

# Economics 6352: Applied Econometrics

Southern Methodist University

Department of Economics

Midterm II

1. State whether the following are true, false or uncertain. Please explain your answers. Correct guess without correct explanation or without explanation will not gain points. Partial credit will be given to partially correct explanations.

- (a) In a panel data model with fixed effect  $a_i$ ,  $i = 1, 2, \dots, N$ ,  $t = 1, 2, \dots, T$ :

$$y_{it} = \beta x_{it} + a_i + u_{it}$$

in which  $cov(u_{it}, x_{is}) = 0 \forall t, s$ . If the  $a_i$ 's are not correlated with the regressors  $x_{it}$ , then the pooled OLS estimates are consistent and standard errors are correct, as long as we use White heteroscedasticity robust standard errors.

- (b) Consider the structural equation  $y_{1i} = \beta_1 y_{2i} + \beta_2 x_i + u_i$ . Let  $w_i$  denote the vector of instrumental variables for this equation ( $w_i$  includes  $x_i$ ), and  $w_i$  is independent of  $u_i$ . Let  $\hat{y}_{2i}$  designate the fitted value obtained by regressing  $y_{2i}$  on  $w_i$ . The estimator constructed by using  $\hat{y}_{2i}$  and  $x_i$  is more efficient than the 2SLS estimator computed using  $w_i$  as the instrumental variables.

2. Following Munnell (1990), Baltagi and Pinnoi (1995) considered the following Cobb-Douglas production function relationship investigating the productivity of public capital in private production:

$$\ln(Y) = \alpha + \beta_1 \ln(KG) + \beta_2 \ln(KP) + \beta_3 \ln(L) + \beta_4(unem) + \varepsilon,$$

where  $Y$  is gross state product,  $KG$  is public capital which includes highways and streets, water and sewer facilities and other public buildings and structures,  $KP$  is the private capital stock based on the Bureau of Economic Analysis national stock estimates,  $L$  is labor input measured as employment in nonagricultural payrolls.  $unem$  is the state unemployment rate included to capture business cycle effects. The panel consists of annual observations for 48 contiguous states over the period 1970-1986. The following table gives parameter estimates from several estimation procedures (with standard errors beneath each estimate in parentheses):

	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\lambda$
Pooled OLS	0.155 (0.017)	0.309 (0.010)	0.594 (0.014)	-0.007 (0.001)	A
Fixed Effects	-0.026 (0.029)	0.292 (0.025)	0.768 (0.030)	-0.005 (0.001)	B
Feasible GLS	0.009 (0.024)	0.313 (0.020)	0.724 (0.025)	-0.006 (0.001)	0.878

- (a) Interpret the coefficient on public capital in each of the estimation procedures.
  - (b) What is  $\lambda$ ? What is the value of A in the table? What is the value of B?
  - (c) Describe the test you would use to test whether or not the pooled OLS model is appropriate.
  - (d) Describe the test you would use to test between the fixed effects and random effects procedures.
  - (e) Assuming the tests you describe above favor the fixed effects model, give two reasons why the fixed effects result may not be correct.
3. Again, consider the problem from question 2. Suppose we have reason to believe that the public capital stock is measured with error. For simplicity, let's assume that the measurement error is independently and identically distributed across time and state. The following table gives the result for IV estimation in this model (with standard errors beneath each estimate in parentheses):

	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$
IV Estimation	0.02	1.01	0.002	-0.004
	(0.068)	(0.025)	(0.041)	(0.001)

- (a) What is the possible consequence of measurement error in the public capital stock?
- (b) Given that we do not have any additional variables, what can be used as an instrumental variable for public capital stock in the fixed effects model?
- (c) Interpret the coefficient on public capital. How does this differ from the fixed effects estimate in question 2?