R CODE 0428

packages <- c("POE5Rdata", "AER", "car", "lmtest", "sandwich", "boot", "ggplot2")

installed <- packages %in% installed.packages()

if (any(!installed)) install.packages(packages[!installed])

lapply(packages, library, character.only = TRUE)

# 載入資料 -----------------------------------------------------------------------

data("mroz")

married\_data <- subset(mroz, lfp == 1)

# 10.18 (a) 母親與父親是否大學畢業指標變數 -------------------------------------

married\_data$mothercoll <- ifelse(married\_data$mothereduc > 12, 1, 0)

married\_data$fathercoll <- ifelse(married\_data$fathereduc > 12, 1, 0)

pct\_mother <- mean(married\_data$mothercoll) \* 100

pct\_father <- mean(married\_data$fathercoll) \* 100

cat("母親有大學教育者比例：", round(pct\_mother, 2), "%\n")

cat("父親有大學教育者比例：", round(pct\_father, 2), "%\n")

# 10.18 (b) 計算相關係數矩陣 -----------------------------------------------------

corr\_matrix <- cor(married\_data[, c("educ", "mothercoll", "fathercoll")])

print(round(corr\_matrix, 4))

# 10.18 (c) 第一個 IV 模型 --------------------------------------------------------

iv\_model1 <- ivreg(log(wage) ~ educ + exper + I(exper^2) |

mothercoll + exper + I(exper^2),

data = married\_data)

summary(iv\_model1)

confint(iv\_model1)

# 10.18 (d) 檢查 IV 模型診斷 -----------------------------------------------------

summary(iv\_model1, diagnostics = TRUE)

# 10.18 (e)(f)(g) 使用雙工具變數 --------------------------------------------------

iv\_model2 <- ivreg(log(wage) ~ educ + exper + I(exper^2) |

mothercoll + fathercoll + exper + I(exper^2),

data = married\_data)

summary(iv\_model2)

confint(iv\_model2)

summary(iv\_model2, diagnostics = TRUE)

# -------------------------------------------------------------------------------

# 10.20 CAPM 模型與工具變數分析 ---------------------------------------------------

data("capm5")

capm5$ex\_mkt <- capm5$mkt - capm5$riskfree

capm5$ex\_msft <- capm5$msft - capm5$riskfree

# (a) CAPM 模型回歸

capm <- lm(ex\_msft ~ ex\_mkt, data = capm5)

summary(capm)

# (b) 工具變數 rank 回歸 mkt

capm5$rank <- rank(capm5$ex\_mkt)

first\_stage <- lm(mkt ~ rank, data = capm5)

summary(first\_stage)

# (c) Hausman 檢定

capm5$v\_hat <- first\_stage$residuals

hausman\_model <- lm(ex\_msft ~ ex\_mkt + v\_hat, data = capm5)

summary(hausman\_model)

# (d) IV regression

capm\_iv <- ivreg(ex\_msft ~ ex\_mkt | rank, data = capm5)

summary(capm\_iv)

# (e) 增加 pos 作為額外工具變數

capm5$pos <- ifelse(capm5$ex\_mkt > 0, 1, 0)

first\_stage2 <- lm(ex\_mkt ~ pos + rank, data = capm5)

summary(first\_stage2)

# (f) Hausman 檢定第 2 次

capm5$v\_hat2 <- first\_stage2$residuals

hausman\_model2 <- lm(ex\_msft ~ ex\_mkt + v\_hat2, data = capm5)

summary(hausman\_model2)

# (g) 第二個 IV 回歸

capm\_iv2 <- ivreg(ex\_msft ~ ex\_mkt | pos + rank, data = capm5)

summary(capm\_iv2)

# (h) Sargan 過度識別檢定

re <- resid(capm\_iv2)

sargan <- lm(re ~ rank + pos, data = capm5)

S <- nrow(capm5) \* summary(sargan)$r.squared

p\_value <- 1 - pchisq(S, df = 1)

cat("Sargan 統計量 =", round(S, 4), "\n")

cat("p-value =", round(p\_value, 4), "\n")

# -------------------------------------------------------------------------------

# 10.24 工具變數模型的異質性檢定與穩健性分析 --------------------------------------

# (a) 繪製殘差圖檢查異質變異

iv\_model3 <- ivreg(log(wage) ~ exper + I(exper^2) + educ |

exper + I(exper^2) + mothereduc + fathereduc,

data = married\_data)

married\_data$e\_iv <- resid(iv\_model3)

ggplot(married\_data, aes(x = exper, y = e\_iv)) +

geom\_point(alpha = 0.6) +

geom\_smooth(method = "loess", se = FALSE, color = "purple") +

labs(x = "EXPER", y = "IV residuals") +

theme\_minimal()

# (b) Breusch-Pagan 檢定

married\_data$e\_iv\_sq <- married\_data$e\_iv^2

bp\_model <- lm(e\_iv\_sq ~ exper, data = married\_data)

NR2 <- nrow(married\_data) \* summary(bp\_model)$r.squared

cat("NR² =", round(NR2, 4), "\n")

cat("p-value =", round(1 - pchisq(NR2, df = 1), 4), "\n")

# (c) 估計 robust 標準誤

robust\_result <- coeftest(iv\_model3, vcov = vcovHC(iv\_model3, type = "HC1"))

print(robust\_result)

b <- robust\_result["educ", "Estimate"]

se <- robust\_result["educ", "Std. Error"]

cat("95% confidence interval for EDUC:", round(b - 1.96 \* se, 4), "to", round(b + 1.96 \* se, 4), "\n")

# (d) Bootstrap 推論

boot\_iv <- function(data, indices) {

d <- data[indices, ]

coef(ivreg(log(wage) ~ exper + I(exper^2) + educ |

exper + I(exper^2) + mothereduc + fathereduc,

data = d))["educ"]

}

set.seed(123)

boot\_result <- boot(data = married\_data, statistic = boot\_iv, R = 200)

boot\_ci <- boot.ci(boot\_result, type = "norm")

cat("EDUC 係數 (bootstrap):", round(mean(boot\_result$t), 4), "\n")

cat("Bootstrap SE:", round(sd(boot\_result$t), 4), "\n")

cat("95% C.I. (normal method):",

round(boot\_ci$normal[2], 4), "to", round(boot\_ci$normal[3], 4), "\n")