

Econometric Analysis of Panel Data Assignment 3

Part I. Instrumental Variable Estimation

This exercise is based on Baltagi/Griffin's gasoline demand model, which we extend to the following random effects model:

 $\log G_{i,t} = \beta_1 + \beta_2 \log Y_{i,t} + \beta_3 \log P_{i,t} + \beta_4 \log C_{i,t} + \beta_5 \log G_{i,t-1} + u_i + \varepsilon_{i,t}$

where G = per capita gasoline consumption, Y = income, P = price, C = cars per capita. (Use Baltagi's gasoline data posted on the course web site, for the computations.) Note the appearance of the lagged value of the dependent variable.

- (1) Will the ordinary least squares estimator of β for this model be unbiased? Consistent? Efficient? Explain.
- (2) Is the GLS estimator consistent? Explain.
- (3) Estimate the model by OLS and report your results.
- (4) Estimate the model by FGLS, ignoring its dynamic nature, and report your results. (Note that a year of data is lost because of the presence of the lagged dependent variable.)
- (5) Suitable instruments for this model, using data within the model, might include a time trend and lagged values of income, price and cars per capita. What are the explicit assumptions which would justify this suggestion.
- (6) Compute the instrumental variable estimates for this model, ignoring the random effect term, u_i.
- (7) Under the assumptions made so far (presumably), this model can be viewed as a special case of the Hausman and Taylor model discussed in class. Show how this is the case, then propose how to estimate the parameters of the model.

NOTES: Baltagi, Chapter 8, contains an application of this sort of model. (Ignore the λ_t term in his application. Commands that can be used with NLOGIT are shown below. Stata contains a compact single command procedure for fitting the Hausman and Taylor model.)

```
create ; t=year-1959$
create ; logg=lgaspcar ; logy=lincomep ; logp=lrpmg $ (Just changes notation)
create ; logc=lcarpcap ; logg1=logg[-1]$
create ; logy1=logy[-1]; logp1=logp[-1] ; logc1=logc[-1]$
create ; logg=lgaspcar ; logy=lincomep ; logp=lrpmg ; logc=lcarpcap$
namelist; x1 = logy, logp,logc ; x2 = logg1 ; z1=one $
Namelist; x = x1, x2 $
Calc
        ; kx1 = col(x1) ; kx2 = col(x2) ; kz1 = col(z1) ; kz2=0$
regress ; if[t > 1] ;lhs=logg ;rhs=x$
regress ; if[t > 1] ;lhs=logg ;rhs=x ; str=country ; panel ; random effects$
       ; if[t > 1] ;lhs=logg ;rhs=x
2sls
         ; inst=one,logy,logp,logc,t,logy1,logp1,logc1$
Regress ; if [t > 1] ; lhs = logg ; rhs = x1, x2 ; pds=18 ; fixed ; panel $
Calc
        ; s2e = ssqrd $
        ; dwit = logg - x'b $
Create
Regress ; if[t > 1] ; lhs = dwit ; rhs = one ; pds = 18 ; panel ; keep = dwi $
       ; if[t > 1] ; lhs = dwi ; rhs=z1 ; inst = x1,z1 $
2sls
Calc
        ; s2s = ssqrd $
       ; s2u = s2s - s2e/18 $
Calc
Regress ; if[t > 1] ; lhs = logg ; rhs = x1,x2,z1; panel ; pds=18 ; random
         ; start=kx1,kx2,kz1,0,s2e,s2u$
```

Part II. A GMM Estimator

Continuing Part I, with the model

$$\log G_{i,t} = \beta_1 + \beta_2 \log Y_{i,t} + \beta_3 \log P_{i,t} + \beta_4 \log C_{i,t} + \beta_5 \log G_{i,t-1} + u_i + \varepsilon_{i,t}$$

suppose it is proposed to estimate the model by relying on the following orthogonality conditions:

let $\mathbf{z}_{i,t} = (\log Y_{i,t}, \log P_{i,t}, \log C_{i,t})$

Then, we assume

 $E[(u_i + \varepsilon_{i,t})] = 0,$ $E[\mathbf{z}_{i,t} \times (u_i + \varepsilon_{i,t})] = 0,$ $E[\mathbf{z}_{i,t-1} \times (u_i + \varepsilon_{i,t})] = 0,$ $E[\mathbf{z}_{i,t-2} \times (u_i + \varepsilon_{i,t})] = 0$

(1) Show that this set of conditions is sufficient to estimate the model. Write out the 10 moment conditions. I.e., show precisely how to set up the moment conditions for estimation.

(2) Construct the GMM estimator.

(3) Compute the GMM estimator and test the overidentifying restrictions. Discuss the implications of the test results.

```
Sample ; all $
Create ; g=lgaspcar ; g1 = g[-1] $
Create ; y=lincomep ; y1 = y[-1] ; y2 = y[-2] $
create ; p=lrpmg ; p1 = p[-1] ; p2 = p[-2] $
Create ; c=lcarpcap ; c1 = c[-1] ; c2 = c[-2] $
Reject ; Year < 1962 $
Namelist ; x = one,y,p,c,g1$
Namelist ; z = one,y,p,c,y1,p1,c1,y2,p2,c2 $
? First step, 2SLS to obtain a consistent estimator.
2sls ; lhs = g ; rhs = x ; inst = z ; res = e $
Create ; e^2 = e^*e^{\$}
Matrix ; W = \langle z' [e2] z \rangle \$
Matrix ; vgmm = x'z * w * z'x ; vgmm=<vgmm>
       ; bgmm = vgmm * x'z * w * z'g $
Matrix ; stat(bgmm,vgmm,x)$
Matrix ; egmm = g - X*bgmm ; list ; q = egmm'Z * W * Z'egmm $
```