Social Data Science

Data and Big data

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Today:

1. Empirical design
2. Distinguish
   data generating process
   from
   modes of collection
3. Characteristics of big data
4. strategic data provision

Different data for different questions
or
Different questions for different data

Sometimes possible to separate **data collection process** from underlying **data generating process** – and sometimes not

Fundamental difference between what people do and what they say they do

‘cheap talk’ / ‘put your money where your mouth is’ / honest/costly signaling

What is your question, again?

1. Research question from theory
2. Ideal empirical design
3. Feasible empirical design / collection
4. Results
5. Adjustment of theory/question/design
6. New results
7. …

A. What data do we have
B. What question can they answer
C. Research question
D. Results

All models are wrong – but some are useful

George Box

Two key goals

1. Forecasting: individual behavior, policy consequences, voting, Champions League, grades …
   Data science / machine learning (but also macroeconomics)
2. Hypothesis testing, derived from theory
   ´Traditional' social science

1. Forecasting

- Example: Bank wants to forecast non-payment on loans (P_d: probability of default)
- Couldn't care less about theory
- Rough "Data Science": try to predict from all available data
- Suppose we find that birth weight predicts default
  - Bank is happy, better fit (defer ethics etc)
  - Policy: does investing in pre-natal care reduce defaults?
- In practice: set of predictors typically taken from (some) theory, even if casual
- Complications: if customers know that P_d depends on birth weight, would/should they disclose it? What if loans only to disclosers? Would they tell the truth?

2. Hypothesis testing

- Theory (rational choice, sociology, biology, common sense, …) posits effect of X on Y
  A. Selection/type theory: People who are impatient cannot defer immediate pleasures -> smoke and drink while pregnant -> give birth sooner. If impatient parents -> impatient children (whether by nature or nurture), we have an explanation.
  B. Biological theory: low birth weight affects brain development and neurological wiring for patience.
- If (A), little role for policy; also, both can be true at same time
- How to distinguish: exogenous shock to birthweight, but ethically tricky ...

Goodhart's law

- Most popular: "When a measure becomes a target, it ceases to be a good measure."

- What he wrote: "Any observed statistical regularity will tend to collapse once pressure is placed upon it for control purposes."

Targets and Measures

- You cannot be told how your bank constructs your P_d. Why?
  - Goodhart's law: people will attempt to outmaneuver measure
  - (thought)example: spending on shoes good indicator of account overdraft -> shoe lovers will have others buy for them, ceases to be a good measure

Case of Google Flu

- Google Flu: web searches for Flu symptoms predicted actual flu cases
- By-product of Google's main service
- But from 2010, not so well: overestimated actual flu cases, partly as result of autosuggest feature, partly because model was overfitted (Andreas will return to that)
- Best predictor: number of cases past week

Data generating process

What is the **data generating process**?

Observational: endogenous decisions, researcher passive collector of data

Randomization: treatment-control

(Some) exogeneity: policy interventions, sometimes with comparisons, researchers sometimes involved

Important: more data does not give better result/more precision if estimator is biased

Randomized experiments

- Distinguish
  - **Lab experiments**: traditionally computer-based in econ, but also eye tracking/brain images (fMRI)/physiological
  - **Survey experiments**: assign survey respondents to different frames/treatments/primings, e.g. have SocDems and Liberals say same thing and look at support
  - **Field experiments**: experimental control in the real world, e.g. banks charging different rates to learn about mobility of customers; Facebook experimenting with different algorithms; …)

Randomized experiments

- Distinguish
  - Natural experiments
    (weather induced: effects of poverty on violence, randomization of names on election ballots, …)
  - Quasi-experiments
    (effects of change in policy; effect of tax reform on tax planning; effect of immigrant allocation on crime)
- Throughout: exogenous (outside of the individual) change

Randomized experiments

- Large, important current debate in (development) economics
- CofE: what are effects of penalties on teachers' absence in Indian village schools – evidence from randomized experiments
- **Randomly** selected teachers get harsh penalty for no-shows -> difference in absenteeism **causal effect** of penalty
- (Broader EofC Q: why is education sector in rural India so inefficient?)

Randomized experiments

- Strong on internal validity: from randomization **any** effect on absenteeism is from harsher penalties; good for testing theory
- Weak(er) on external validity – would effect be similar in Africa? Would effect from lab work outside lab? Why, why not?
- (compare: medicine works in similar ways across locations)

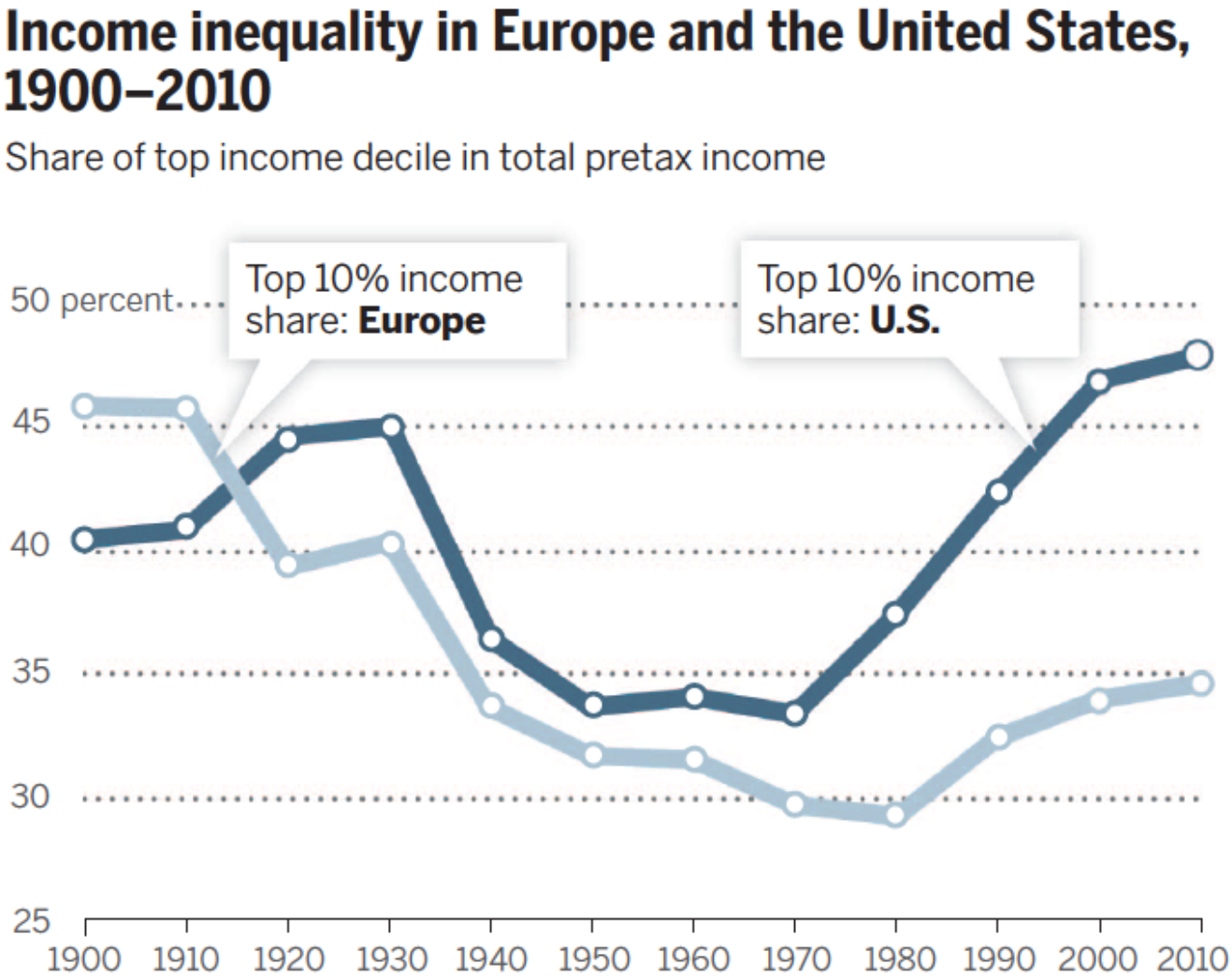
Randomized experiments

- Challenges
  - Limits to what can be studied by experimentation (**ethics**; law; feasibility)
  - Funding (field experiments expensive, survey exp less so)
  - Often **participation constraint** – voluntary participants' gain >= 0 or no incentive
  - Subjects leave for various (systematic) reasons
  - Large-scale randomization can be hard in field experiments

Observational data

- Generated without experimental or exogenous intervention
- Typically reveals correlations or descriptive patterns that can be interesting in themselves

Example: Inequality



Source: Piketty and Saez, Science 2014, tax return data

Observational data

- Generated without experimental or exogenous intervention
- Typically reveals correlations or descriptive patterns that can be interesting in themselves
  - Are in themselves silent about causality
  - Theory may provide structure to learn about causal mechanism under strong assumptions
  - May conflate correlation and causality

Observational data

- Example: Does being in private schools affect grades
  - Classic: Catholic schools and grades in US
  - Collect attendance and grades -> run regression
- But: suppose some parents are more focused on schooling than others
  - Send kids to private school more
  - More involved in school + homework
- What do higher grades measure?
  - Effect of private school OR effect of involved parents?

Observational data

- What to do?
  - Assign kids/parents randomly to private schools?
- More complicated
  - Waiting-list experiment design: people who sign up reveal themselves as school interested, compare grades between those in program and on waiting list -> much narrower design
  - Modeling (US case): use fact that Catholics are much more likely to choose Catholic schools

Big data is often observational

- Not always basis for causal claims
  - But interesting nonetheless: Description
- Can (potentially) be combined with natural/quasi-experiments.
  - Example: very detailed data on transportation/mobility and exogenous weather shocks-> effect of weather on mobility
  - Payday and consumption
- BUT: Google, FB, Amazon etc -> lots of field experimental data, in house

Modes of data collection

- (Ethnographic / participant observer)
- Survey
  - Interview survey (in person), phone survey, internet survey, …
- Administrative data
  - Used for administrative purposes
  - Some countries: census, tax return
  - DK: CPR-registry based
- (Primary collection: texts, counting)
- “Big data”: in social sciences typically a by-product of digitally stored transactions (in a broad sense)

Modes of data collection

- Note: survey, admin data, big data can all have randomized / exogenous elements or be purely observational (e.g. social media text and weather shocks)
- Often in Lab/field experiments: ask about income, education etc – but may be biased
- Sometimes: combine experimental data with admin or big data (but rare)

Ethnographic

- Pros
  - Attempt to understand situations from participants' perspective
  - Very detailed observations (e.g. dynamics at a meeting: who speaks when, who listens, who nods off and flirts etc)
- Cons
  - Very difficult to generalize (if even the goal)
  - Typically very small n, not for stats
  - Hard to reproduce / replicate

Surveys

- Pros
  - Can be cheap
  - Elicit info on attitudes, beliefs, expectations
  - Necessary when no other means exist
  - Combine with open-ended info
  - Easily anonymized (firms; China)
- Cons
  - Can be expensive
  - Non-random samples, sometimes very much so (paid surveys)
  - Cheap talk
  - Diverse interpretations (e.g. 1-10 scales, Maasai example)
  - Very different quality: interview vs. internet
  - Not full researcher control: Interviewer completions

Administrative data

- Denmark, Norway, Sweden
  - Population-wide
  - Ex: Know population ‘by pressing Enter’
    - Most other countries: census (counting people), surveys, rough approximations
  - In DK, built on Central Person Registry number
  - System constructed for source taxation in 1960s, now used as ubiquitous identifier
- Why do some countries have CPR-like systems and some not?

Administrative data

- Pros
  - Often full population
  - In DK: third party reported -> no reporting bias, no survey bias
  - Very detailed, no survey fatigue
  - Often very precise, since used for admin purposes
- Cons
  - No soft data (attitudes, expectations); can be linked to surveys
  - Privacy concerns
  - Restricted to what is collected for admin reasons, both type and frequency (e.g. annual)

Administrative data

- Lots of work in Danish econ utilizes register data
  - Taxation
  - Education
  - Health
  - Financial decisions
  - Labor market
- Combined with
  - Personality measures
  - Attitudes/political prefs from surveys
  - Expectations from surveys
  - Biological data (neuro-measures, genetics)
  - Data from experiments

No agreed upon definition what Big Data is

- Large N?
- High frequency / much detail?
- Many different measurements?
- Based on what people do ('honest signals')
  - ctr surveys
  - Not always honest
- Different to different people/traditions
- To Americans, Danish admin/register data is big data

‘Big data’

- Pros
  - Often based on **real decisions** (as admin data), but more detail, e.g. auctions
  - **High frequency** (e.g. wifi), high granularity -> almost ‘large N ethnographic data’ = “deep data”
  - Sometimes cheap/free
- Cons
  - No established protocol for collection
  - Sometimes dubious quality, selection issues (both known/unknown), hard to validate
  - Start-up costs
  - Even more privacy concerns
  - Corporate gatekeepers -> bias in access (Facebook, Google)

Characteristics of ‘big data’

- Structured (row/column-style) vs. unstructured (images/text)
- Temporally referenced (date, time, frequency)
- Geographically referenced (wifi, bluetooth, Google)
- Person identifiable (identify vs. distinguish individuals vs. not distinguish individuals)
  - Separate medium (e.g. phone) from owner

Example: CSS

Heat map of people with mobile devices on CSS (anonymous)

Strategic data management and production

- People / firms / governments do not always provide truthful and/or complete data
- Example: No penalty for lying in surveys – but no reason not to either
- **Political reasons** for obscuring or inventing data: Greece in EU, Chinese economy
- Firms: Proprietary info, competition reasons, fooling customers and regulators (VW)

Strategic data management and production

- Individual demand for privacy (We return to this)
  - Could be **instrumental**:
    - lack of privacy decreases consumer surplus by better estimate of reservation price (e.g. Steering: Mac vs PC when ordering online)
    - Concerns about political issues
  - Or an **objective in itself**: Privacy as a political goal

Social desirability bias I

- Key concern in surveys, but more general problem:
  What if people answer so as to conform with general notions of what's desirable?
  - Examples: Won't admit to not voting or having sexually transmitted diseases, exaggerates income
  - Reports buying healthy food vs unhealthy food
  - Important for asking/assessing sensitive questions

Social desirability bias II

- Why?
- Distinguish
  a) self-deception
  b) impression management
- Example: What do you value most in a potential mate?
  – People say: "kind and understanding”
  – From dating data: physical attractiveness, status
  – Bias could be both (a) and (b)