

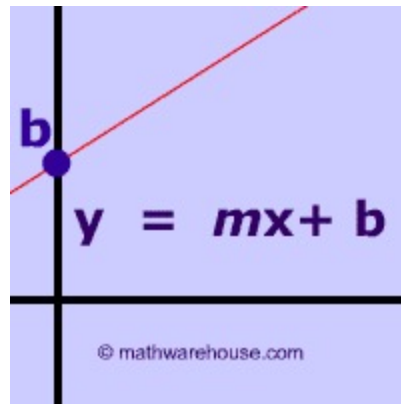
Understanding Data

Feb 20, 2017



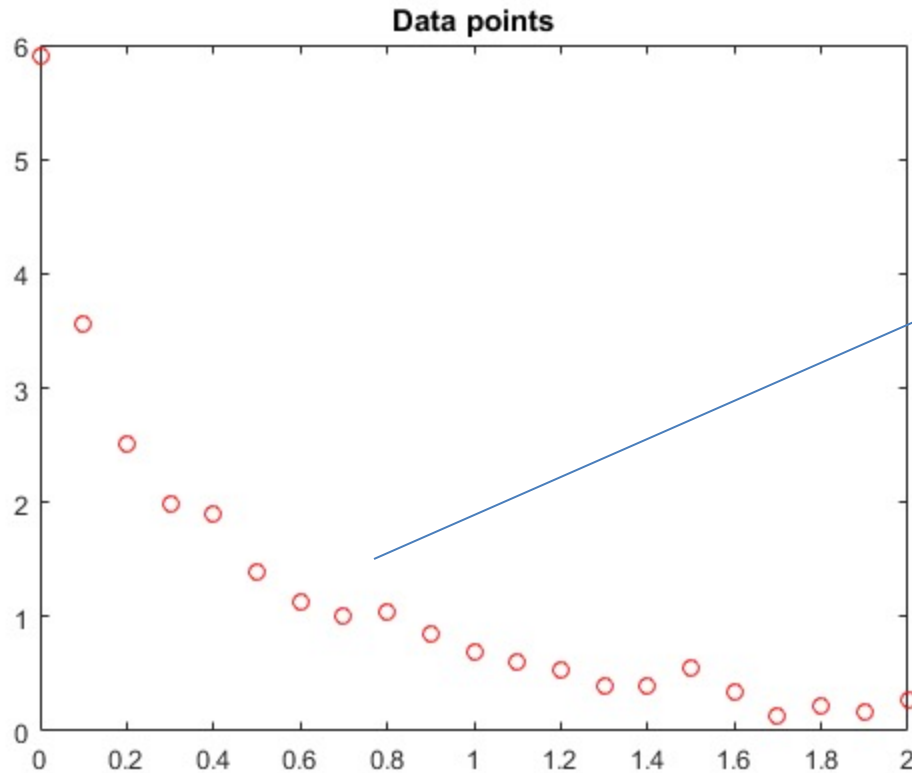
Straight lines

- $y=mx+b$: m is the slope of the line and b is the y-intercept



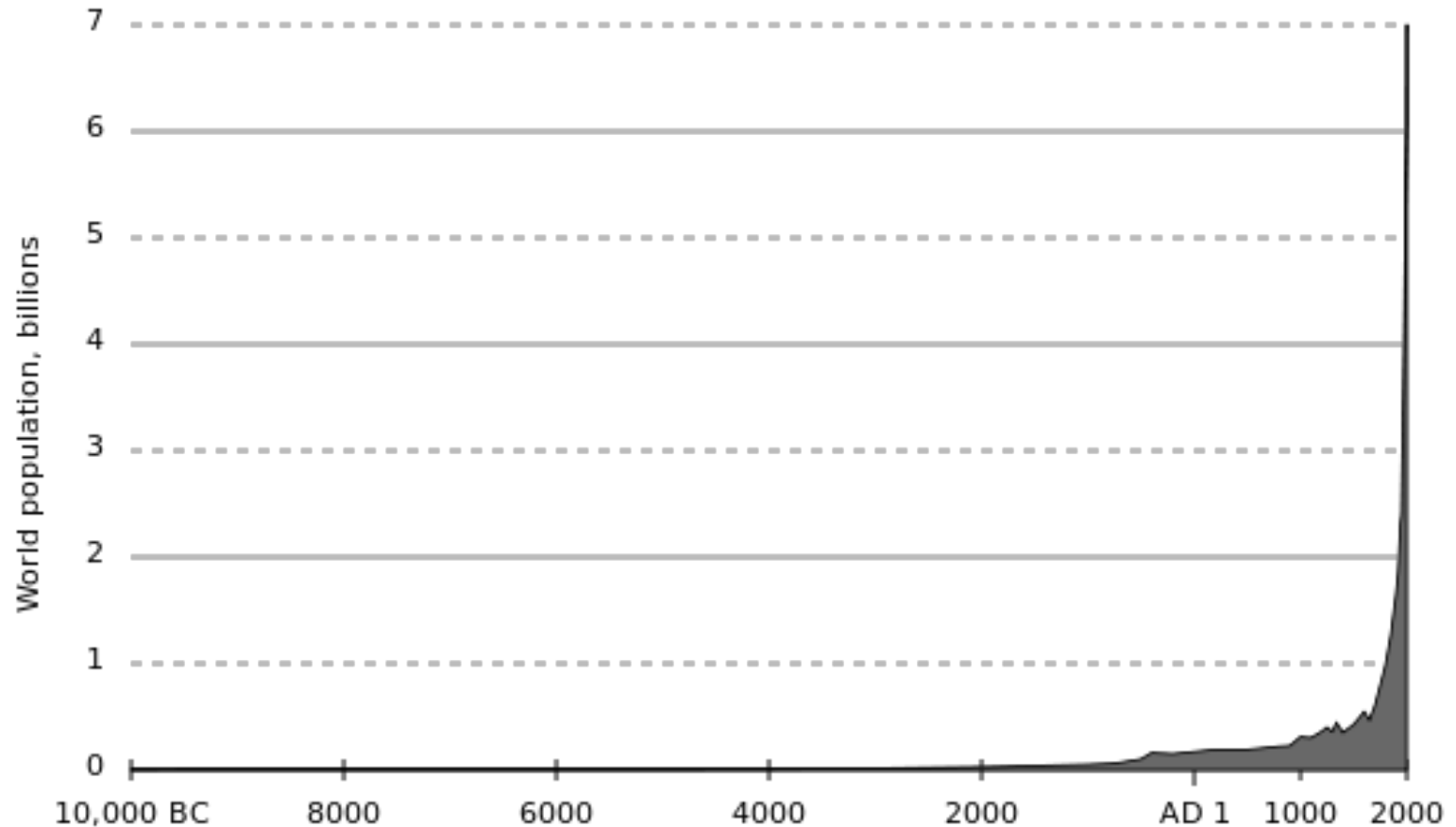
- Slope $m = (y_2 - y_1) / (x_2 - x_1)$

Real Data is usually **non-linear**

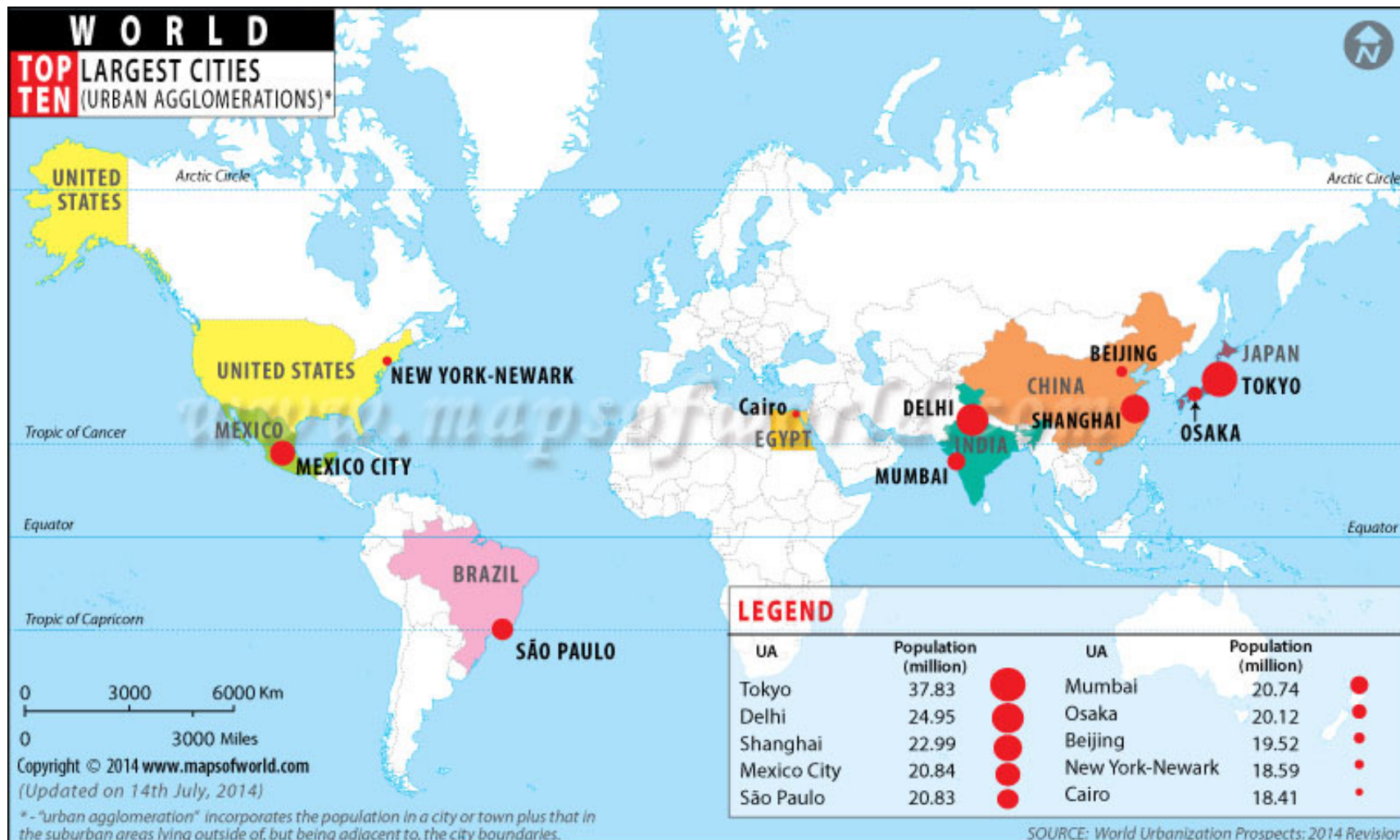


This data would
Not look like a
Straight line
If connected

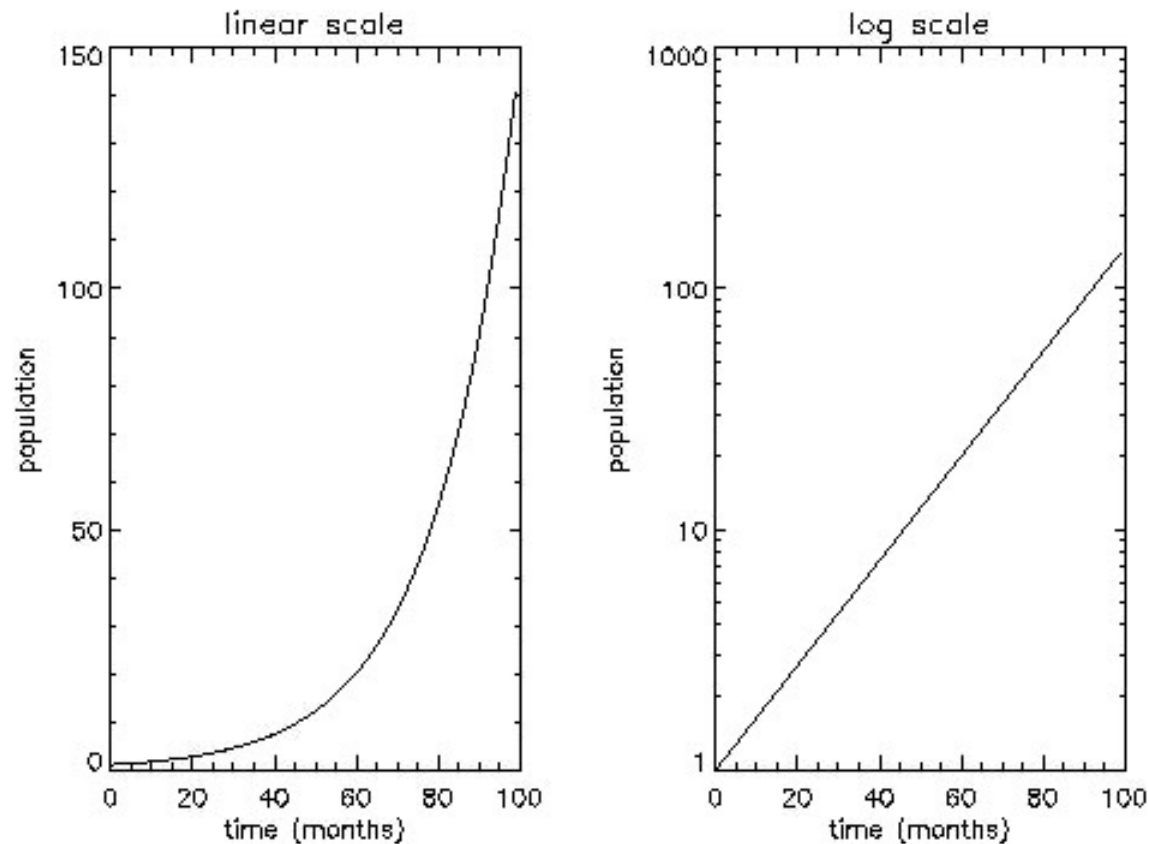
Human Population Growth



Most populous cities



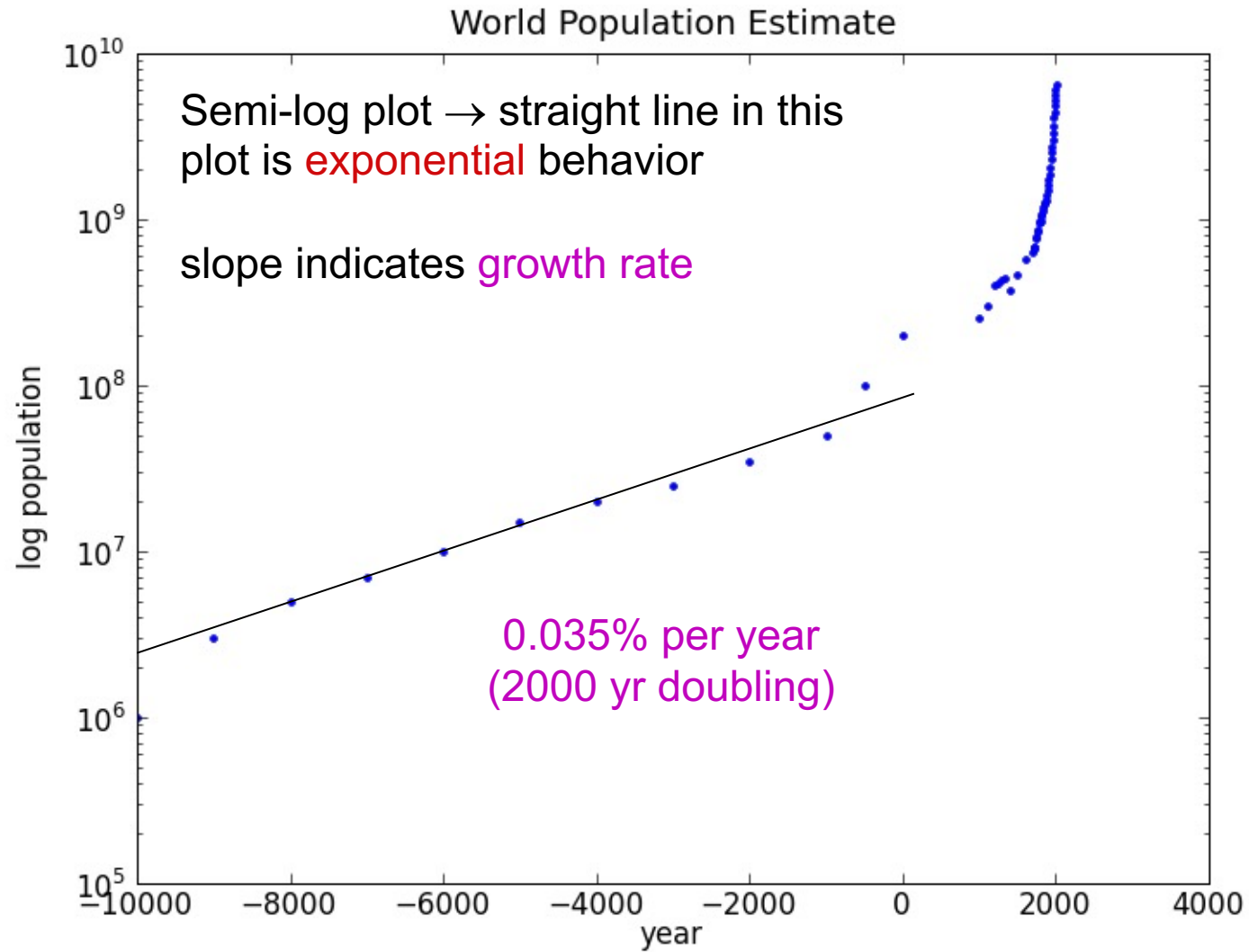
The log scale

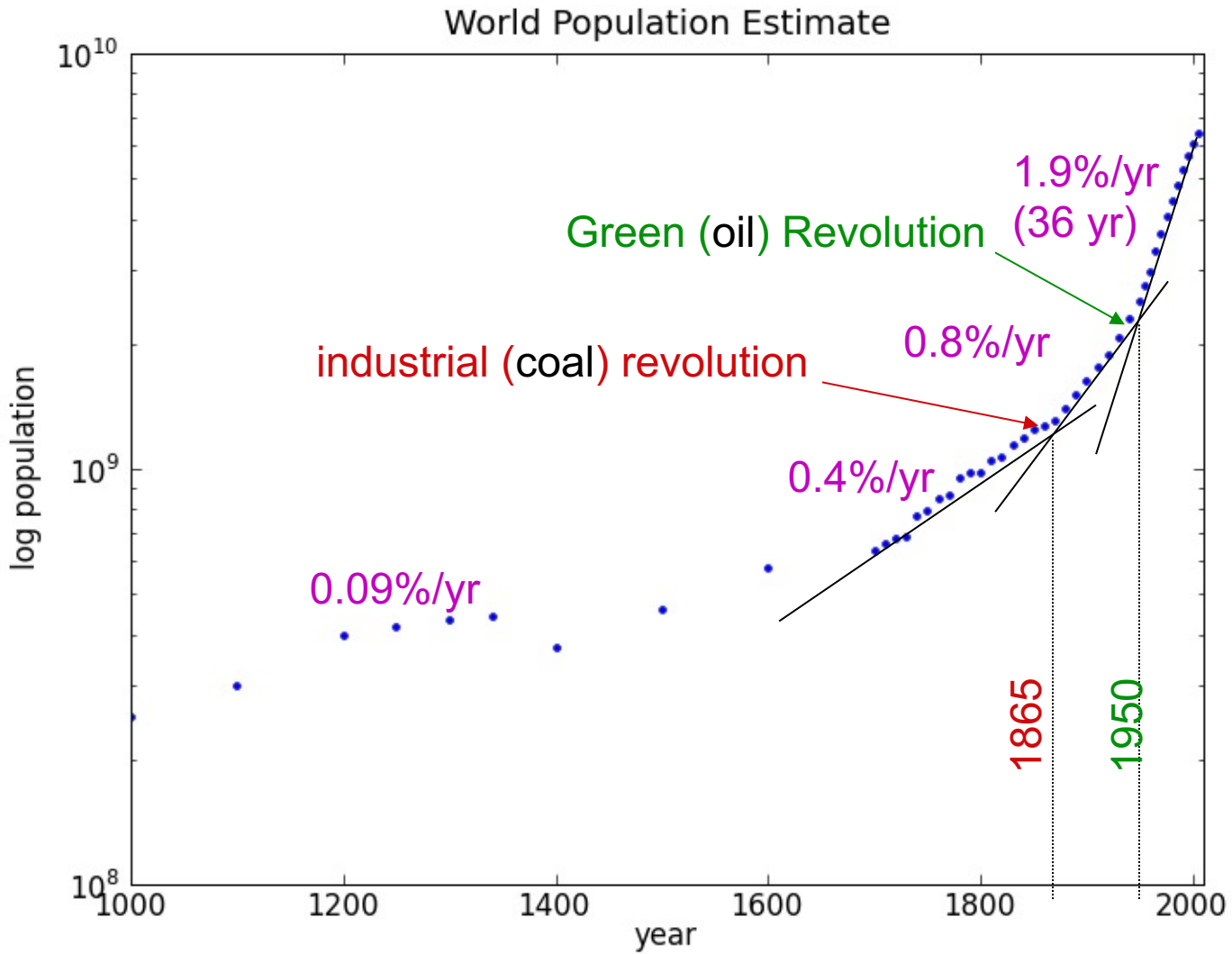


Exponential plot is curved on linear scale, and straight on a logarithmic scale

Developing Exponential Intuition

- When the rate of increase depends directly on how much stuff there is, we get exponential growth
 - interest earned depends on balance
 - more rabbits are born if the population is larger
- Important concept is doubling time
 - A 1% yearly increase doubles in 70 years
 - $1.01^{70} = 2.0$
 - A 5% increase doubles in 14 years
 - $1.05^{14} = 2.0$
 - **Law of 70**: doubles in $(70 / \% \text{ rate})$ periods





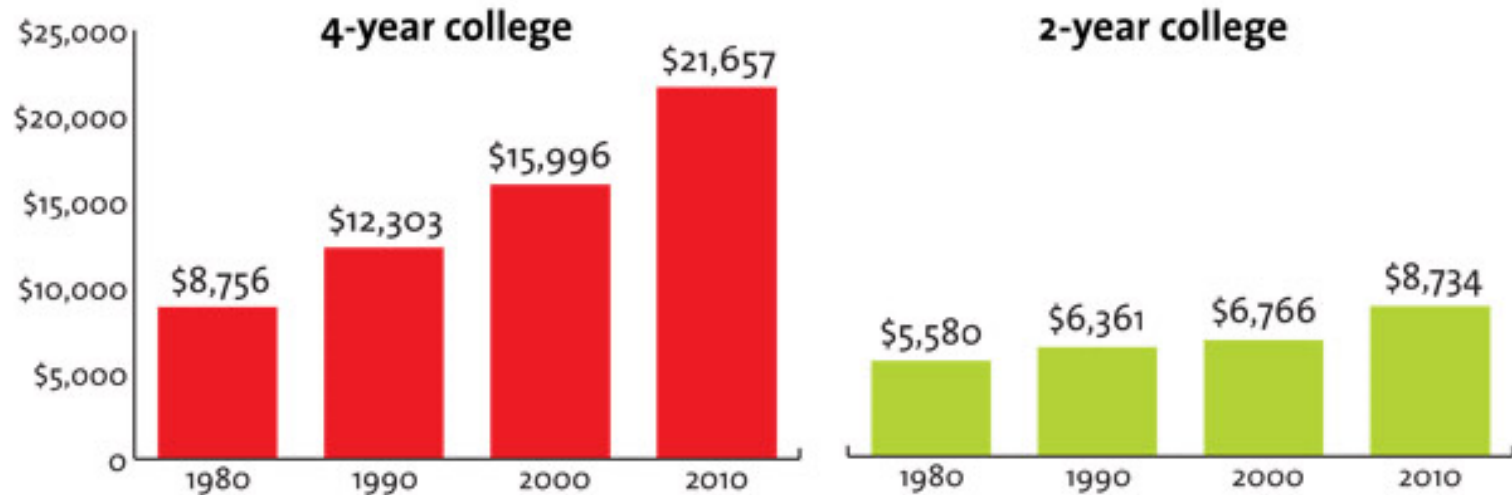
Where do you think human population is heading?

Student debt Data

Average Price of College

Major Expenses

Average price of a year of college, 1980-2010

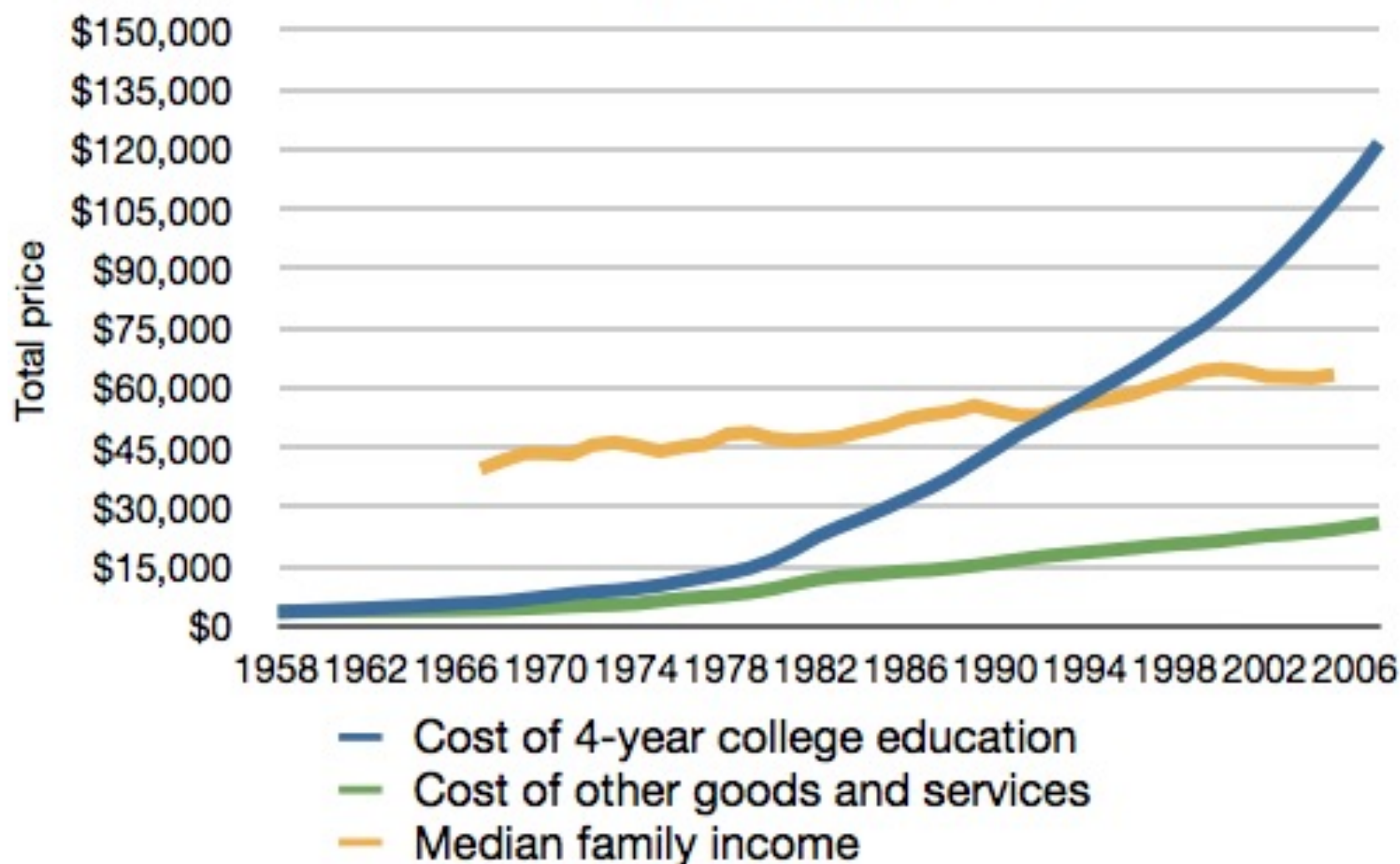


In 2010 dollars. Includes tuition, room and board, and fees.
Source: National Center for Education Statistics

Mother Jones

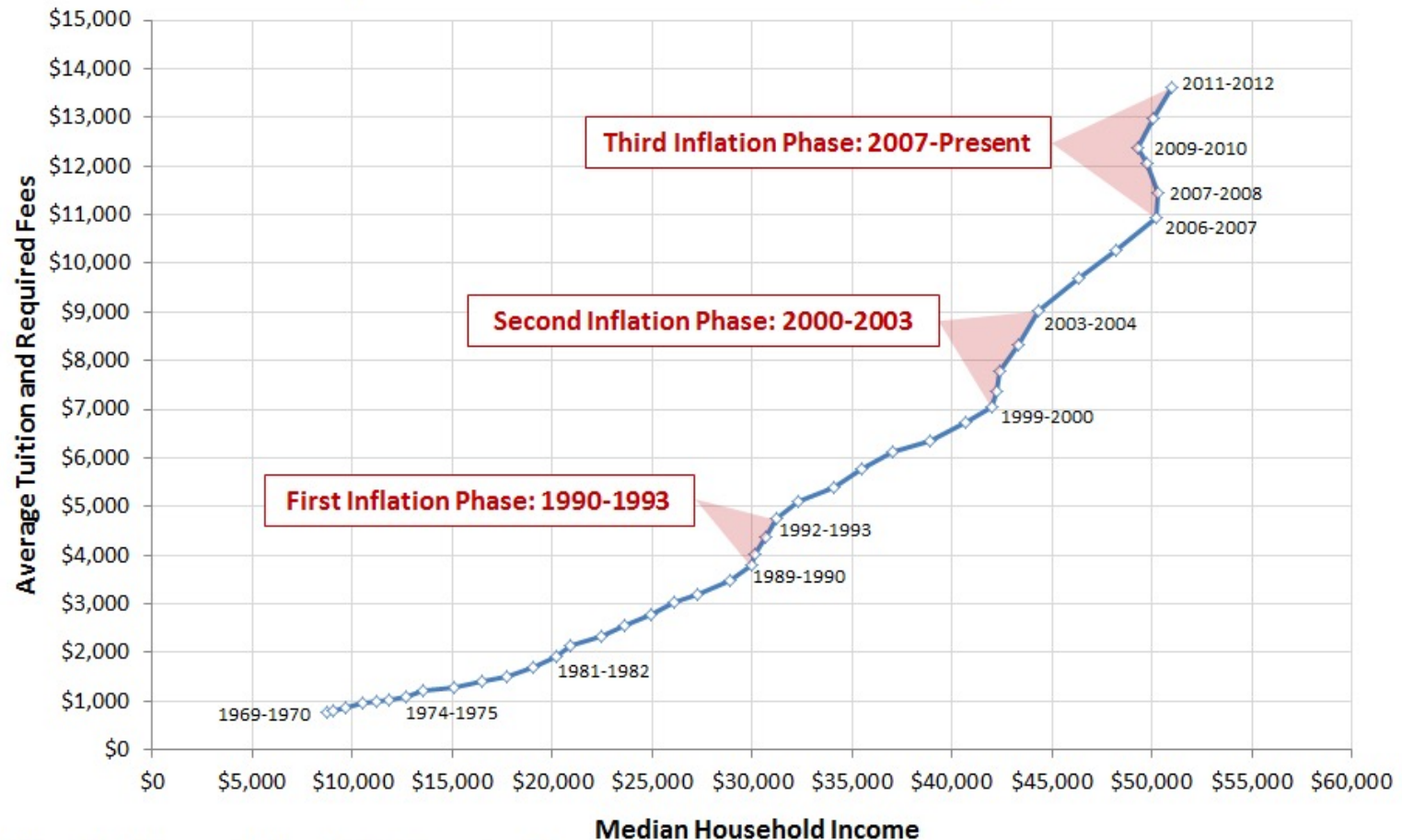
- How quickly have tuition prices gone up from 1980-2010? Describe using a line.
- What was tuition like in the 1970s?

4-year college costs



Look for sudden changes

The Inflation of the Higher Education Bubble: Average College Tuition and Required Fees vs Median Household Income, 1969-2012



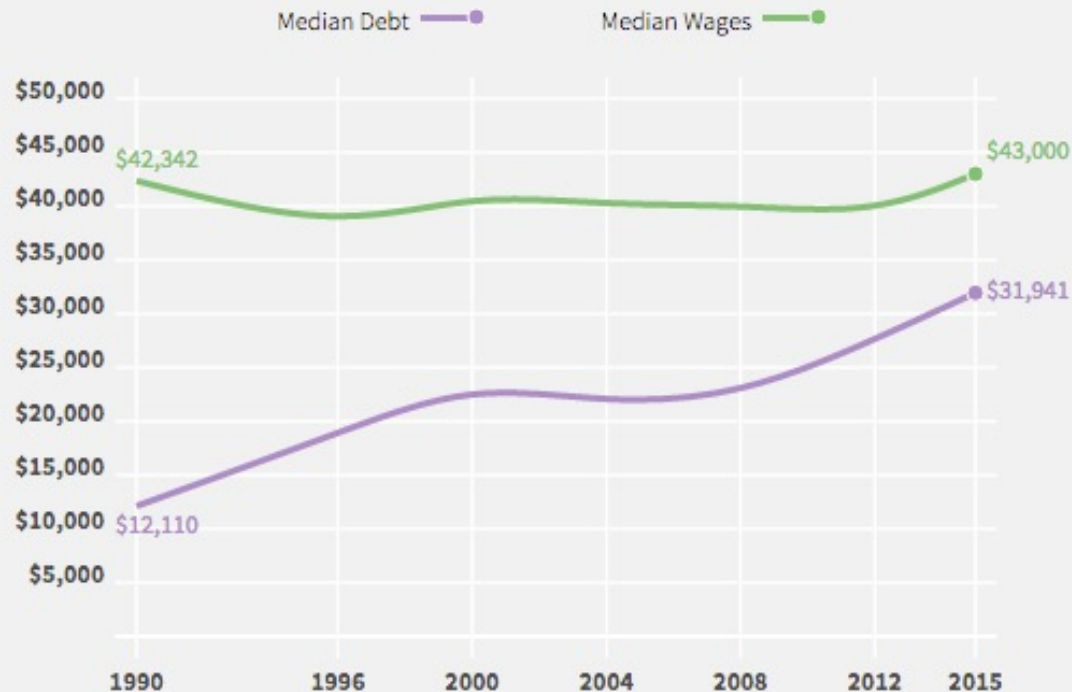
Note: School Years coinciding with U.S. Recessions shown on chart. Nominal values (not adjusted for inflation).

© Political Calculations 2014

Student Debt data

Student Debt Significantly Outpacing Wage Growth

Median wages have increased 1.6% over the last 25 years while median debt has risen 163.8%

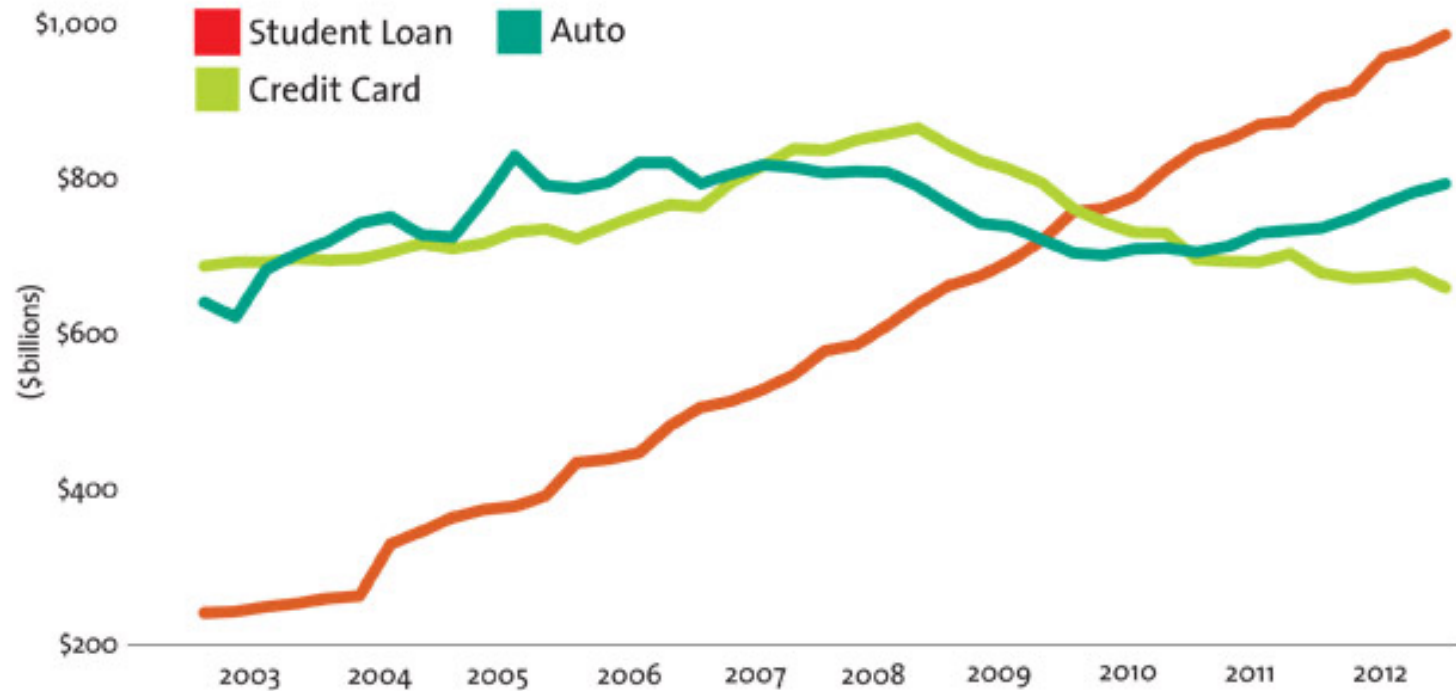


Sources: Brad Hershbein of the W.E. Upjohn Institute for Employment Research, U.S. Department of Education, Federal Reserve Bank of New York, Mark Kantrowitz

Notes: Median debt at graduation for bachelor's degree recipients only. 2015 figure is a projection. Median wages for graduates aged 22 to 27, full-time workers only, with a bachelor's degree only. Figures expressed in constant 2015 dollars, adjusted using U.S. Bureau of Labor Statistics, Consumer Price Index.

Maxed Out

Total debt held by borrowers



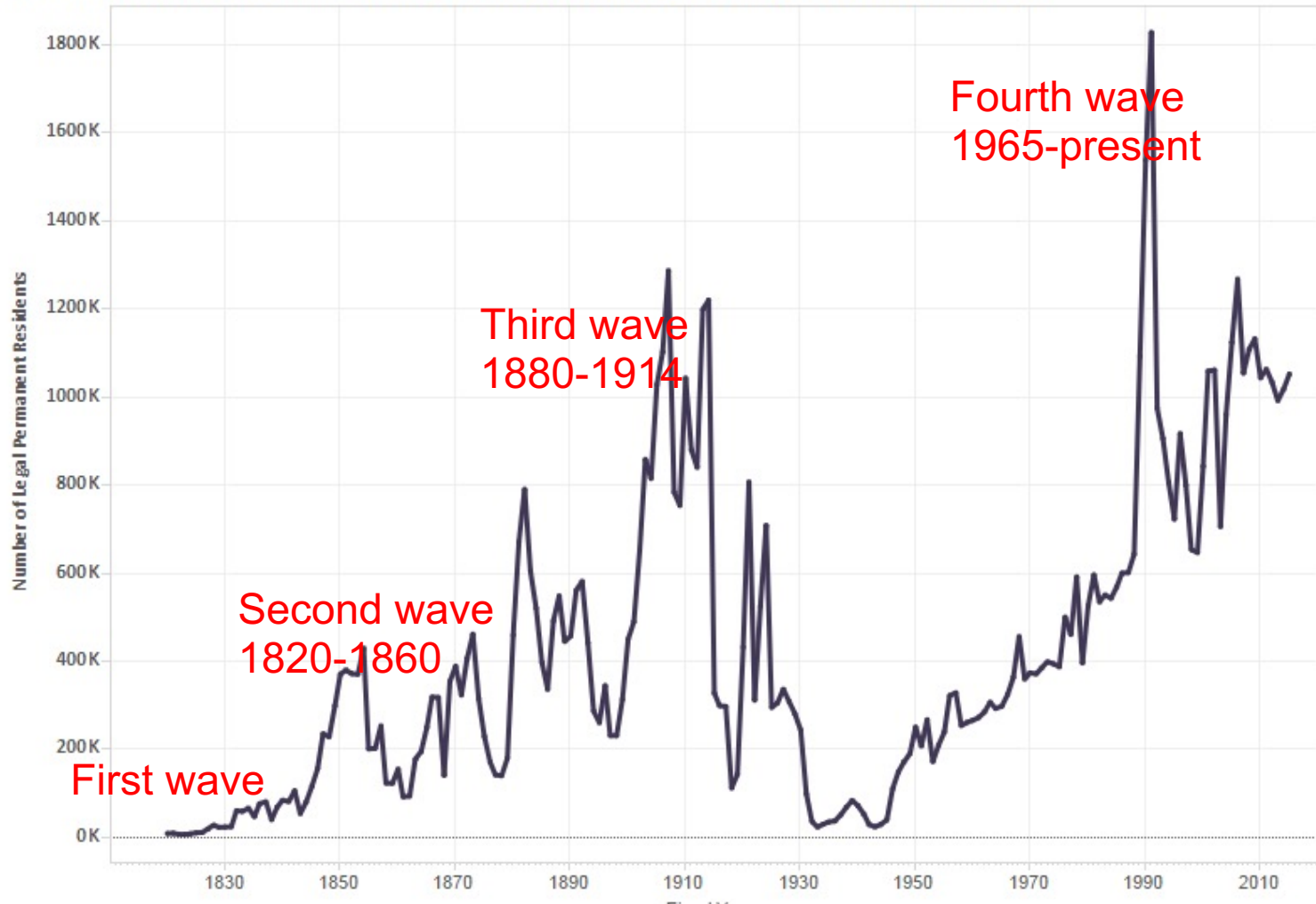
Source: Federal Reserve Bank of New York

Mother Jones

Immigration Data

What are the reasons for the spikes?

Annual Number of U.S. Legal Permanent Residents, Fiscal Years 1820-2015



FIRST WAVE

English, Scots, Scots-Irish, Germans (migrated to Pennsylvania for religious freedom), Dutch, French, Spanish (migrated to Florida and southwest for Christian converts), Puritans (migrated to Massachusetts to establish a community restricted to members of their faith)

SECOND WAVE

German (escaping economic problems and seeking political freedom), British, Irish (poverty and famine encouraged emigration).

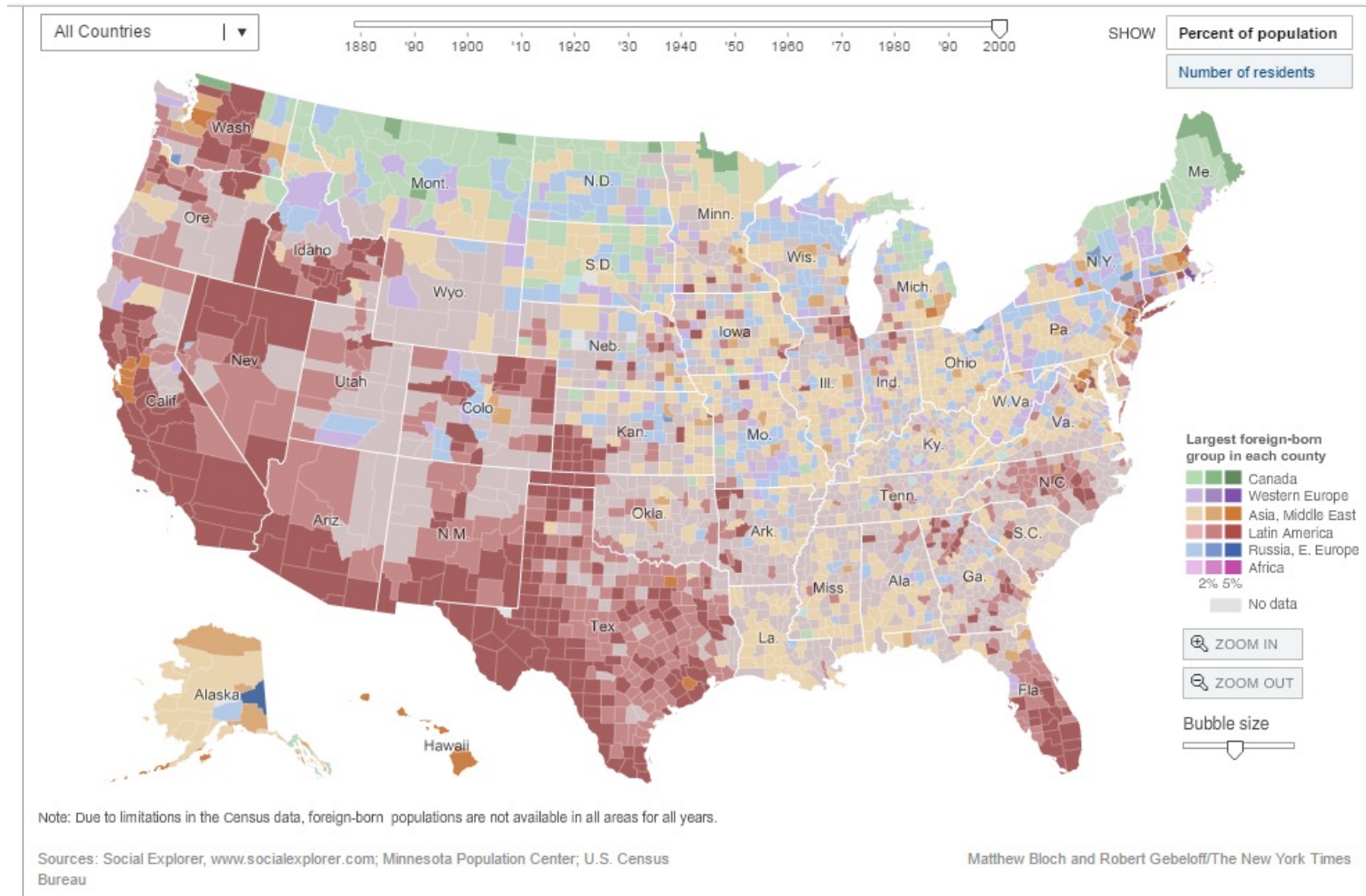
THIRD WAVE

Chinese, Japanese, and other Asian countries (migrated to the western states).

FOURTH WAVE

Europeans, Asians, Hispanics (Mexico)

Interactive Immigration data



Click on the map.