UNIVERSITY OF CAMBRIDGE
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Updated: February 19, 2012

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Contest Quiz 5

Question Sheet

In this quiz we will review concepts of instrumental variables covered in lecture 5.

Question 1

Consider the following 2nd stage equation form a 2SLS regression of the long-run price elasticity of the demand for cigarettes using data for the 10-year difference (2000 to 2010) for 48 counties.

$$\begin{aligned} \Delta log(Q) &= -0.12 - 0.94\Delta log(P) + 0.53\Delta log(Inc) + e \\ &\quad (0.07)\ \ (0.21) \qquad\quad (0.34) \end{aligned}$$

Standard errors are reported in parentheses below the coefficient estimates. An instrument was used to address the endogeneity of cigarette price. The F-statistic from the 1st stage regression is 33.6. For a variable description, see Table 1.

Table 1: Variable description

variable	description
$\Delta log(Q)$	10-year change in log quantity demanded
$\Delta log(P)$	10-year change in log price
$\Delta log(Inc)$	10-year change in log income

(i) Referring to the above regression, suppose the government plans to increase the retail price by GBP 0.5 per pack. Calculate the predicted percentage change in demand if the current price per pack is GBP 7.50. Give the lower bound of a 95% confidence interval for this percentage change in demand. [use *qnorm*() to obtain the critical quantile]

(ii) Suppose that the income falls by 2% due to a recession. What is the predicted percentage change in demand?

(iii) Suppose that the recession only lasts one year. Will the estimates in the above regression provide a reliable answer to Question 1-ii?

a) Yes
b) No

(iv) Suppose that the F-statistic in the above regression was 3.6 instead of 33.6. Would the estimates in the above regression provide a reliable answer to Question 1-i?

a) Yes
b) No

Question 2

Consider the IV (= instrumental variable) regression model.

$$Y_i = \beta_0 + \beta_1 X_i + \beta_2 W_i + u_i$$

where X_i is correlated with the error term, u_i, and Z_i is therefore used as an instrument. Which of the two assumptions for a valid instrument are violated when:

(i) Z_i is independent of (Y_i, X_i, W_i)? a) Instrument relevance b) Instrument exogeneity

(ii) $Z_i = W_i$? a) Instrument relevance b) Instrument exogeneity

(iii) $Z_i = 1$ for all i? a) Instrument relevance b) Instrument exogeneity

(iv) $Z_i = X_i$? a) Instrument relevance b) Instrument exogeneity

Now assume that we have two instruments, Z_{1i} and Z_{2i} instead, and the value of the Sargan-Test statistic is 18.2.

(v) At the 5%-level, does this suggest that $E(u_i|Z_{1i}, Z_{2i}) \neq 0$?
a) Yes, b) No

(vi) At the 5%-level, does this suggest that $E(u_i|Z_{1i}) \neq 0$?
a) Yes, b) No

Question 3

Consider a model that explains birth weight of babies by the smoking status of their mothers and a set of control variables as follows:

$$log(bwgth) = \beta_0 + \beta_1 male + \beta_2 parity + \beta_3 log(faminc) + \beta_4 packs + u$$

For a variable description, see Table 2.

(i) In one sentence, why might we expect *packs* to be endogenous?

(ii) Enter the variable id of a variable in Table 2 that might be used as an instrument for *packs*.

(iii) Use the data in *data_x.csv* to estimate the equation above by OLS.[1] Given your OLS estimates, what is the effect of one more *pack* of cigarettes on *bwght*? [give your answer in percentage points]

(iv) Use the data in *data_x.csv* to estimate the equation above by instrumental variable regression using an appropriate instrument for *packs*. Which of the two coefficient estimates for *packs* is more realistic?

a) OLS
b) IV

(v) Is the instrument you have chosen a good instrument? Base your judgement on a formal test.

a) Yes
b) No

[1] To access the data go to http://www.camcon.eu/data/series5/ and download *data_x.csv* where x is your group id, e.g. 1 for Group1, displayed in the upper right corner of the website after login.

Table 2: Variable description

id	variable	description
1	faminc	1988 family income, $1000s
2	cigprice	cigarette price in home state, 1988
3	bwght	birth weight, ounces
4	fatheduc	father's years of educ
5	motheduc	mother's years of educ
6	parity	birth order of child
7	male	=1 if male child; 0 otherwise
8	white	=1 if white; 0 otherwise
9	cigs	cigarettes smoked per day while pregnant
10	lbwght	log of bwght
11	bwghtlbs	birth weight, pounds
12	packs	packs smoked per day while pregnant
13	lfaminc	log(faminc)