For the students of

M. Com. (Applied Economics) Sem. IV

Paper: Research Methodology (Unit III)

Note: Study material may be useful for the courses wherever Research Methodology paper is being taught.

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Topic: Procedure of Testing of Hypothesis

Meaning of Research Hypothesis (es):

A research hypothesis refers to a tentative solution to a problem which is framed in advance before the collection and analysis of data for the given objectives. Once the researcher identifies and defines the research problem in a precise manner, he can make a guess as to the possible answers. These guesses, which are assumed by the researcher for solving the problem or using as guide for further investigation, are called hypotheses.

Webster's New International Dictionary of English Language, 1956 defines the word "hypothesis" as "a proposition, condition or principal which is assumed, perhaps without belief, in order to draw out its logical consequences and by this method to test its accord with facts which are known or may be determined."

Various Types of Hypotheses:

There are different types of hypotheses or different ways in which hypotheses can be formed.

a) The hypotheses may be framed to describe the characteristics of population or universe. It may also state the percentage or proportion of the items of the universe possessing a certain specific characteristics.

For example, "The level of primary education in Government Schools of Uttar Pradesh is not satisfactory." Or "The proportion of the students attending regular classes is decreasing in higher education." These are termed as Descriptive Hypothesis.

b) It may be formed as a statement describing the relationship between two or more variables or frequency of occurrences of an event. For example, “Families with low income spend greater proportion on consumer goods” termed as Relational Hypothesis.

c) Sometimes hypothesis is formed for the purpose of making comparison between two variables or two groups belonging to same variable; For example, “Girl’s performance is better than boy’s performance at all levels of schooling”.

d) Another type of hypothesis asserts that a particular characteristic is one of the factors which determine another characteristic. In other words, when change in one variable (Independent Variable) can cause the change in other related variable (Dependent Variable), a hypothesis is framed to assess this kind of cause and effect relationship and it is termed as Causal Hypothesis.

e) When we measure the difference or association between two or more statistical values based on pertinent data, it is called Statistical Hypotheses. For example, “There is no significant difference between means of two samples taken from the same population” or “There is no association between Literacy and Criminality.”

f) Sometimes a researcher is not very sure about the phenomenon in question or there is lack of background information. In this case he may take a hypothesis which is not very specific and it is subject to modification during conducting the research process, such type of hypothesis is called Working Hypothesis.

Essentials of a good hypothesis:

A good usable hypothesis is the one which satisfies the following criteria:

1. A hypothesis should be empirically testable and able to deduce logical inferences.

2. Hypothesis should be closest to the things observable and it should enable a researcher to reach at correct decision.

3. It should be conceptually clear so as to explain the concept and leaving no scope for ambiguity.

4. The hypotheses must be specific but not in general terms.

Procedure of Testing a Hypothesis

After having completed collection, processing and analysis of data a test procedure has to be followed for determining if the null hypothesis is to be accepted or rejected. The test procedure or the rule is based upon a test statistic and a rejection

region.

The procedure of testing hypothesis is briefly described below:

1. Setting up a hypothesis:

At the very outset, we take certain hypothesis with regard to related variables under the assumptions defined for the study. Generally, there are two forms of hypotheses which must be constructed; and if one hypothesis is accepted, the other one is rejected.

i. Null Hypothesis: It is very useful tool to test the significance of difference. Any hypothesis concerned to a population is called statistical hypothesis. In the process of statistical test, the rejection or acceptance of hypothesis depends on sample drawn from population. The statistician tests the hypothesis through observation and gives a probability statement. The simple hypothesis states that the statistical measures of sample and those of the population under study do not differ significantly. Similarly it may assume no relationship or association between two variables or attributes. In case of assessing the effectiveness of a literacy campaign on the awareness of rural people we assume "There is no effect of the campaign on public awareness". It is denoted by H_o

For example, if we want to find out whether extra coaching has benefitted the students or not: the null hypothesis would be;

Ho (1): The extra coaching has not benefitted the students.

Similarly, if we want to find out whether a particular drug is effective in curing Malaria we will take the null hypothesis:

Ho (2): The drug used under experimentation is not effective in curing Malaria.

Similarly for testing the significance of difference between two sample, null hypothesis would be:

Ho (3): "There is no significant difference between the variation in data of two samples taken from the same parent population." i.e. $\sigma_1 = \sigma_2$

The rejection of the null hypothesis indicates that the differences have statistical significance and the acceptance of null hypothesis indicates that the differences are due to chance and arised because of sampling fluctuation. Since many practical problems aim at establishment of statistical significance of differences, rejection of

the null hypothesis may thus indicate success in statistical project.

ii. Alternative Hypothesis: As against the null hypothesis, the alternative hypothesis specifies those values that the researcher believes to hold true, and, of course, he hopes that the sample data lead to acceptance of this hypothesis as true.

Rejection of Null hypothesis H_o leads to the acceptance of alternative hypothesis, which is denoted by H_1.

With respect to the three null hypotheses as stated above, researcher might establish the following alternative hypotheses:

Thus H_1 (1): The extra coaching has benefitted the students.

H_1 (2): The drug used under experimentation is effective in curing Malaria

H_1 (3): "There is significant difference between the variation in data of two samples taken from the same parent population." i.e. $\sigma_1 \neq \sigma_2$

The null and alternative hypothses can also be written as :

H_0: $(\sigma_1 - \sigma_2 = 0)$

H_1: $(\sigma_1 - \sigma_2 \neq 0)$

H_o : $\mu_1 - \mu_2 = 0$

H_1: $\mu_1 - \mu_2 \neq 0$

Type I and Type II Errors:

When two hypotheses are set up, the acceptance or rejection of a null hypothesis is based on a sample study. While we make a decision on the basis of the data analysis and testing of the significance difference, it may lead to wrong conclusions in two ways

(i.) Rejecting a true null hypothesis

(ii) Accepting a false hypothesis. This can be presented in the following table:

	Decision based on sample	
	Accepted H_o	Rejected H_o
H_o true (H_a false)	Correct Decision	Wrong Decision (Type I error) = α
H_o false	Wrong Decision	Correct Decision

(H_a true)	(Type II error) β = 1-α	

By rewriting;

Reject H_o when it is true (Type I error) = α

Accept H_o=when it is false (Type II error) =β

Accept H_o= when it is true (Correct decision)

Reject H_o= when it is false (Correct decision)

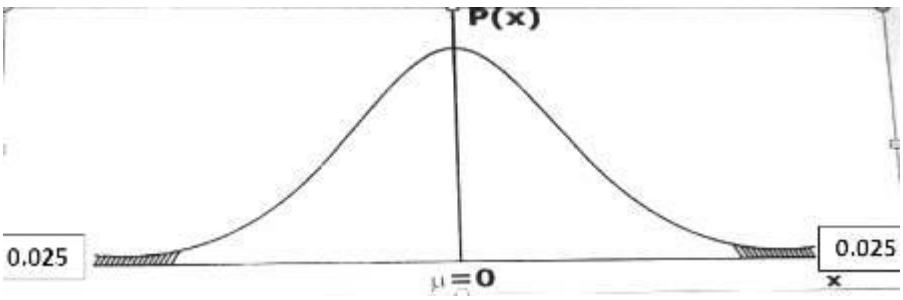
2. Setting up a Suitable Significance Level:

The maximum possibility of committing type I error, which we use to specify in a test, is known as the level of significance. Generally, 5% level of significance is fixed in statistical tests. This implies that we can have 95% confidence in accepting a hypothesis or we could be wrong 5% in taking the decision.

The range of variation has two regions-acceptance region and critical region or rejection region. If the sample statistic falls in critical region, we reject the hypothesis, as it leads to false decision. We go with H_1, if the computed value of sample statistic falls in the rejection region.

The critical region under a normal curve, as stated earlier can be divided into two ways; (a) two sides under a curve (Two Tailed Test) (b) one side under a curve; either on the right tail or left tail (One Tailed Test).

Acceptance and rejection regions in case of a two-tailed Test (with 5% significance level)



3. Setting a Test Criterion:

The third step in hypothesis testing procedure is to construct a test criterion. This involves selecting an appropriate probability distribution for the particular test, that is, a probability distribution which can properly be applied. Some probability distributions that are commonly used in testing procedures are Z, t, F and χ^2.

4. Computation:

After completing first three steps we have completely designed a statistical test. We now proceed to the fourth step- computing various measures from a random sample of size n, which are necessary for applying the test. These calculations include the test statistic and the standard error of the test statistic.

5. Making a decision or Conclusion:

Finally we come to a conclusion stage where either we accept or reject the null hypothesis. The decision is based on computed value of test statistic, whether it lies in the acceptance region or rejection region.

If the computed value of the test statistic falls in the acceptance region (it means computed value is less than critical value), the null hypothesis is accepted. On the contrary, if the computed value of the test statistic is greater than the critical value, the computed value of the statistic falls in the rejection region and the null hypothesis is rejected.