

Determining what to observe

Overview

- Why is case selection important?
- Different types of inference
- Sample surveys
- Some examples of sampling plans
- How many cases?
- Great sampling disasters
- Sampling and non-sampling errors

Why is case selection important?

- Variability of human populations
 - Oak leaves
 - Frenchmen
- If variability is small, case selection is easy
 - “Anyone will do.”
- In human populations variability is great
 - typically we assume that short term variability is small
 - It doesn't matter if value of X on A is recorded today and value of X on B is recorded next week

Inference

- Case selection or sampling is a vital link in the chain of inductive logic
 - Sampling method determines whether valid inferences from sample to population can be made.
 - Describe sample in order to infer something about the population from which it has been drawn.
- NB Inference problem does not always arise in this form.
 - Sometimes you are only interested in (or the method of case selection only permits) description of the case(s) selected – ie a convenience sample, case study
 - No formal apparatus of inference is needed
 - You describe what you see
 - **BUT:** Evidential basis for description may be imperfect (requiring inference in a different sense)

Inference continued

- What can be inferred from the surviving historical “relics” about Henry VIII’s motives for splitting from the Church of Rome?
 - Primary evidence
 - documents; eye-witness accounts; letters; nearly contemporaneous interpretations
 - What remains will be a sample of what existed
 - Random selection - fire, flood and rodents
 - Non-random selection - suppression and misrepresentation

Inference continued

- Historical craftsmanship
 - Source criticism
 - How close was the writer to the events?
 - What were their motivations in writing?
 - Do both sides of the correspondence survive?
 - Inference aided by high level generalisations about:
 - Human behaviour; what makes sense etc.
- NB inferences **in this sense** are about singular events

Inference continued

- **Sample survey**
 - inference from sample to finite population
 - estimation of % Jedi Knights in UK
 - point estimate;
 - interval estimate
 - sampling process should be constructed to ensure **long run** “representativeness” ie reflect the variability of the population with regard to relevant characteristics
- Usually not possible to know **with certainty** whether any **particular** sample is “representative”

Inference continued

- **Experiment/clinical trials**
 - Statistical inference is from a particular randomisation to the population of all possible randomisations **with those (or equivalent) subjects**
 - External Validity
 - What is the population from which the subjects have been drawn? To which population can we generalize the results?
 - Random sampling from population + randomisation to experimental conditions = external+internal validity

Inference continued

- Inference when apparently the whole population is observed
 - ie annual time series on welfare state spending and economic openness in all OECD states 1950-2001
 - can regard observed outcomes as “sample” from a hypothetical population of all the outcomes that might have been observed - **conditional on the truth of a particular model of the data generation process**
- Sample selection issues about which states and which time periods are included

Summary

- **Historian**
 - tries to describe what has happened in a particular case
 - inferences about the case from partial and incomplete sources
 - disadvantaged compared to contemporary case study/ethnographic observation in that historian's data are finite
- **Sample Survey**
 - random sampling of cases to facilitate inferences from sample values to finite population values
- **Experimentation**
 - randomisation ensures valid inference, but not external validity
- **Model based inference**
 - depends on formulation of an explicit stochastic model, observed outcomes are one “sample” from it

Sample Surveys

- Probabilistic
 - Every element in target population has a non-zero probability of selection
 - **Simple Random Sampling SRS**
 - selection probabilities are equal
 - uses no auxiliary information about population structure
 - **Stratified Random Sample**
 - incorporates auxiliary information about structure of the population into the sampling process
 - selection probabilities can be equal or unequal
 - **Clustered Random Sample**
 - Data form naturally occurring or artificially constructed groups
 - » classes in schools; postcode areas

Sample Surveys continued

- Common to all probabilistic methods
 - **Human judgement plays no part in the selection of cases/elements drawn into the sample**
 - If this condition is not satisfied then all attempts to apply standard statistical inference models are **invalid**
 - “What we can’t say we can’t say, and we can’t whistle it either.” ! Frank Ramsey
 - Human judgement may enter into the choice of auxiliary information to incorporate

Selecting the sample

- Probabilistic sampling requires a frame/list/ or some other mechanism to generate a sample from
 - Desirable properties
 - Covers all the target population
 - Each case identifier appears once and only once
 - No relevant sequencing in the list
 - Contains contact information
- No sampling frame/mechanism is perfect

UK frames of choice

- For sampling households or individuals
 - Small users Postal Address File (PAF)
 - List of dwellings receiving less than 30 items of mail per day
 - Supplemented by “point of interview” randomisation tool (Kish Grid) to select
 - households in dwelling
 - » individuals in households
- For sampling establishments or workplaces
 - Interdepartmental Business Register (IDBR)
 - In 1992 - 340375 separately identifiable workplaces
 - BT’s Business Database
 - 1.7m locations with a business telephone line

Random Digit Dialling

- Widely used in USA for drawing probability sample for telephone interviewing
 - Typically several stages
 - Numbers are blocked into groups by their first 7 digits
 - Block is chosen at random
 - Number from the block is dialled at random
 - If it is a domestic (business) number, the block is retained
 - Numbers in block are called until a fixed number of interviews are achieved

1998 Workplace Employment Relations Survey

- Target population
 - All British workplaces with 10+ employees
- Sampling frame
 - IDBR
- Stratification (disproportionate) by
 - Number of employees; Industry
 - sampling fractions
 - Workplaces with less than 25 employees 1/545
 - Workplaces with 500+ employees 1/21

Working in Britain 2000

- Target population
 - Employed and Self-employed population of Britain aged 20-60.
- Sampling frame
 - Small user PAF
- Primary sampling units
 - Postcode sectors (South of Caledonian Canal)
 - Stratified by population density and % in SEG 1 or 2
 - Sectors selected with probability proportional to size
- 40 (47 in London) addresses selected in each sector
- Households at address and individual in household selected with Kish grid

How many cases?

- Outside of context of probability sampling to make population inferences the question has no well defined meaning
 - But...holding quality constant, more information is usually better than less
- In the context of studies using probability sampling sensible answers can usually be given in relatively straightforward circumstances (though the details may be a little involved)
- Answer depends on:
 - Magnitude of effect you want to detect ie the size of a difference between two proportions
 - The probability with which you want to detect the effect (if it is real)
 - Amount of variability of the attribute you are interested in
 - The reliability with which you can measure the attribute
 - The size of the subgroups you want to measure the effect in
 - The extent to which you can control for exogenous influences

Great Sampling Disasters I

- Literary Digest Presidential Election Polls
 - Correctly predicted result in 1920, 1924, 1928 and 1932
- 1936 F. D. Roosevelt (incumbent) versus Alf Landon



- LD poll had Landon winning by 57% to 43%.
- Actual result- Roosevelt 61%
- Sample size 2 million (out of 10 million ballots sent out by LD)
- Sampling frame
 - Lists of telephone subscribers and car owners

Great Sampling Disasters II

- **George Gallup** got the 1936 election result correct
- Also got 1940 and 1944 right
- Pioneered the use of **quota sampling**
- 1948 Presidential race was between Truman and Dewey



- Gallup predicted Dewey would win
- In fact it was too close to call
- Truman retained the Presidency

Great Sampling Disasters III

- April 1992 UK General Election
- Eve of Election polls by the big 5: (Lab%:Con%)
 - Harris (40:38)
 - Mori (39:38)
 - NOP (42:39)
 - Gallup (38:38.5)
 - ICM (38:38)
- Actual Result Lab 35.2: Con 42.8
- Causes
 - Non-response handling; late swing (?); poor quota controls
- See JRSS Series A, 159, 1996

Sampling and Non-sampling errors

- Probability sampling and only probability sampling permits the valid estimation of sampling variability
 - No probability sampling=no standard errors
- Other types of error are also important
 - Bias from unit non-response
 - Bias from item non-response
 - Measurement and classification errors
- In the UK unit non-response is reaching worryingly high levels