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SOME EXAMPLES IN USAGE OF PARAMETRIC TESTS

SAHANA PRASAD
ASSOCIATE PROFESSOR
DEPARTMENT OF STATISTICS
CHRIST UNIVERSITY
BANGALORE

ABSTRACT

A parametric statistical test is one that makes assumptions about the parameters of the population distribution(s) from which one's data are drawn. They are used for interval and ratio scales of measurement and for testing the property of a single population, e.g. Testing the mean/median value, The percentage or proportion of the population which has a particular property and to test dispersion/spread of a specified property in the population. Parametric tests are used for parametric data which have an underlying normal distribution . As their shape can be defined mathematically, more conclusions can be drawn from such data. Variances are assumed to be homogenous and these measure the quality of sample parameters or for testing if estimates of a parameter are equal for two samples. Some common examples of parametric tests are z-test, t-test etc. This paper studies some examples on application of parametric tests. A note on testing normality using SPSS is also provided.

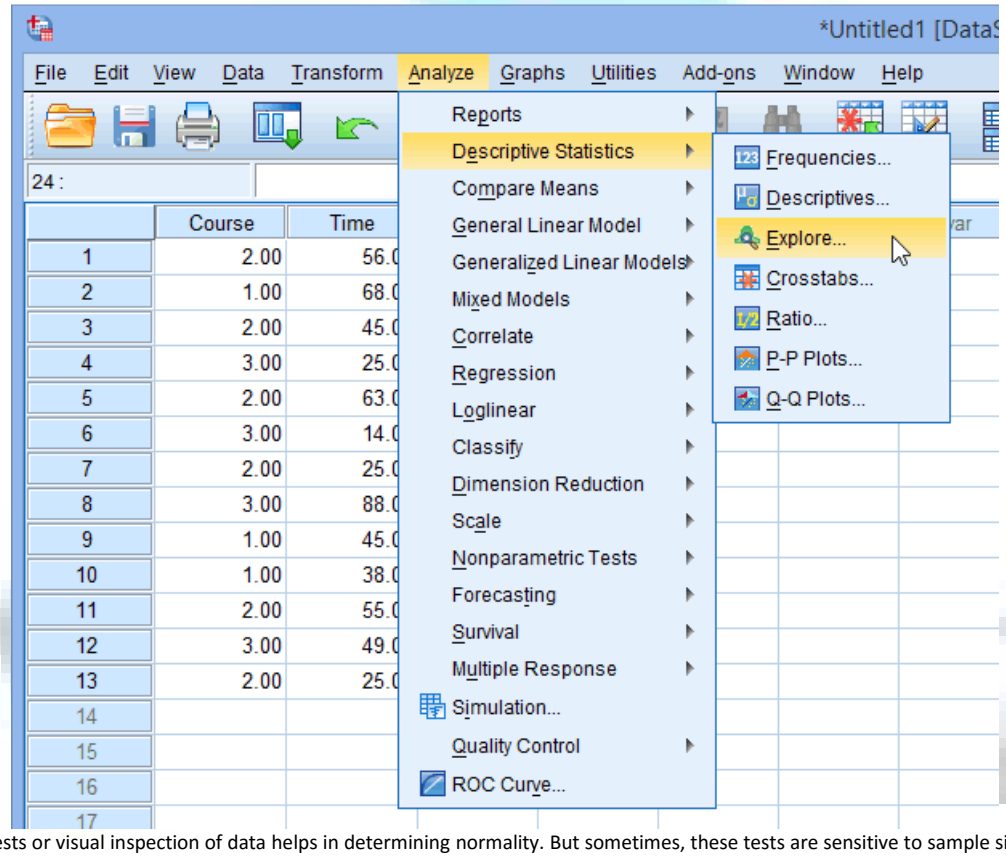
KEYWORDS

parametric tests, normal distribution, application of tests, parametric data, SPSS.

1. INTRODUCTION

While attempting to select a test, the critical question would be to be clear on the hypothesis. In many cases, there would be no hypothesis but only to understand the situation. For example, in medical studies, there would not be any hypothesis for a prevalence study. It is only to determine prevalence. It is important to decide beforehand whether the study is confirmatory or exploratory. Parametric tests are used test hypotheses about specific parameters of the population such as the mean or the variance. The main assumptions are that the measured values are independent, that means the selection or non selection will not bias the choice of other units. Observations are drawn from normal samples and the populations for comparing two or more groups must have the same variance. Measurements should be done atleast on interval scale. some examples are Z-test, t-test, ANOVA etc. To begin with, we test for normality using skewness and kurtosis. Then, a suitable test is applied.

FIG. 1



Generally, statistical tests or visual inspection of data helps in determining normality. But sometimes, these tests are sensitive to sample sizes. The experience of statisticians can help in making a subjective judgement about the data from graphs which allow good judgement of the data visually.
Using SPSS, we use EXPLORE command when we have more than two groups also. This can be applied if we have a categorical independent variable. When we have more than two categorical variables which are independent, then we need to use split file option.

EXAMPLES

EXAMPLE 1: a sample of 50 students is taken from a large population and the mean height of the students is found to be 64 inches with a population standard deviation of 4 inches. can it be reasonably regarded that the mean height of the students of the population is 64 inches.
The suitable tool in this case is "test for single mean when variance is known".

Null hypothesis H_0 : The mean height of the students of the population is 66 inches. μ =66

Alternative hypothesis H_1 : The mean height of the students of the population is not equal to 66 inches. $\mu \neq$ 66

Test Statistic: $z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}} \sim N(0,1)$

Level of Significance: $\alpha = 0.05$

Decision Rule: Reject H_0 if $| z | \geq z_{\alpha/2}$

Calculation:

Given n=50, $\bar{x}$ =64, $\sigma = 4$, μ_0 =66, α =0.05

$$z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}} = -3.53$$

$$z_{\alpha/2} = 1.96$$

Statistical Decision: Since |-3.53|>1.96 we reject the null hypothesis.

Conclusion: The mean population height of the students is not equal to 66 inches.

EXAMPLE 2: General Nucleonics, the major energy corporation is attempting to take over all Sergeant Nucleonics. General's consultant reports that 60% of Sergeant's shareholders support the takeover bid. To be sure of this, General's president requests a telephone survey of a random sample of Sergeant's shareholders. The staff polls 1500 shareholders and find that 784 support the takeover bid. At level of significance 0.01, does the poll refute the consultant's report?

The suitable Tool is "Test for single proportion" as the proportion of shareholders is given in the question as also the sample proportion.

Solution

Null hypothesis H_0 : The proportion of sergeant shareholders who support the takeover bid is 0.60.

P =50

Alternative hypothesis H_1 : The proportion of sergeant shareholders who support the takeover bid is less than 0.60.

P < 0.60

Test Statistic: $z = \frac{p - P}{\sigma_p} \sim N(0,1)$

Level of Significance: $\alpha = 0.01$

Decision Rule: Reject H_0 if $z \leq -z_{\alpha}$

Calculation:

Given X=784, n=1500, P =0.60

$$p = \frac{X}{n} = 0.52 \quad \sigma_p = \sqrt{\frac{P(1-P)}{n}}$$

$$z = \frac{p - P}{\sigma_p} = -6.32$$

$$-z_{\alpha} = 2.33$$

Statistical Decision: Since -6.32<-2.33 we reject the null hypothesis.

Conclusion: The proportion of sergeant shareholders who support the takeover bid is less than 0.60, hence the poll refute the consultant's reports.

EXAMPLE 3: An attitude survey was conducted on randomly selected MLAs from two states towards the economic policy adopted by the central government. In state A, Congress party was in power; in the other state B, a combined Left Front was in power. If $S_A = 10$, $S_B = 15$, $n_A = 20$, $n_B = 25$, can we say the variances differ significantly at 0.05 level of significance?

The suitable Tool is " Snedecor's F test" as we are comparing several variances at the same time.

Solution:

Given: $S_A = 10$, $S_B = 15$, $n_A = 20$, $n_B = 25$

$$H_0 = S_A^2 = S_B^2; H_1 : S_A^2 \neq S_B^2$$

i. $$F = \frac{n_B S_B^2}{n_B - 1} \Big/ \frac{n_A S_A^2}{n_A - 1} = \frac{234.375}{105.263} = 2.227$$

ii. The tabulated value $F_{0.05,24,19} = 2.11$, hence the critical region is $F \geq 2.11$

iii. The observed F is in the critical region. We therefore reject H_0 and conclude that MLAs from the Congress run state appear more homogeneous in their attitude towards the new economic policy than the MLAs from the Left Front run state.

EXAMPLE 4: A psychologist predicts that students will learn most effectively with a constant background sound, as opposed to an unpredictable sound or no sound at all. She randomly divides twenty-four students into three groups of eight. All students study a passage of text for 30 minutes. Those in group 1 study with background sound at a constant volume in the background. Those in group 2 study with noise that changes volume periodically. Those in group 3 study with no sound at all. After studying, all students take a 10 point multiple choice tests over the material. Their scores are as follows:

TABLE 1

Group	Test scores							
Constant sound	7	4	6	8	6	6	2	9
Random sound	5	5	3	4	4	7	2	2
No sound	2	4	7	1	2	1	5	5

The suitable tool is One way ANOVA as "sound" is the only variable here which may be affecting the scores.
Ho: There is no significant difference between test scores of various groups.
H_1: There is a significant difference between test scores of various groups.
The ANOVA table is given below:

TABLE 2

Sources of Variation	Sum of Squares	Degrees of freedom	Mean sum of squares	F
Within groups	87.88	21	4.18	3.59
Between groups	30.08	2	15.04	

Table value of F at (2, 21) at 0.05 = 3.4668
Conclusion: The psychologist can conclude that hypothesis H1 may be supported. The means are as he/she predicted and the constant music group has the highest score.

CONCLUSION

As with all statistical tests, parametric tests have to be used with caution and using judgement. It is necessary for the assumptions to be satisfied and if applied in a proper manner, they prove to be invaluable tools of hypothesis testing.

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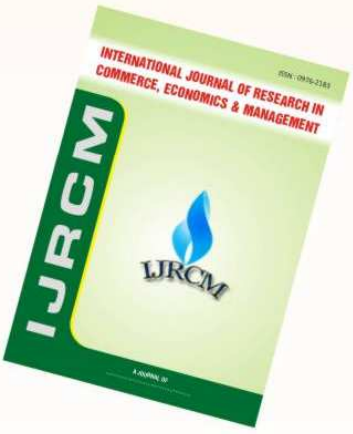
In this age of Commerce, Economics, Computer, I.T. & Management and cut throat competition, a group of intellectuals felt the need to have some platform, where young and budding managers and academicians could express their views and discuss the problems among their peers. This journal was conceived with this noble intention in view. This journal has been introduced to give an opportunity for expressing refined and innovative ideas in this field. It is our humble endeavour to provide a springboard to the upcoming specialists and give a chance to know about the latest in the sphere of research and knowledge. We have taken a small step and we hope that with the active co-operation of like-minded scholars, we shall be able to serve the society with our humble efforts.

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