Empirical Exercise - E5.2

Chi-Yuan Fang

2021-03-21

Using the data set *Growth* described in Empirical Exercise 4.1, but excluding the data for Malta, run a regression of $Growth$ on $TradeShare$.

a. Is the estimated regression slope statistically significant? That is, can you reject the null hypothesis $H_0 : \beta_1 = 0$ vs. a two-sided alternative hypothesis at the 10%, 5%, or 1% significance level?

Solution

- **Prepare**

$H_0 : \beta_{height} = 0$ v.s. $H_1 : \beta_{height} \neq 0$

Let the significance level be 0.10, 0.05, or 0.01.

- **Calculate**

```r
# import data
library(readxl)
Growth <- read_xlsx("Growth/Growth.xlsx")

Growth_n <- Growth[Growth$country_name != "Malta",]

E52a_model <- lm(growth ~ tradeshare, data = Growth_n)

summary(E52a_model)
```

```
##
## Call:
## lm(formula = growth ~ tradeshare, data = Growth_n)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.4247 -0.9383  0.2091  0.9265  5.3776
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.9574     0.5804   1.650   0.1041
## tradeshare    1.6809     0.9874   1.702   0.0937 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.789 on 62 degrees of freedom
## Multiple R-squared:  0.04466,    Adjusted R-squared:  0.02925
## F-statistic: 2.898 on 1 and 62 DF,  p-value: 0.09369
```

- **Conclude**

Because $p - value = 0.0937$, we reject H_0 at $\alpha = 0.10$, but do not reject H_0 at $\alpha = 0.05$ or 0.01.

b. What is the p-value associated with the coefficient's t-statistic?

Solution

See part (a).

c. Construct a 90% confidence interval for β_1.

Solution

```r
E52c <- function(x, y){
  # numbers of sample
  n <- length(y)

  # sample mean
  xbar <- mean(x)
  ybar <- mean(y)

  # OLS coefficient
  b1hat <- cov(x,y)/var(x)
  b0hat <- ybar - b1hat*xbar

  yhat <- b0hat + b1hat*x

  # explained sum of squares (ESS)
  ESS <- sum((yhat - ybar)^2)
  # total sum of squares (TSS)
  TSS <- sum((y - ybar)^2)
  # sum of squared residuals (SSR)
  SSR <- sum((y - yhat)^2)

  # coefficient of determination
  #Rsqure <- ESS/TSS

  # standard error of the regression
  SER <- sqrt(SSR/(n-2))

  # standard error of coefficient
  se_b1hat <- sqrt(SER^2/sum((x - xbar)^2))

  # 95% CI for b1hat
  lower_b1hat <- round(b1hat - qnorm(0.95, mean = 0, sd = 1)*se_b1hat, digit = 4)
  upper_b1hat <- round(b1hat + qnorm(0.95, mean = 0, sd = 1)*se_b1hat, digit = 4)
  CI_b1hat <- paste(lower_b1hat, "-"  ,upper_b1hat)

  Table <- matrix(c(b1hat, se_b1hat, CI_b1hat), nrow = 1)
  colnames(Table) <- c("Estimate", "Standard Error", "90% Confidence Interval")

  Table
}

E52c(Growth_n$tradeshare, Growth_n$growth)
```

```
##      Estimate           Standard Error      90% Confidence Interval
## [1,] "1.68090466305453" "0.987362386192631" "0.0568 - 3.305"
```