

Exercise 7

Problem 1. To examine the quantity theory of money, Brumm (2005) ["Money Growth, Output Growth, and Inflation: A Reexamination of the Modern Quantity Theory's Linchpin Prediction," *Southern Economic Journal*, 71(3), 661–667] specifies the equation:

$$\text{Inflation} = \beta_0 + \beta_1 * \text{Money} + \beta_2 * \text{Output} + u$$

where *INFLAT* is the growth rate of the general price level, *MONEY* is the growth rate of the money supply, and *OUTPUT* is the growth rate of national output. According to theory we should observe that $\beta_0 = 0$, $\beta_1 = 1$, and $\beta_2 = -1$. The data used in this paper is contained in the file *brumm.gdt*. It consists of 1995 year data on 76 countries.

- a) Estimate the model by OLS and interpret all the parameters.
- b) Test the joint hypothesis that $\beta_0 = 0$, $\beta_1 = 1$ and $\beta_2 = -1$. What do you conclude?
- c) Examine the least squares residuals for the presence of heteroskedasticity related to the variable *Money*.
- d) Obtain robust standard errors for the model and compare them to the OLS standard errors. Does your conclusion change in part (b) after using robust standard errors?
- e) It is argued that *Output* may be endogenous. Four instrumental variables are proposed, *INITIAL* = initial level of real GDP, *SCHOOL* = a measure of the population's educational attainment, *INVEST* = average investment as a share of GDP, and *POP RATE* = average population growth rate. Using these instruments, obtain instrumental variables (2SLS) estimates of the inflation equation (do the two stage procedure).
- f) Are the instruments strong?

Problem 2. Consider a simple model to estimate the effect of personal computer (PC) ownership on college grade point average for graduating seniors at a large public university:

$$GPA = \beta_0 + \beta_1 PC + u$$

where PC is a binary variable indicating PC ownership.

- (i) Why might PC ownership be correlated with u ?
- (ii) Explain why PC is likely to be related to parents' annual income. Does this mean parental income is a good IV for PC? Why or why not?
- (iii) Suppose that, four years ago, the university gave grants to buy computers to roughly one-half of the incoming students, and the students who received grants were randomly chosen. Carefully explain how you would use this information to construct an instrumental variable for PC.