

Economics 250

Quiz

(Answer both questions please)

(50) 1. **Hamburger Production**

A man named Ronald in a warlock costume from a large fast-food chain asks you to estimate the production functions of his franchises. He provides you with panel data on output Y_{it} and inputs X_{it} for a random sample of $i=1..N$ restaurants over $T=2$ periods.

Based on his experience, Ronald suggests the log-linear specification:

$$(1) \quad y_{it} = \alpha + \beta'x_{it} + u_{it}, \quad E(x_{it} u_{it}) = 0,$$

where $y=\log(Y)$ and $x=\log(X)$ and β is a vector of linear causal effects.

a) Explain in words (that any clown can understand) to Ronald that there may be individual effects in production α_i and that maximizing behaviour by franchise managers aware of those individual effects would make it wise to estimate this more general specification:

$$(2) \quad y_{it} = \alpha_i + \beta'x_{it} + \epsilon_{it}, \quad E(x_{it} \epsilon_{it}) = 0, \text{ where } \beta \text{ is a vector of linear causal effects.}$$

In your explanation be clear about both why franchises may have individual effects in sales and what kind of omitted variable problem will make Ronald's orthogonality assumption in (1) unlikely to be true in general.

b) Ronald isn't convinced about the use of individual effects in (2). To convince him, you estimate the following regressions (one in each period):

$$y_{i1} = \pi_1 + \pi'_{11}x_{i1} + \pi'_{12}x_{i2} + \omega_{i1}$$
$$y_{i2} = \pi_2 + \pi'_{21}x_{i1} + \pi'_{22}x_{i2} + \omega_{i2}.$$

Estimates of the lead coefficient π_{12} and the lag coefficient π_{21} are both positive. Explain to Ronald how this supports your assumptions in (2).

c) Ronald's company is very impressed with your analysis so far and renews your contract for another year. They give you free meals and lots of little ghost, witch and goblin dolls. Explain to Ronald why you would happily trade all those calories and plastic for a cross-sectional dataset in which inputs x_{it} are randomly assigned so that you could convincingly estimate β , a vector of linear causal effects.

In your explanation be clear about why, even if franchises may individual effects in sales, what kind of omitted variable problem could make your orthogonality assumption in (2) false.

d) Ronald is now confused. He doesn't understand why, in the presence of individual effects, you can estimate a linear causal effect, β , with only one period of data. Explain in a manner polite enough to get your consulting contract renewed.

(50) 2. **Teen Pregnancy and Education**

Labor economists are interested in the effect of teenage childbearing on human capital accumulation. Imagine drawing a representative sample of 28 year old U.S. women and estimating the equation

$$(1) \quad y_i = \alpha + \beta p_i + \gamma'x_i + u_i ,$$

where y is educational attainment, p is a binary indicator of childbearing as a teenager and x is a vector of other covariates. α , β , and γ are linear causal effects. We seek a linear causal effect β .

A) What is a linear causal effect? (If you insist on using the definition from some other course, explain how it corresponds to the one we used in 250A.)

B) Why might p and u be correlated in equation (1) for the U.S. population. Explain what type(s) of omitted variable bias we should worry about.

C) Hotz, McElroy and Sanders (JHR forthcoming) claim that spontaneous abortions (i.e., unintended, natural cessations of pregnancy) among teenagers are uncorrelated with the residual in (1), conditional on having become pregnant as teenagers. Assuming that this is true, for what subpopulation can you estimate β consistently?

D) Write out a formula for a consistent estimate of β for that subpopulation.

E) Explain the problem of weak instruments.

How would you check if your method suffers from a “weak instrument” problem?

F) The negative correlation of spontaneous abortion and childbearing is weakened by the fact that pregnancies can be aborted. Knowing that, what else is special about the subpopulation for which you can estimate β ?

G) Explain in words what it means for spontaneous abortion to be a valid instrument.

H) Can you think of a way of providing evidence (formal testing or otherwise) that the statement in (G) is true? Explain briefly.

After the exam, feel free to look at http://www.econ.ucla.edu/hotz/working_papers/teen.pdf