

Econ 371  
Problem Set #7  
Due December 4, 2009

1. Stock and Watson, question 12.10.

2. Consider a simple regression model

$$Y_i = \beta_0 + \beta_1 X_i + u_i \quad (1)$$

and let  $Z_i$  be a *binary* instrument for  $X_i$ . Use equation (12.4) to show that the *TSLS* estimator of  $\beta_1$  can be written as:

$$\hat{\beta}_1^{TSLS} = \frac{\bar{Y}_1 - \bar{Y}_0}{\bar{X}_1 - \bar{X}_0} \quad (2)$$

where  $\bar{Y}_1$  and  $\bar{X}_1$  denote the means of  $Y_i$  and  $X_i$  (respectively) over that part of the sample with  $Z_i = 1$  and  $\bar{Y}_0$  and  $\bar{X}_0$  denote the means of  $Y_i$  and  $X_i$  (respectively) over that part of the sample with  $Z_i = 0$ .

3. Consider a simple model to estimate the effects of personal computer (PC) ownership on college grade point average for graduating seniors at a university:

$$GPA_i = \beta_0 + \beta_1 PC_i + u_i \quad (3)$$

where  $PC_i$  is a *binary* variable indicating PC ownership.

- Why might *PC* ownership be correlated with  $u_i$ ?
- Explain why *PC* is likely to be related to parent's annual income. Does this mean that parental income is a good IV for *PC*? Why or why not?
- Suppose that, four years ago, the university gave grants to buy computers to half of the incoming students, and the students who received the grants were randomly chosen. Explain how you would use this information to construct an instrumental variable for *PC*.
- If you were told
  - that among those students who received the grants, 90% of them owned a PC and the group had an average GPA of 3.05 and
  - that among those students who did not receive the grants, 75% of them owned a PC and the group had an average GPA of 2.75.

What would your estimate  $\hat{\beta}_1^{TSLS}$  be?

4. Stock and Watson E12.2.