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% Sample code to illustrate estimation of BLP random coeffients model
% with aggregate data
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% For the Quantitative Marketing and Structural Econometrics Workshop
% at Duke University-2013

%Variables for demand equation (y, x) and the instruments (z)
y=log_s_s0;
x=[int p ad qtr];
z=[int cost lad qtr];

%Homogeneous logit without endogeneity fix
bOLS=inv(x'*x)*x'*y;
bOLS

%Homogeneous logit with endogeneity fix (W=I)
W=eye(size(z,2),size(z,2));
bIV1=inv(x'*z*W*z'*x)*x'*z*W*z'*y;
bIV1

%Homogeneous logit with endogeneity fix (W=inv(z'*z)) better than W=I, when
%different instruments have very different numerical  magnitudes; this
%equalizes the relative weights of the instruments in GMM
W=inv(z'*z);
bIV2=inv(x'*z*W*z'*x)*x'*z*W*z'*y;
bIV2

%Homogeneous logit with endogeneity fix (W=inv(E(z'ksi*ksi'*z)))
derr=y-x*bIV2;
zderr=z;
for i=1:1:size(z,2);
     zderr(:,i)=z(:,i).*derr;
 end;
W=inv((zderr)'*(zderr));
bIV3=inv(x'*z*W*z'*x)*x'*z*W*z'*y;
bIV3

%Heterogeneous logit with endogeneity fix
%Note I draw different 50 individuals for the different markets (time periods) from the
%same distribution. With markets, this is perfectly logical.
%With time, one could argue we need the same 50 individuals across
%markets. However, since there is no panel structure in  choices across time,
%different individuals across time is also correct.
%The advantage I see with different individuals is that you sample across
% a wider set of households from the distribution

NCons=50;
xlin=[int p ad qtr];
w1=randn(NObs1,NCons);
w2=randn(NObs1,NCons);
wp=randn(NObs,NCons);
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wp=(reshape([wp';wp'],NCons,NObs1))';
b0=ones(4,1);

blin=bIV3;

options=optimset('Display','iter','TolFun',1e-12,'TolX',1e-12,'MaxIter',2500,↙
'MaxFunEvals',5000, 'LargeScale','off', 'HessUpdate', 'dfp');
[b, fval,exitflag,output,grad,hessian] = fminunc('AgglogitGMM',b0,options);


%Comparing the linear parameters across the different methods
bResults=[bOLS bIV1 bIV2 bIV3 blin]
%Formatted Reporting of the same parameters
horz= ['bOLS' '  bIV-W=I  ' '  bIV-W=zz '  ' bIV-W-ksi*z'     'blin-hetero'];
vert=['Int1 '; 'Int2 ';  'Price';  'Ad   '; 'Q1   ';  'Q2   ';  'Q3   '];
disp(horz)
for i = 1:1: size(vert);
    disp(vert(i,:))
    disp(bResults(i,:))
end;
% The RC Logit Model estimates with both linear (blin) and nonlinear (b) parameters
bResults1=[blin; b];

%Formatted Reporting of the same parameters
horz= ['bFull-hetero ' ];
vert=['Int1 '; 'Int2 ';  'Price';  'Ad   '; 'Q1   ';  'Q2   ';  'Q3   '; 'L11  '; 'L12↙
'; 'L22  '; 'Sigp ';];
disp(horz)
for i = 1:1: size(vert);
    disp(vert(i,:))
    disp(bResults1(i,:))
end;
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