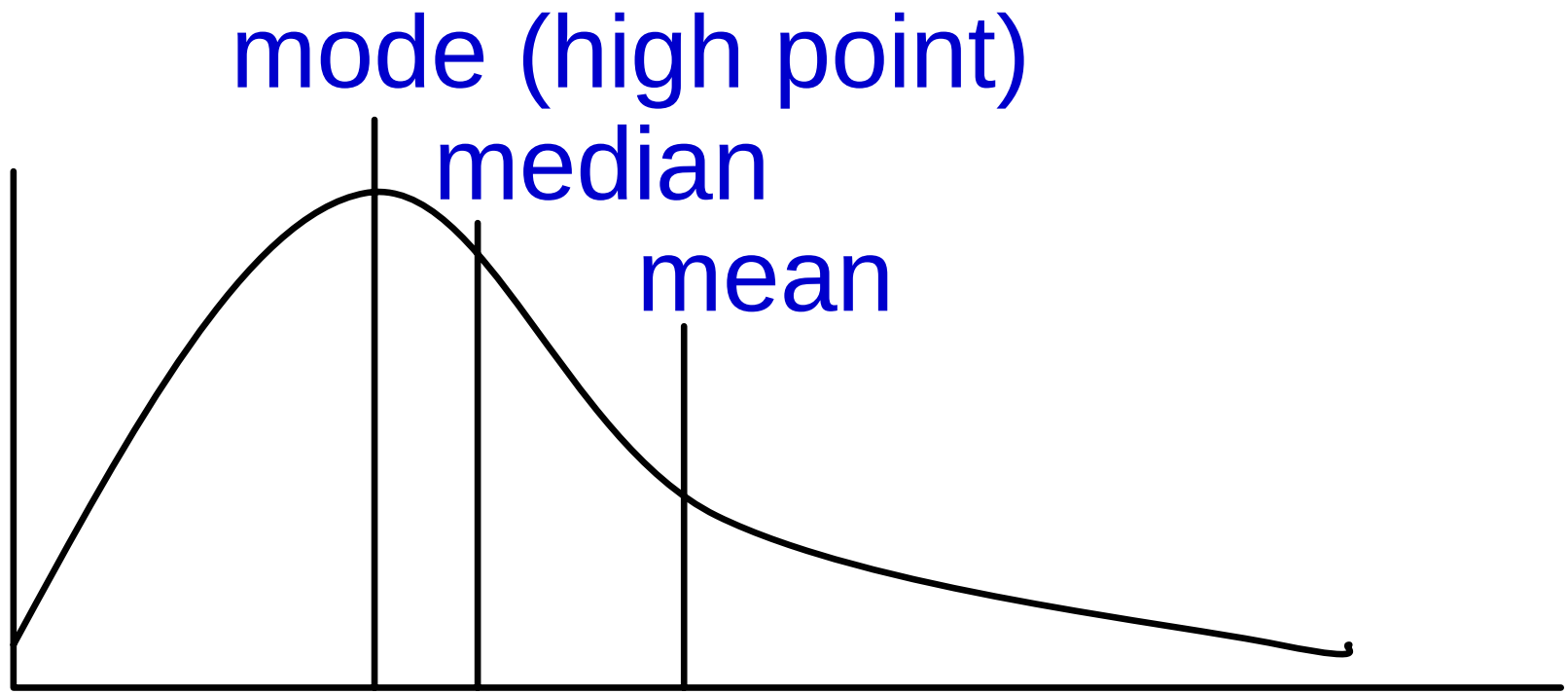
# distribution types

- uniform
- normal symmetrical unimodal
- left skewed
- right skewed (income)
- bimodal

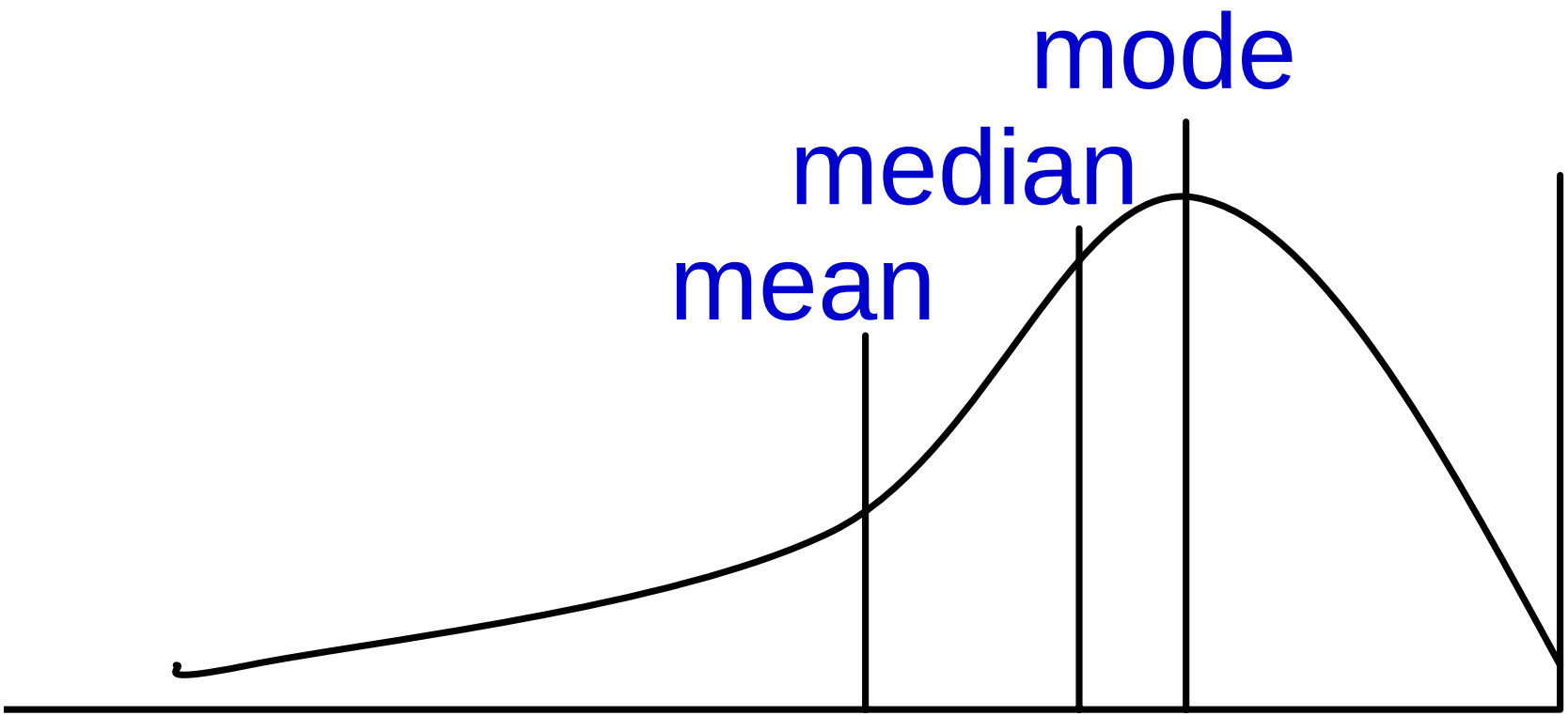
# skew (y-axis: density or freq or %) extCre:ex?



# $\mu > M$: right skew (y-axis: density or freq or %)



# $\mu < M$: left skew (y-axis: density or freq or %)

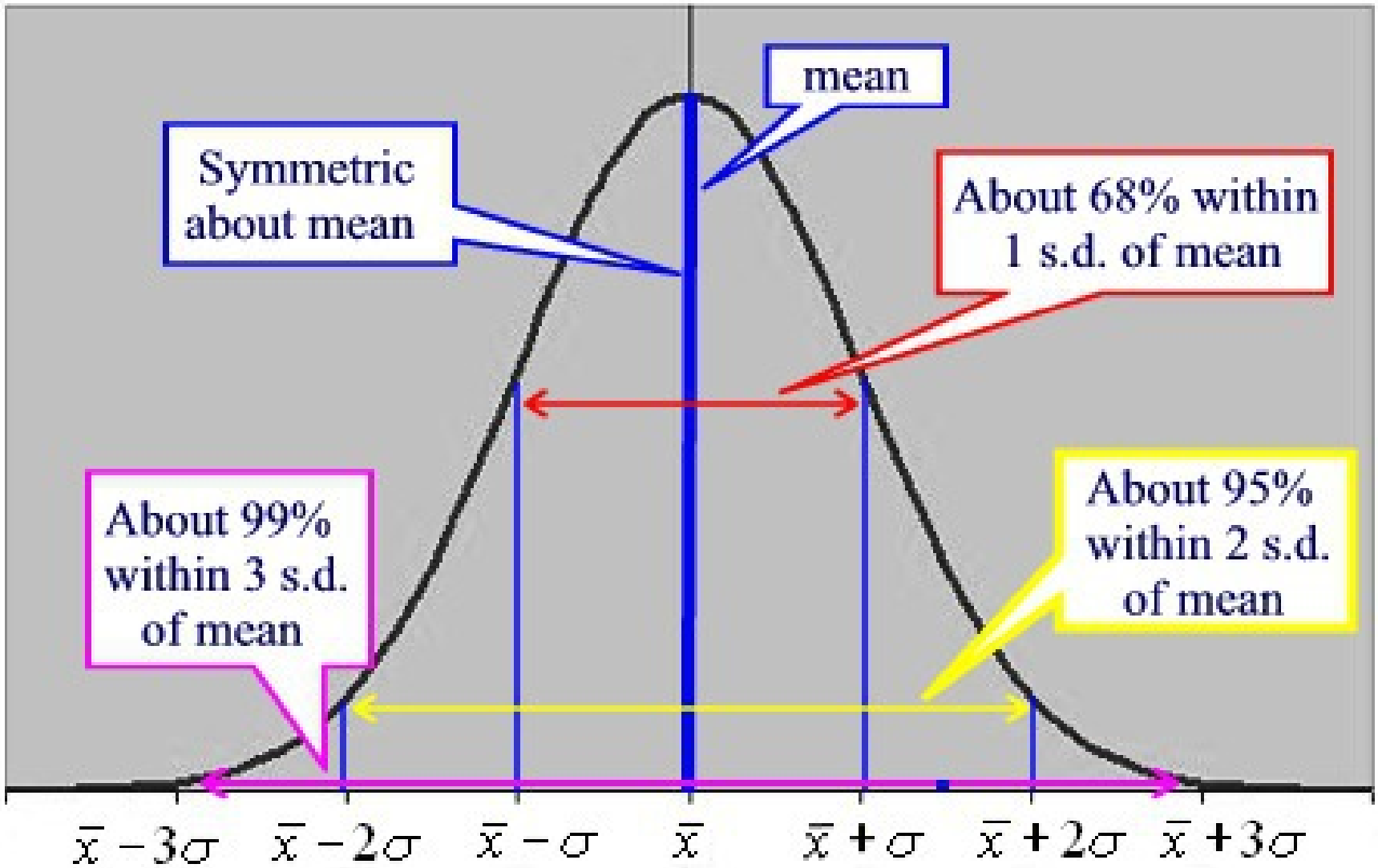


# variability

- $range = max - min$
- p-th percentile: p % are below it; eg 75th percentile of income distribution : 75% of people are poorer than me
- quartile =25 %
- decile = 10%
- median = 2nd quartile = 5th decile = 50th percentile

http://en.wikipedia.org/wiki/Household_income_in_the_United_States

# normal distribution (Wheelan, 2013, fig on p26)



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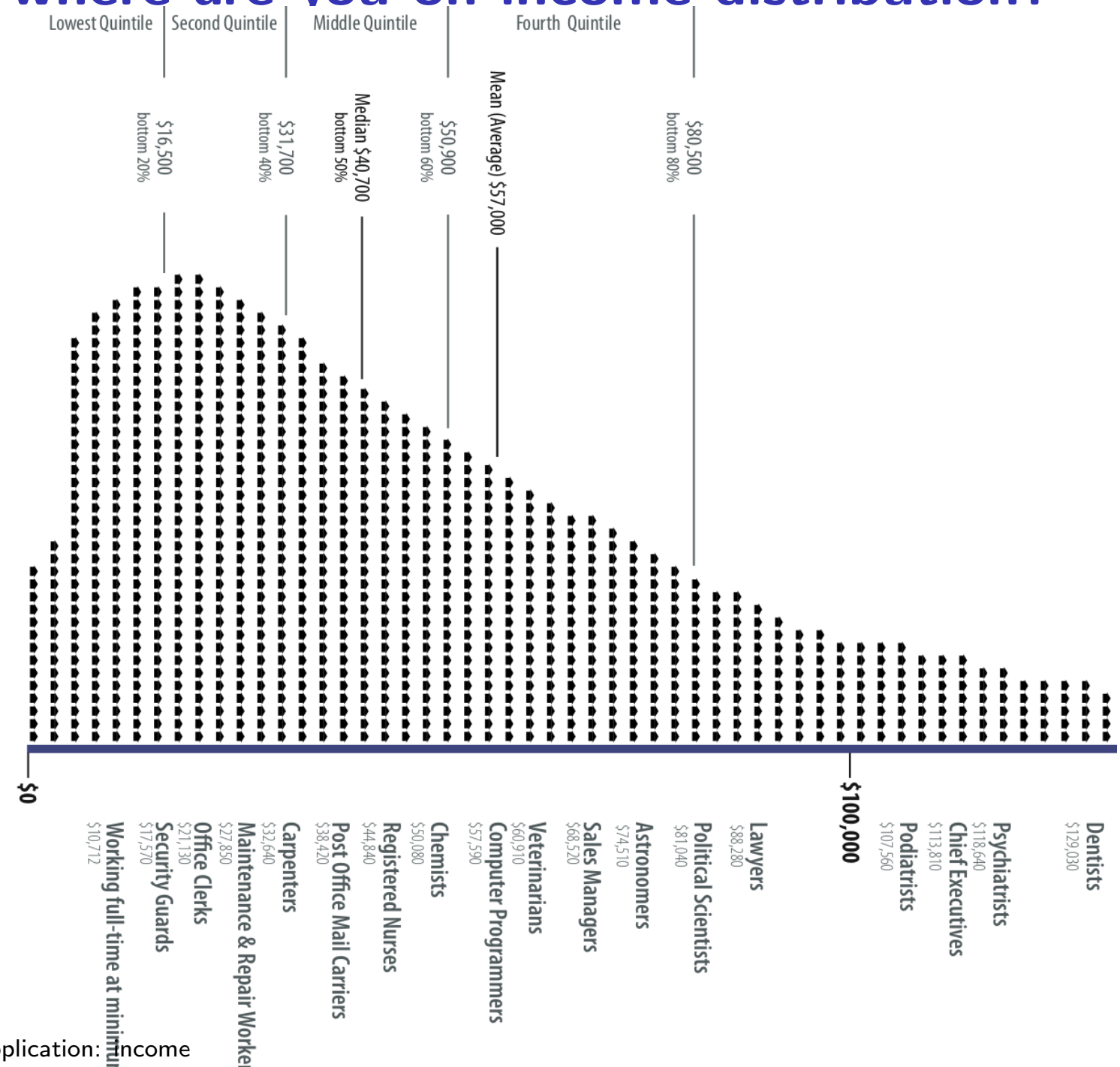
# where are you on income distribution?

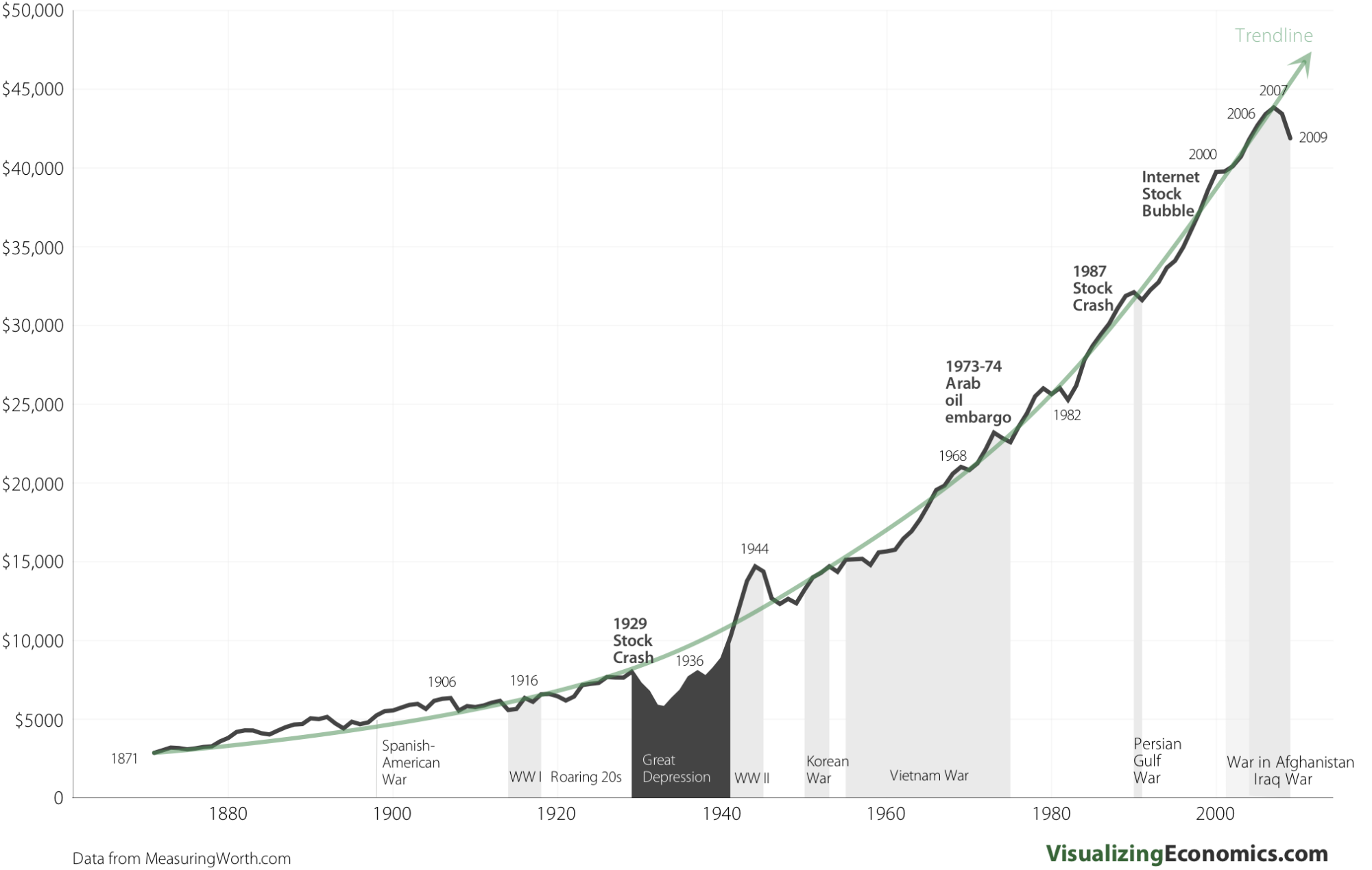


# idea for a project: what you can do

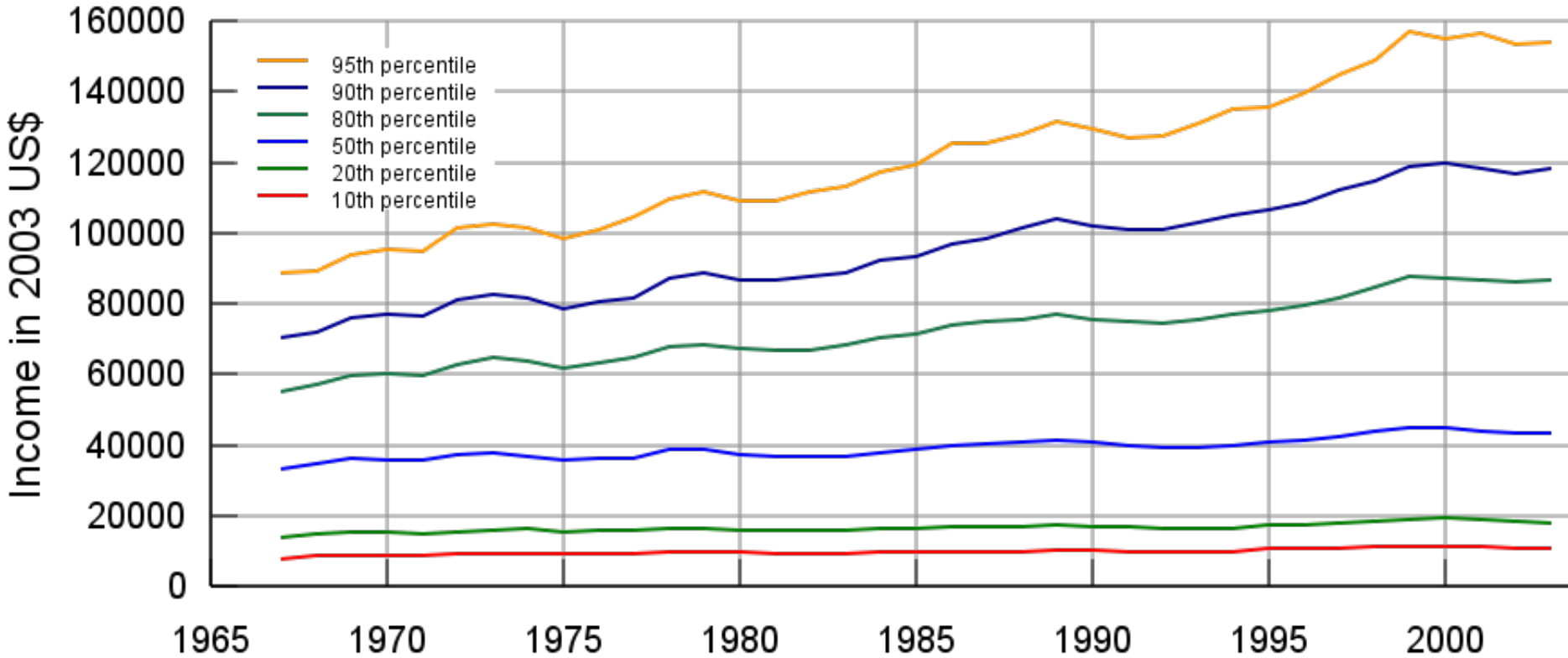
- it would be interesting to break income down by sociodemographics, by geo, and by both
  - it's all realtive, about comparisons, NJ med hh inc $100ish k; see census quick facts haddnofield v camden; world: `https://www.washingtonpost.com/graphics/2018/business/global-income-calculator/`

# cont

- get data and do it yourself, eg: http://visualizingeconomics.com/cool-data/
- and lots of nice visualizations here http://www.gapminder.org/
  - also see Wheelan (2013, ch2) and http://en.wikipedia.org/wiki/Household_income_in_the_United_States#Household_income
  -
- and now let's plot income over time (also see (Wheelan, 2013, p16))...


$50,000
$45,000
$40,000
$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
$5000
0
1880
1900
1920
1940
1960
1980
2000
Trendline
1871
1906
1916
1929
Stock
Crash
1936
1944
1968
1973-74
Arab
oil
embargo
1982
1987
Stock
Crash
2000
Internet
Stock
Bubble
2006
2007
2009
Spanish-
American
War
WW I
Roaring 20s
Great
Depression
WW II
Korean
War
Vietnam War
Persian
Gulf
War
War in Afghanistan
Iraq War
Data from MeasuringWorth.com
VisualizingEconomics.com

# but median income has not been growing much

- 

# how about income distribution over time?

- another interesting thing is to look over time at income distribution
- today's 1st decile has better quality of life than 9th decile 100 years ago (Derek Bok (Bok, 2010))
  - can you translate this to plain English? extCre

# wrap-up

- end every class discussing what we covered and quick look at next week
- end with a review Q&A,
- give some examples (essp in pub pol and pub adm) for concepts covered
- students will discuss concepts from the class
-
- quick look at next class

# bibliography I

Bok, D. (2010): The politics of happiness: What government can learn from the new research on well-being, Princeton University Press, Princeton NJ.

Wheelan, C. (2013): Naked statistics: stripping the dread from the data, WW Norton & Company.