descriptive statistics 1

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outline

basic concepts

summarizing one variable (Wheelan, 2013, ch2): central tendency and dispersion

summarizing more than one variable: crosstabs and correlation, (Wheelan, 2013, ch3,4)

application: income

Doddle

◇ https://beta.doodle.com/poll/agf7b9eg4476iexy#table

interested in working with local non-profit?

- Michael D'Italia: mjd429@camden.rutgers.edu
- again, extra credit for civic engagement!
  - again, see syllabus for elaboration

edu data (edu is most common interest this year)

- US educ data:
  https://nces.ed.gov/
  https://www2.ed.gov/rschstat/landing.jhtml?src=pn
- compare test scores across countries:
  http://www.oecd.org/pisa/
- diversity and disparities:
  https://s4.ad.brown.edu/Projects/Diversity/Researcher/LTBDDload/DataList.aspx
- what is college worth:

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

misc

- looking ahead: a lot of material today
- practicing next week
- then one tough class on probability
- and we will relax in second half of the course
- How's Wheelan and Trochim?
- as we discuss topics, let's discuss examples from Wheelan!!

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basic definitions

- ◇ observation (U/A) v variable (property, attribute of U/A; eg age, price)
  - extra credit: 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 μ, different σ
- ◇ 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]
- ◇ causation v correlation: `http://www.tylervigen.com/`

level of measurement

- ◇ real continuous: interval/ratio (price, weight, temperature)
- ◇ continous/categorical: ordinal (rank of faculty, grades)
- ◇ real categorical: nominal (many) or binary (two) (eg mode of transportation, gender)
- ◇ extra credit: education variable?

howto describe data?

- ◇ numbers
- ◇ graphs (always better unless very few data, say <5)
  humans recognizes patterns in graphs better and faster
- ◇ d

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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 had example 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%

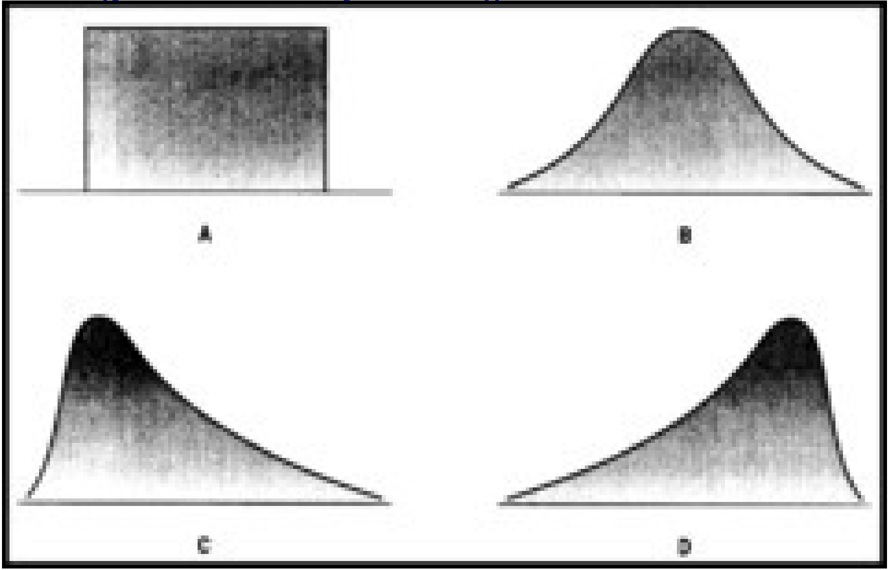
  - `http://www.socialresearchmethods.net/kb/statdesc.php`: tab1, fig1

also (Wheelan, 2013, p20-21)

distribution types

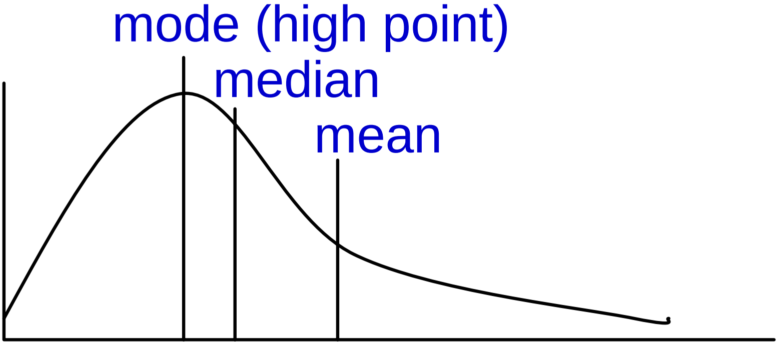
- ◇ uniform
- ◇ normal symmetrical unimodal
- ◇ left skewed
- ◇ right skewed (income)
- ◇ bimodal

skew (y-axis: density or freq)



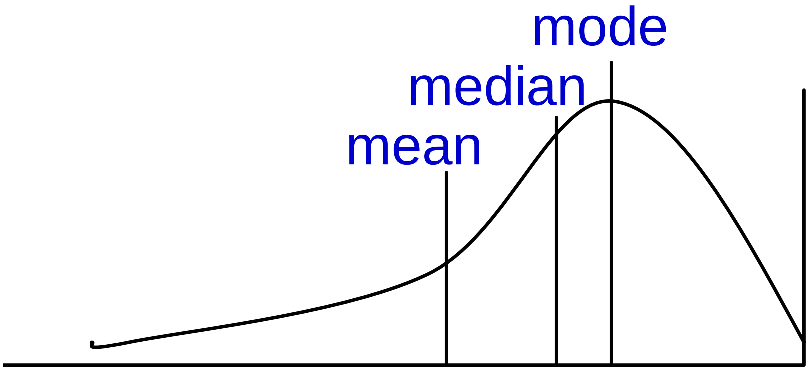
◇

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



◇

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



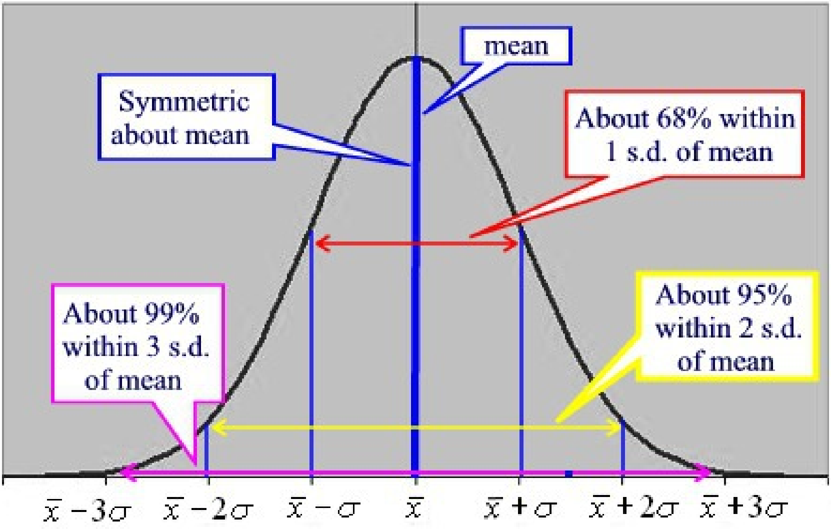
◇

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)



◇

- asymptotically, any variable is normally distributed

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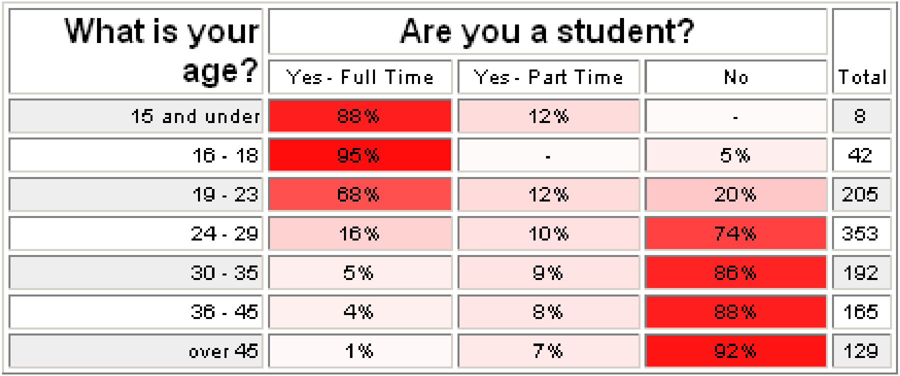
few categories / categorical

◇ use contingency table / cross-tabs
(because you cross-tabulate data)

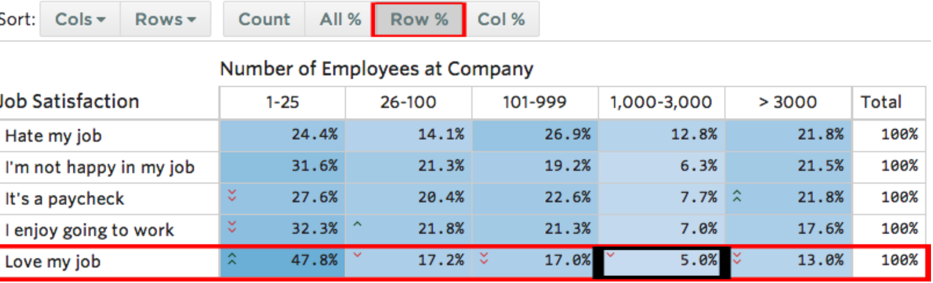
◇ use percents, not counts: then usually it's clear

: so what's the relationship: age and being a student?



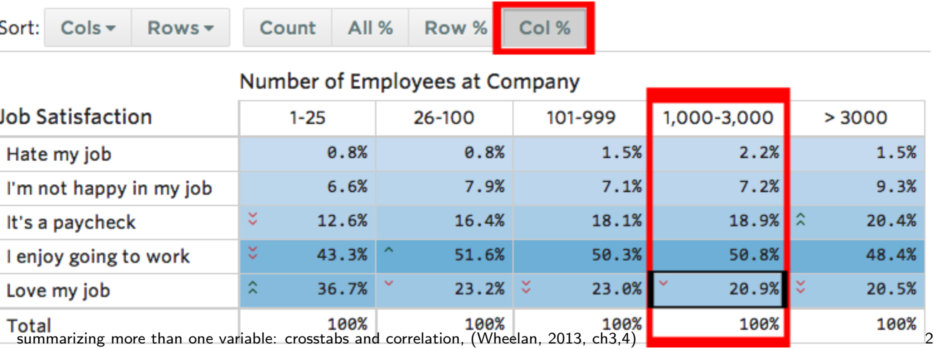
What is your age?	Are you a student?			Total
	Yes - Full Time	Yes - Part Time	No	
15 and under	88%	12%	-	8
16 - 18	95%	-	5%	42
19 - 23	68%	12%	20%	205
24 - 29	16%	10%	74%	353
30 - 35	5%	9%	86%	192
36 - 45	4%	8%	88%	165
over 45	1%	7%	92%	129

crosstabs: row percents v col percents



Number of Employees at Company

Job Satisfaction	1-25	26-100	101-999	1,000-3,000	> 3000	Total
Hate my job	24.4%	14.1%	26.9%	12.8%	21.8%	100%
I'm not happy in my job	31.6%	21.3%	19.2%	6.3%	21.5%	100%
It's a paycheck	˅˅ 27.6%	20.4%	22.6%	7.7%	˄˄ 21.8%	100%
I enjoy going to work	˅˅ 32.3%	˄ 21.8%	21.3%	7.0%	17.6%	100%
Love my job	˄˄ 47.8%	˅ 17.2%	˅˅ 17.0%	˅ 5.0%	˅˅ 13.0%	100%



Number of Employees at Company

Job Satisfaction	1-25	26-100	101-999	1,000-3,000	> 3000
Hate my job	0.8%	0.8%	1.5%	2.2%	1.5%
I'm not happy in my job	6.6%	7.9%	7.1%	7.2%	9.3%
It's a paycheck	˅˅ 12.6%	16.4%	18.1%	18.9%	˄˄ 20.4%
I enjoy going to work	˅˅ 43.3%	˄ 51.6%	50.3%	50.8%	48.4%
Love my job	˄˄ 36.7%	˅ 23.2%	˅˅ 23.0%	˅ 20.9%	˅˅ 20.5%
Total	100%	100%	100%	100%	100%

percentage change v percentage point change

◇ say good school's dropout rate increases from 2% to 4%

- percentage point increase is $4-2=2$
- percentage increase is $(\frac{4-2}{2}) * 100 = 100$

◇ say bad school's dropout rate increases from 50% to 75%

- percentage point increase is $75-50=25$
- percentage increase is $(\frac{75-50}{50}) * 100 = 50$

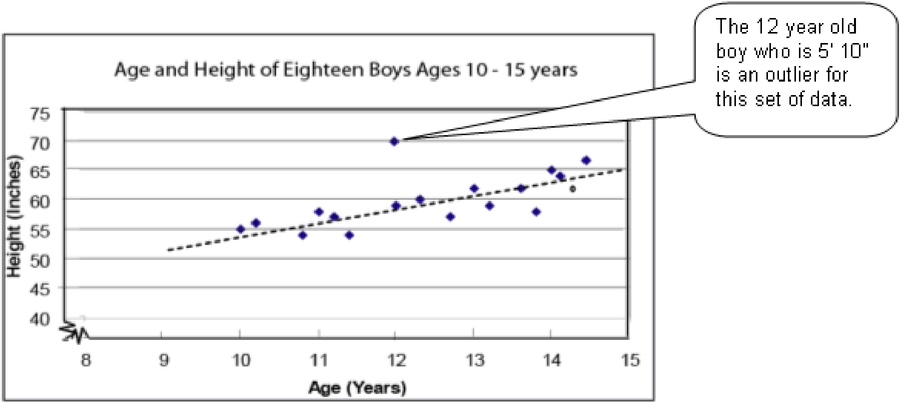
◇ if you start from low base (eg 2), then small percentage point increase is huge percent increase!

many categories / continuous data

- ◇ use correlation and scatterplots
  - · just plot them in scatterplot; identify outliers!
  - · blackboard: examples with outliers
  - · correlation ranges between -1 and 1
  - · $< |4|$ low
  - · $|.4 - .6|$ moderate
  - · $> |.7|$ strong
- ◇ again, keep in mind causation v correlation

TODO: just insert here one of these corr coef graphs showng strength of relationship based on look

scatterplot

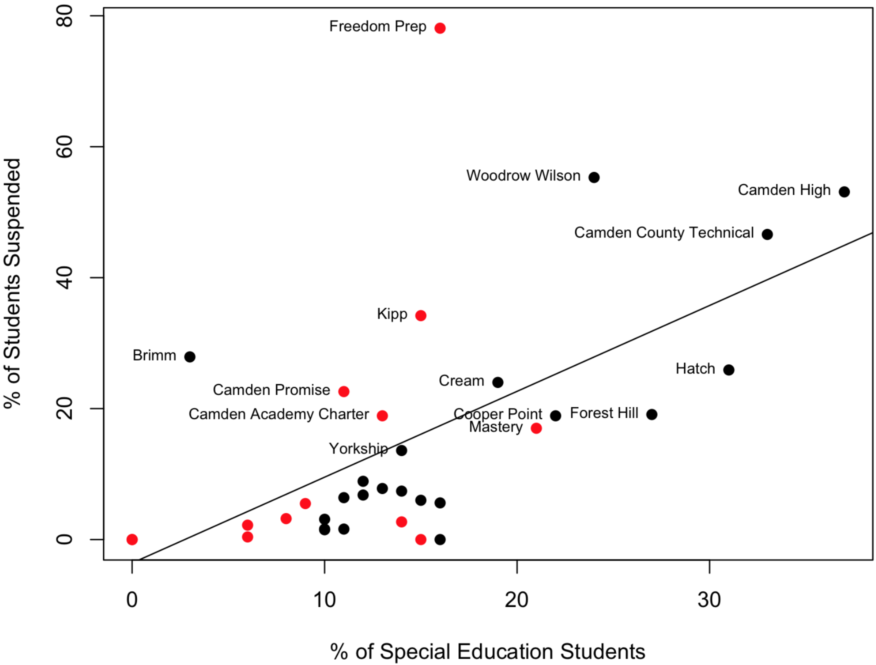


◇

- also see http://www.socialresearchmethods.net/kb/statcorr.php

◇ next slide: https://danley.camden.rutgers.edu/2017/04/13/who-suspends-the-highest-percentage-of-camden-students-freedom-prep/

- red: charter/renaissance; black: Camden schools


Freedom Prep
Woodrow Wilson
Camden High
Camden County Technical
Kipp
Brimm
Camden Promise
Cream
Hatch
Camden Academy Charter
Cooper Point
Forest Hill
Mastery
Yorkship
80
60
40
20
0
10
20
30
% of Students Suspended
% of Special Education Students

do scatterplots

◇ it is useful to produce a scatterplot

- you'd see outliers–
- and whether the relationship is due to them
- blackboard: relationships biased due to outliers
- say marriage rate and divorce rate and Nevada

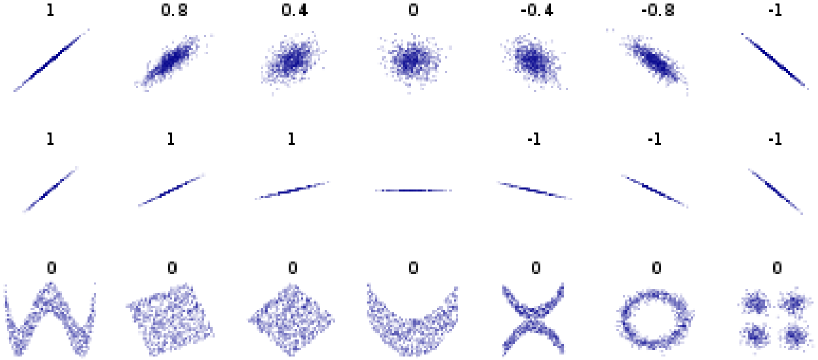
Wheelan in ch11 mentions Whitehall studies

- fascinating stuff!
- high status causes better health!
  - great book 'Status Syndrome' http://a.co/jaUuwT7
- say nobel prize or oscar boosts one's health and longevity
  - these successful folks live longer and in better health
  - than exact same people (income, lifestyle, etc) but without status

closer look at status syndrome

- `https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2566175/`
- see Table 2A for correlations
  - especially 'Decision latitude'
  - conclusions? extra credit

correlations for different scenarios



◇

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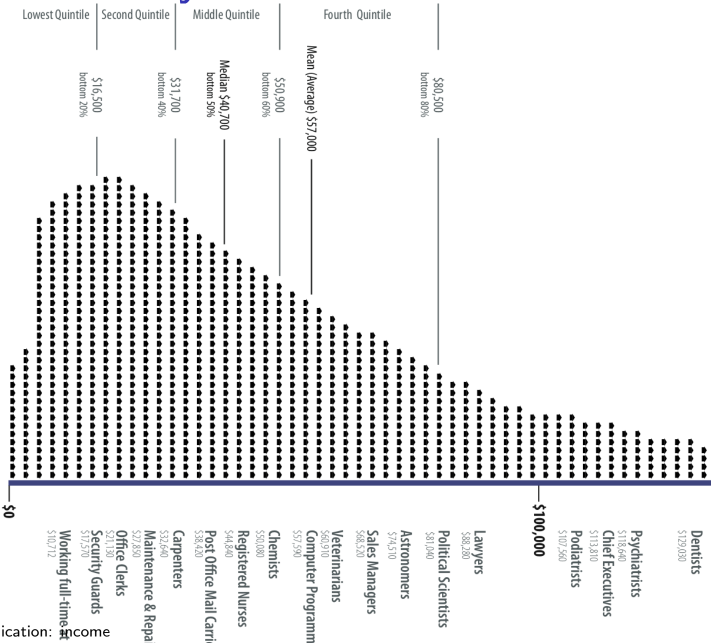
where are you on income distribution?

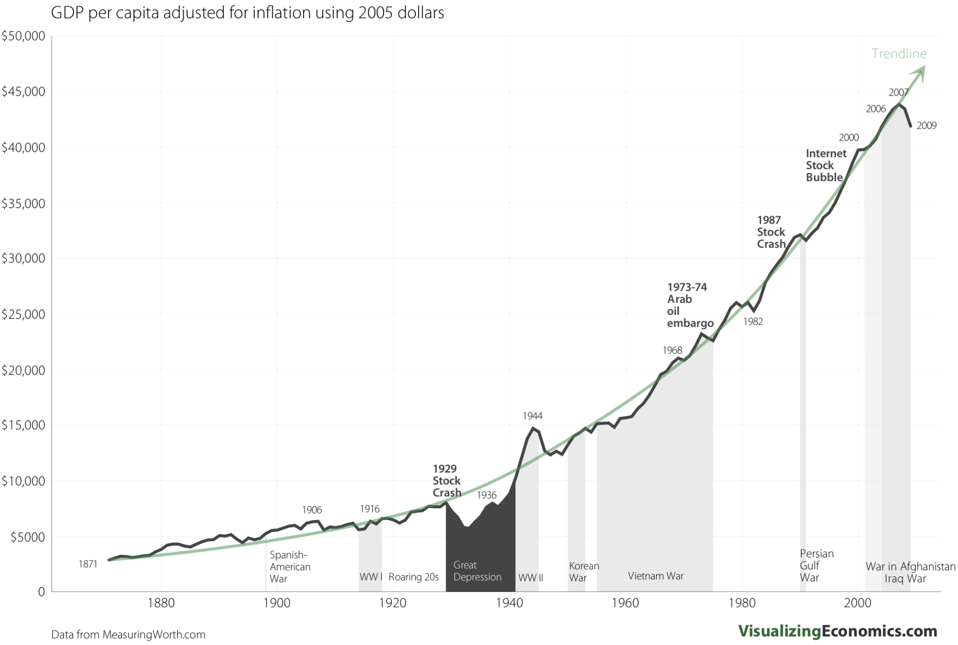


idea for a project: what you can do

- it would be interesting to break income down by sociodemographics,
  by geography, and by both

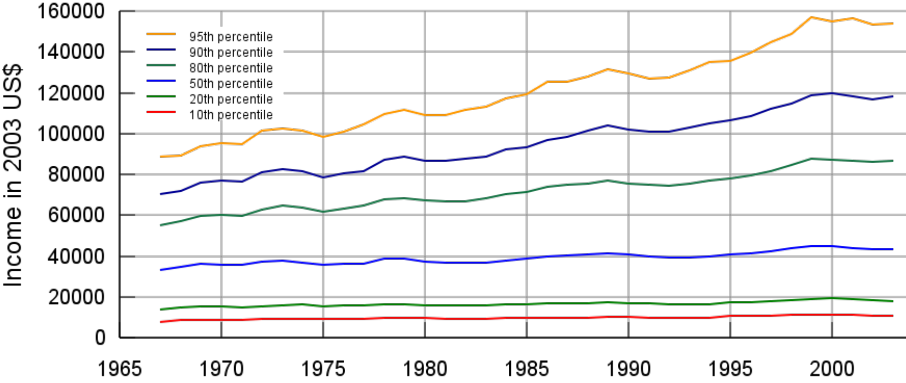
- get data and do it yourself, eg: http://visualizingeconomics.com/cool-data/
- and lots of nice visualizations here http://www.gapminder.org/
- also see Wheelan (2013, ch2) and http://en.wikipedia.org/wiki/Household_income_in_the_United_States#Household_income

- and now let's plot income over time (also see (Wheelan, 2013, p16))...


GDP per capita adjusted for inflation using 2005 dollars
$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
Internet Stock Bubble
2000
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 bottom decile has better quality of life than 9th decile 100 years ago (Derek Bok)

· can you translate this to plain English? extra credit

next week

◇ we will always end the class by having a quick look at the next class

bibliography I

Okulicz-Kozaryn, A. and J. M. Mazelis (2016): "More Unequal In Income, More Unequal in Wellbeing," Social Indicators Research.

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