15.6

Using the NLS panel data on N = 716 young women, we consider only years 1987 and 1988. We are interested in the relationship between ln($WAGE$) and experience, its square, and indicator variables for living in the south and union membership. Some estimation results are in Table 15.10.

TABLE 15.10 Estimation Results for Exercise 15.6

	(1) OLS 1987	(2) OLS 1988	(3) FE	(4) FE Robust	(5) RE
C	0.9348	0.8993	1.5468	1.5468	1.1497
	(0.2010)	(0.2407)	(0.2522)	(0.2688)	(0.1597)
EXPER	0.1270	0.1265	0.0575	0.0575	0.0986
	(0.0295)	(0.0323)	(0.0330)	(0.0328)	(0.0220)
$EXPER^2$	−0.0033	−0.0031	−0.0012	−0.0012	−0.0023
	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0007)
SOUTH	−0.2128	−0.2384	−0.3261	−0.3261	−0.2326
	(0.0338)	(0.0344)	(0.1258)	(0.2495)	(0.0317)
UNION	0.1445	0.1102	0.0822	0.0822	0.1027
	(0.0382)	(0.0387)	(0.0312)	(0.0367)	(0.0245)
N	716	716	1432	1432	1432

(standard errors in parentheses)

f. Column (5) contains the random effects estimates. Which coefficients, apart from the intercepts, show the most difference from the fixed effects estimates? Use the Hausman test statistic (15.36) to test whether there are significant differences between the random effects estimates and the fixed effects estimates in column (3) (Why that one?). Based on the test results, is random effects estimation in this model appropriate?

Ans.

最大差異：EXPER^2，差異為 $\frac{0.0023}{0.0012} = 1.92$ 倍

t–statistic: $t = \dfrac{b_{FE,k} - b_{RE,k}}{\sqrt{\widehat{\text{var}}(b_{FE,k}) - \widehat{\text{var}}(b_{RE,k})}} = \dfrac{b_{FE,k} - b_{RE,k}}{\sqrt{se(b_{FE,k})^2 - se(b_{RE,k})^2}}$

$t_{EXPER} = \dfrac{0.0575 - 0.0986}{\sqrt{0.0330^2 - 0.0220^2}} \approx -1.67$ $\quad$ $t_{EXPER^2} = \dfrac{-0.0012 - (-0.0023)}{\sqrt{0.0011^2 - 0.0007^2}} \approx 1.29$

$t_{SOUTH} = \dfrac{-0.3261 - (-0.2326)}{\sqrt{0.1258^2 - 0.0317^2}} \approx -0.77$ $\quad$ $t_{UNION} = \dfrac{0.0822 - 0.1027}{\sqrt{0.0312^2 - 0.0245^2}} \approx -1.06$

```
> qnorm(0.95)
[1] 1.644854
```

|−1.67| > 臨界值 = 1.64 → 在 10% 顯著水準下，有顯著差異，只有 EXPER 的係數差異接近顯著。

僅 EXPER 顯示有顯著差異，內生性證據偏弱。使用隨機效果模型（RE）是適當的。

$H_0 : \beta_{FE,k} = \beta_{RE,k}$ No endogeneity $\quad$ $H_1 : \beta_{FE,k} \neq \beta_{RE,k}$ Endogeneity

因為 15.36 > 臨界值 = 13.28 → 拒絕虛無假設

```
> qchisq(p = 0.99, df = 4)
[1] 13.2767
```

應拒絕使用隨機效果模型（RE），因為其估計結果可能有偏誤。

推薦使用固定效果模型（FE）作為較穩健的選擇。