Sampling and hypothesis testing

Slides are essentially based on the two following recommended textbooks for this course:

1. Research methods for business students (fifth edition)
   by: Mark Saunders, Philip Lewis, Adrian Thornhill

2. Essentials of business research
   by: Jonathan Wilson
Sampling and hypothesis testing

What is Statistical Population?

“A statistical population is a set of entities concerning which statistical inferences are to be drawn”


What is Sample?

“A finite part of a statistical population whose properties are studied to gain information about the whole”

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What is Sampling?

“The act, process, or technique of selecting a suitable sample, or a representative part of a population for the purpose of determining parameters or characteristics of the whole population”

Inductive approach divided into two parts:

- Survey research: Which is Positivism and thesis is used to validate hypothesis and the question is how much
- Case-study: which is Interpretivism, thesis is used to produce hypothesis and the question is how and why.

Sampling is attached to the survey research.
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Sampling - a valid alternative to a census when

• A survey of the entire population is impracticable

• Budget constraints restrict data collection

• Time constraints restrict data collection

• Results from data collection are needed quickly


The disadvantages of Sampling

• There is room for potential bias in the selection of suitable subjects for the research. This may be because the researcher selects subjects that are more likely to give the desired results, or that the subjects tend to select themselves.

• Sampling requires a knowledge of statistics, and the entire design of experiment depends upon the exact sampling method required.

Shuttleworth, M. and Blakstad, O. 2010, How to write a research paper, 5th edn, Lulu Enterprises Inc.
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The five stage process

1. Identify sampling frame from research objectives
2. Select your sampling techniques
3. Decide on a suitable sample size
4. Collect your data
5. Access your response rate

Sample frame work

“The sampling framework for any probability sample is a complete list of all the cases in the population from which your sample will be drawn.”

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Sampling techniques

Sample example

- Define two variables: show size and height
- Define scales of each variable: show size (European scale) and height (cm)
- Choose your sample (students in the class)
- Develop the hypothesis
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Probability Sampling

“The term probability sampling is used when the selection of the sample is purely based on chance. The human mind has no control on the selection or non-selection of the units for the sample. Every unit of the population has known nonzero probability of being selected for the sample units for the sample.”

Non-Probability Sampling

“In non-probability sampling, the sample is not based on chance. It is rather determined by some person. We cannot assign to an element of population the probability of its being selected in the sample. Somebody may use his personal judgment in the selection of the sample. In this case the sampling is called judgment sampling.”
Simple Random Sampling

A simple random sample gives each member of the population an equal chance of being chosen.

Advantage: ideal for statistical purposes

Disadvantages: - hard to achieve in practice
               - requires an accurate list of the whole population
               - expensive to conduct as those sampled may be scattered over a wide area
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Systematic Sampling

“This is random sampling with a system! From the sampling frame, a starting point is chosen at random, and thereafter at regular intervals.”

For example, suppose you want to sample 8 houses from a street of 120 houses. 120/8 = 15, so every 15th house is chosen after a random starting point between 1 and 15. If the random starting point is 11, then the houses selected are 11, 26, 41, 56, 71, 86, 101, and 116.

Hunt, N and Tyrrell, S, 2004, discuss sampling methods, Coventry University.

<table>
<thead>
<tr>
<th>Systematic Sampling</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population</strong></td>
</tr>
<tr>
<td>Directory of the population (sample frame)</td>
</tr>
<tr>
<td><strong>Sample Method</strong></td>
</tr>
<tr>
<td>Select a skip interval with a random starting point</td>
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<tr>
<td><strong>Resulting Sample</strong></td>
</tr>
<tr>
<td>Every member of the sample frame has an equal chance of being selected into the sample</td>
</tr>
</tbody>
</table>

Richard, M and Jacobs, OSA, Educational Research: Sampling a Population, EDU 8603
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Stratified Random Sampling

“In a stratified sample the sampling frame is divided into non-overlapping groups or strata, e.g. geographical areas, age-groups, genders. A sample is taken from each stratum, and when this sample is a simple random sample it is referred to as stratified random sampling.”

Suppose that the total number of staff is 180 and we are asked to take a sample of 40 staff, stratified according to the mentioned categories.

% male, full time = ( \( \frac{90}{180} \) x 100 ) = 50
% male, part time = ( \( \frac{18}{180} \) x 100 ) = 10

This tells us that in our sample of 40:
50% should be male, full time. 50% of 40 is 20.
10% should be male, part time. 10% of 40 is 4.

Richard M and Jacobs, OSA, Educational Research: Sampling a Population, EDU 8603

Hunt, N and Tyrrell, S, 2004, discuss sampling methods, Coventry University.
Cluster Sampling

In cluster sampling the units sampled are chosen in clusters, close to each other. The population is divided into clusters, and some of them are then chosen at random. Within each cluster units are then chosen by simple random sampling or some other method.

Hunt, N and Tyrrell, S, 2004, discuss sampling methods, Coventry University.
Quota Sampling
In quota sampling the selection of the sample is made by the interviewer, who has been given quotas to fill from specified sub-groups of the population.

For example, an interviewer may be told to sample 50 females between the age of 45 and 60.

Anyone who has had the experience of trying to interview people in the street knows how tempting it is to ask those who look most helpful, hence it is not the most representative of samples, but extremely useful.

Hunt, N and Tyrrell, S, 2004, discuss sampling methods, Coventry University.
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The sample size depends on:

- The confidence that you need to have in your data
- The comparative sample size of earlier studies
- The margin of error that you can tolerate
- The type of analysis you are going to undertake
- The size of the total population from which your sample is being drawn
- Using formulas and publish tables

Asses your response rate

**Response rate**: the number of people who answered the survey divided by the number of people in the sample.

\[
\text{Response rate} = \frac{X}{Y}
\]
Hypothesis testing and Hypothesis

• **Hypothesis testing** is a common practice in science that involves conducting tests and experiments to see if a proposed explanation for an observed phenomenon works in practice. The purpose of hypothesis testing is to test the viability of the null hypothesis in the light of experimental data.

• A **hypothesis** is a tentative explanation for some kind of observed phenomenon, and is an important part of the scientific method.

Null hypothesis

The null hypothesis typically corresponds to a general or default position. For example, the null hypothesis might be that there is no relationship between two measured phenomena or that a potential treatment has no effect.

*The main goal of hypothesis testing is to tell us whether we have enough evidence to reject the null hypothesis.*

*Lack of evidence to the contrary is not evidence that the null hypothesis is true.*
Alternative Hypothesis

The alternative exclusively disproves and rejects the null by a different predictive result.

Example

Relationship between weather and how people feel:

H0: People don’t feel better when it is sunny.
H1: People feel better when it is sunny.
Sampling and hypothesis testing

Exercise 4

- Define two variables related to your research topic
- Write the hypothesis
- Gather data to test the hypothesis
- Test the hypothesis and write a brief conclusion