Research Methodology

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lesson : Hypothesis Development

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Introduction

- The second main important consideration in the formulation of a research problem in quantitative research is the construction of a hypothesis.
- Hypothesis brings clarity, focus and specificity to a research problem, but are ***not essential*** for a study.
- You can conduct a valid investigation without constructing a single hypothesis.
- Hypothesis arise from a set of ***hunches*** that are tested through the study.
- In these examples, you started with superficial hunch or an assumption. Only after a careful investigation, you arrive at a conclusion about the validity of the your assumptions.

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Introduction *cont'd*

- In most cases, the hypothesis will be based upon either previous studies or your own or someone else's observations.
- In social science, where direct knowledge of ***population parameter(s) is rare***, hypothesis testing is often used strategy for deciding whether a ***sample data*** offer such support for a hypothesis that generalization can be made. Thus hypothesis testing enables us to make ***probability statements*** about ***population parameter(s)..***

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Introduction *cont'd*

- Therefore, often a research hypothesis is a predictive statement, capable of being tested by scientific methods, that relates an independent variable to some independent variable.
- E.g.: *"Students who receive counseling will show a greater increase in creativity than students not receiving counseling".*
- *E.g.: "the automobile A is performing as well as automobile B"*

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Characteristics of hypothesis

- Hypothesis should be clear and precise.
  - E.g.: *the average age of the male students in this class is higher than that of the female students.*
- Hypothesis should be capable of being tested.
  - E.g.: *Modern man evolved from apes.*
  - *The universe started off with a big bang*
- Hypothesis should state relationships between variables.
- Hypothesis should be operationalize.

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Basic concepts of testing hypothesis

1. ***Null hypothesis and alternative hypothesis***

- ***Null Hypothesis is a statement about a population parameter, such as the population mean, that is assumed to be true.***
- E.g.: children in Sri Lanka watch an average of 3 hours of TV per week. This is a starting point so that we can decide whether this is likely to be true.
- ***E.g.: A manufacturer is filling 100 packages with flour.***
- ***Thus the null hypothesis,***

$$H_0 : \mu = \mu_{H_0} = 100$$

Population mean — Hypothesized mean

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Basic concepts of testing hypothesis *cont'd*

- If our sample does not support this null hypothesis, we should conclude that something else is true.
- What we conclude rejecting the null hypothesis is known as alternate hypothesis.
- ***Alternate hypothesis*** is a statement that directly contradicts a null hypothesis by stating that that the actual value of a population parameter is less than, greater than, or not equal to the value stated in the null hypothesis.
- If we accept H_0 then we are rejecting H_1 and if we reject H_0 then we are accepting H_1

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Basic concepts of testing hypothesis *cont'd*

2. ***The level of Significance***

- In this stage we set the criteria for the decision.
- To set the criteria for a decision, we state the level of significance for a test.
- This is similar to the criterion that jurors use in a criminal trial. Jurors decide whether the evidence presented shows guilt beyond a reasonable doubt (this is the criterion).
- level of significance is typically set at 5% in behavioral research studies.
- The 5 per cent level of significance means that researcher is willing to take as much as a 5 per cent risk of rejecting the null hypothesis when it (H_0) happens to be true.

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Basic concepts of testing hypothesis *cont'd*

3. ***Type I and type II errors***

- **Type I error**
  - **Rejecting a true null hypothesis**
  - **The probability of committing a type I error is called as** α
- **Type II error**
  - **Falling to reject a false null hypothesis**
  - **The probability of committing a type I error is called as** β

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Basic concepts of testing hypothesis *cont'd*

4. ***One tail and Two tail tests***

- A ***two-tailed test*** rejects the null hypothesis if, say, the sample mean is significantly higher or lower than the hypothesized value of the mean of the population.

$$H_0: \mu = \mu_{H_0} \text{ and } H_a: \mu \neq \mu_{H_0}$$

- ***example:*** A sample of 40 sales receipts from a grocery store has *x = Rs137 and* standard deviation = *Rs30.2. Use these values to test* whether or not the mean is sales at the grocery store are different from Rs150. Set *α = .01*

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- **Step 1:** Set the null and alternative hypotheses

$$H_0: \mu = 150$$

$$H_1: \mu \neq 150$$

- **Step 2**: Calculate the test statistic

$$Z = \frac{\overline{x} - \mu_0}{\sigma/\sqrt{n}} = \frac{137 - 150}{30.2/\sqrt{40}} = -2.722$$

- **Step 3:** Set Rejection Region

Looking at the picture below, we need to put half of α *in the left tail, and the other half of* α *in* the right tail. Thus,

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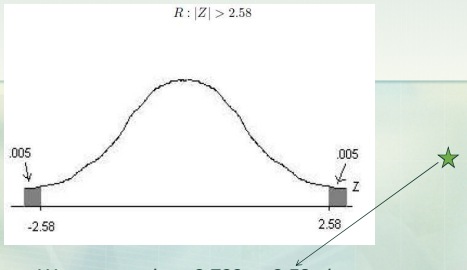

- We can see that *-2:722 > -2:58, thus our test statistic is in the rejection region. Therefore* we reject the null hypothesis in favor of the alternative. We can conclude that the mean is significantly different from Rs150, thus I have proven that the mean sales at the grocery store is not Rs150.

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- A ***one-tailed test*** would be used when we are to test, say, whether the population mean is either lower than or higher than some hypothesized value.

$H_0: \mu = \mu_{H_0}$ and $H_a: \mu < \mu_{H_0}$

- *Example:* An insurance company is reviewing its current policy rates. When originally setting the rates they believed that the average claim amount was $1,800. They are concerned that the true mean is actually higher than this, because they could potentially lose a lot of money. They randomly select 40 claims, and calculate a sample mean of $1,950. Assuming that the standard deviation of claims is $500, and set *α= :05,* test to see if the insurance company should be concerned.

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- **Step one:** Set the null and alternative hypotheses

$$H_0: \ \mu \leq 1800$$

$$H_1: \ \mu > 1800$$

- **Step two:** Calculate the test statistic

$$Z = \frac{\overline{x} - \mu_0}{\sigma/\sqrt{n}} = \frac{1950 - 1800}{500/\sqrt{40}} = 1.897$$

- **Step three:** Set Rejection Region

Looking at the picture below, we need to put all of α in the right tail. Thus,

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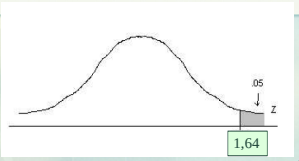

- ***Step four:*** Conclude

We can see that 1*:897 >1:64, thus our test statistic is in the rejection region. Therefore we* reject the null hypothesis. Thus the company should concern about the current policies in the company.

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Hypothesis testing with SPSS

- A researcher who intends to assess the Entrepreneurial intention among undergraduates of the University of Kelaniya uses Multiple regression analysis to test the most significant variables determining the Entrepreneurial Intention.
- He forms the hypothesis as follows.

H_1: There is a significant impact of Credibility on Entrepreneurial Intention

H_{2a}: There is a significant impact of Perceived Desirability on Entrepreneurial Intention

H_{2b}: There is a significant impact of Perceived Feasibility on Entrepreneurial Intention

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Hypothesis testing with SPSS *cont'd*

- Multiple regression analysis output

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.726	3.943		.438	.663
	Perceived Desirability	.485	.213	.229	2.282	.025
	Perceived Feasibility	.314	.062	.510	5.090	.000

a Dependent Variable: Entrepreneurial Intention

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Hypothesis testing with SPSS *cont'd*

- What are the significant variables in this study?
- Both predictor variables become significant. Since, P<0.05.
- Thus, the researcher concludes, ***perceived feasibility and desirability are significant variables in determining entrepreneurial intention.***

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Hypothesis testing with SPSS *cont'd*

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.877	3.925		.478	.634
	Credibility	.347	.037	.683	9.268	.000

a Dependent Variable: Entrepreneurial Intention

- Predictor variable (credibility) become significant. Since, P<0.05.
- Thus, the researcher concludes, ***credibility is also a significant in determining Entrepreneurial intention.***

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Hypothesis testing with SPSS *cont'd*

Summary of data analysis is given below through hypothesis testing.

No	Hypothesis	Result	Tools
H_1	There is a significant impact of Credibility on Entrepreneurial Intention	Accepted	Regression
H_{2a}	There is a significant impact of Perceived Desirability on Entrepreneurial Intention	Accepted	Regression
H_{2b}	There is a significant impact of Perceived Feasibility on Entrepreneurial Intention	Accepted	Regression

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Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5749.005	2	2874.503	42.924	.000(a)
	Residual	6495.835	97	66.967		
	Total	12244.840	99			

a Predictors: (Constant), Perceived Feasibility, Perceived Desirability
b Dependent Variable: Entrepreneurial Intention

- The researcher assess the overall model fit, (significance) P<.05

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References..

- Kumar, R 2011, *Research Methodology: A Step by Step Guide for Beginners*, 3rd edn, Sage Publications.
- Sekaran, U & Bougie, R 2009, *Research Methods for Business: A Skill Building Approach*, 5th edn, John Wiley & Sons.

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