ECON20003 Quantitative Methods 2

Tutorial 5 (Week 3 - Tuesday)

Zheng Fan

The University of Melbourne

Introduction

Zheng Fan

- Ph.D candidate in Economics at Unimelb
- know more about me: zhengfan.site

If you need help,

- Consultation & Ed discussion board (your first priority)
- Email Dr. Xuan Vu for all subject matters
- Consult Stop 1 for special consideration
- Email: fan.z@unimelb.edu.au (last resort!)

Before posting any questions, make sure you have reviewed the materials on Canvas and questions on Ed discussion board!

Tutorial Overview

In this tutorial we study statistical inference for

- Population variances
- Ratios of two population variances
- Population proportions
- Differences in population proportions

All procedures rely on distributional assumptions and appropriate sampling conditions.

Assumptions for Variance Inference

- Random sample of independent observations
- Quantitative continuous variable
- Interval or ratio scale
- Population is normally distributed

These assumptions are crucial especially for small samples.

Exercise 1 Steel Shafts

Attempt questions 1 (a) and (b) in groups

- (a) Using R to load the data and calculate necessary statistics to calculate the 90% confidence interval

$$\left(\frac{(n-1)s^2}{\chi^2_{\alpha/2,n-1}}, \frac{(n-1)s^2}{\chi^2_{1-\alpha/2,n-1}} \right)$$

- (b) Writing down the hypothesis and using R to calculate the corresponding test statistics
- Using the provided R code to implement the hypothesis testing, and confirm whether (a) and (b) is correct

Exercise 2 Bank Tellers

Attempt questions 2 (a) and (b) in groups

- (a) Using R to load the data and calculate necessary statistics to calculate the 95% confidence interval

$$\left(\frac{s_1^2/s_2^2}{F_{\alpha/2,n_1-1,n_2-1}}, \frac{s_1^2/s_2^2}{F_{1-\alpha/2,n_1-1,n_2-1}} \right)$$

- (b) Writing down the hypothesis and using R to calculate the corresponding test statistics
- Using the provided R code to implement the hypothesis testing, and confirm whether (a) and (b) is correct

Inference on a Population Proportion

Binary population with outcomes coded as 0 and 1

- Population proportion equals the population mean
- Sample proportion estimates the population proportion

Inference can be based on normal approximation or exact binomial methods.

Exercise 3 Recruitment Services

Context

- Sample size $n = 600$
- Interest in proportion of employers using recruitment services

Tasks

- Construct 99 percent confidence interval
- Test whether proportion exceeds 20 percent

Exercise 4 Greenhouse Effect Beliefs

Context

- Two independent surveys conducted at different times
- Binary belief variable

Tasks

- Construct confidence interval for change in proportions
- Test for decrease in belief

Not only need to know how to use R, but also formula

Exercise 4 Greenhouse Effect Beliefs

For Confidence Interval

$$s_{\hat{p}_1-\hat{p}_2} = \sqrt{\frac{\hat{p}_1\hat{q}_1}{n_1} + \frac{\hat{p}_2\hat{q}_2}{n_2}}$$

$$(\hat{p}_1 - \hat{p}_2) \pm z_{\alpha/2} s_{\hat{p}_1-\hat{p}_2}$$

Hypothesis testing

$$H_0 : p_1 - p_2 = 0, H_A : p_1 - p_2 > 0$$

$$\hat{p} = \frac{f_1 + f_2}{n_1 + n_2}$$

$$s_{\hat{p}_1-\hat{p}_2} = \sqrt{\hat{p}\hat{q}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$

$$z_{\text{obs}} = \frac{\hat{p}_1 - \hat{p}_2}{s_{\hat{p}_1-\hat{p}_2}}$$

Make sure your define notations properly.