TABLE 15.10

	(1) OLS 1987	(2) OLS 1988	(3) FE	(4) FE Robust	(5) RE
	Estimation Results for Exercise 15.6				
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)

a. The OLS estimates of the ln(*WAGE*) model for each of the years 1987 and 1988 are reported in columns (1) and (2). How do the results compare? For these individual year estimations, what are you assuming about the regression parameter values across individuals (heterogeneity)?

a. 結果具一致性, 個体間無差異

b. The ln(*WAGE*) equation specified as a panel data regression model is

$$\ln(WAGE_{it}) = \beta_1 + \beta_2 EXPER_{it} + \beta_3 EXPER_{it}^2 + \beta_4 SOUTH_{it} + \beta_5 UNION_{it} + (u_i + e_{it}) \quad (XR15.6)$$

Explain any differences in assumptions between this model and the models in part (a).

b. 變數加上了時間、個体的下標, 代表變數可隨時間、個体産生
變化, 且此變動具有殘差 $e_i . u_i$

c. Column (3) contains the estimated fixed effects model specified in part (b). Compare these estimates with the OLS estimates. Which coefficients, apart from the intercepts, show the most difference?

South之係數 −0.2128 → −0.3261, 下降 −0.1133

d. The *F*-statistic for the null hypothesis that there are no individual differences, equation (15.20), is 11.68. What are the degrees of freedom of the *F*-distribution if the null hypothesis (15.19) is true? What is the 1% level of significance critical value for the test? What do you conclude about the null hypothesis.

$F_{0.05}(715, 711) = 1.2$, $F^* = 11.68 > 1.2$ ⟹ Reject Ho
應使用 FE model

e. Column (4) contains the fixed effects estimates with cluster-robust standard errors. In the context of this sample, explain the different assumptions you are making when you estimate with and without cluster-robust standard errors. Compare the standard errors with those in column (3). Which ones are substantially different? Are the robust ones larger or smaller?

除了 EXPER, EXPER^2, 其餘變數之 SE 皆變大

Q17

(a)回歸結果與信賴區間如下

```
Call:
lm(formula = liquord ~ incomed - 1, data = liquor_diff)

Residuals:
    Min      1Q   Median      3Q     Max
-3.6852 -0.9196 -0.0323  0.9027  3.3620

Coefficients:
        Estimate Std. Error t value Pr(>|t|)
incomed  0.02975    0.02922   1.018    0.312

> # 建立 95% 信賴區間
> confint(model, level = 0.95)
              2.5 %      97.5 %
incomed -0.02841457 0.08790818
```

Q20

(a)回歸結果如下:小班隊成績提升顯著，助教則否。教師經驗與成績成正比。且白人、亞裔學生有顯著差異，且男生女生之間也存在差異。最後經濟弱勢也會影響成績。

```
Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) 437.76425    1.34622 325.180  < 2e-16 ***
small         5.82282    0.98933   5.886 4.19e-09 ***
aide          0.81784    0.95299   0.858    0.391
tchexper      0.49247    0.06956   7.080 1.61e-12 ***
boy          -6.15642    0.79613  -7.733 1.23e-14 ***
white_asian   3.90581    0.95361   4.096 4.26e-05 ***
freelunch   -14.77134    0.89025 -16.592  < 2e-16 ***
```

(b) 結果與(a)具一致性

```
Coefficients:
              Estimate Std. Error  t-value  Pr(>|t|)
small         6.490231   0.912962   7.1090 1.313e-12 ***
aide          0.996087   0.881693   1.1297    0.2586
tchexper      0.285567   0.070845   4.0309 5.629e-05 ***
boy          -5.455941   0.727589  -7.4987 7.440e-14 ***
white_asian   8.028019   1.535656   5.2277 1.777e-07 ***
freelunch   -14.593572   0.880006 -16.5835 < 2.2e-16 ***
```

(c)p-value<0.05, 拒絕虛無假設=>固定學校效果是有用的。

```
> # 檢定學校固定效果是否顯著
> pFtest(fe_model, pooled_model)

        F test for individual effects

data:  readscore ~ small + aide + tchexper + boy + white_asian + freelunch
F = 16.698, df1 = 78, df2 = 5681, p-value < 2.2e-16
alternative hypothesis: significant effects
```