

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.

a. 兩年係數都差不多  
→ 無異質性

b. 考慮 panel data, 以時間期 and 個體作為下標  
表示, 允許個體和時間變動隨機誤差,  
 $u_i$  則是不同時間變動

c. 截距變化最大  
FE 95% CI

$EXPER (-0.0085, 0.1235)$   $EXPER^2 (-0.0034, 0.031)$

d.  $F = 11.68 > F_{0.05(15, 911)} = 1.2$   
→ reject  $H_0$ , 支持固定效果

e. by within transformation, 隨機變量  $\tilde{e}_{it} = e_{it} - \bar{e}_i$ , 即使有 autocorrelation, 仍係  
序列相關, cluster robust standard error 允許  $e_{it}$  heteroskedasticity 及序列相關

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 (0.2010)	0.8993 (0.2407)	1.3468 (0.2522)	1.5468 (0.2688)	1.1497 (0.1597)
EXPER	0.1270 (0.0295)	0.1265 (0.0323)	0.0575 (0.0330)	0.0575 (0.0328)	0.0986 (0.0220)
EXPER <sup>2</sup>	-0.0033 (0.0011)	-0.0031 (0.0011)	-0.0012 (0.0011)	-0.0012 (0.0011)	-0.0023 (0.0007)
SOUTH	-0.2128 (0.0338)	-0.2384 (0.0344)	-0.3261 (0.1258)	-0.3261 (0.2495)	-0.2326 (0.0317)
UNION	0.1445 (0.0382)	0.1102 (0.0387)	0.0822 (0.0312)	0.0822 (0.0367)	0.1027 (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)?
- 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).
- 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?
- 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?
- 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?