9. Estimation of Qualitative Dependent Variable Models

FRML F3 SIG = 1/SIGI;
ANALYZ F1-F3;

? Note: the above can be done more easily with:
TOBIT Y C X;

9.7.7. Multinomial Logit

? Multinomial Logit (X=characteristics of the chooser)
?
? Simulate data with 3 choices and 2 X's.
CONST N 1000;
SMLP 1 N;
?
DOT 1 2;
RANDOM (UNIFORM) X;
ENDDOT;
DOT 1 2 3;
RANDOM (UNIFORM) F;
U = -LOG(-LOG(F));
ENDDOT;
?
Y1 = U1;
Y2 = -1 + X1 + X2 + U2;
Y3 = -1 + X1 + X2 + U3;
Y1 = Y1 > Y2 & Y1 > Y3;
Y2 = Y2 > Y1 & Y2 > Y3;
Y3 = Y3 > Y1 & Y3 > Y2;
Y = 1*Y1 + 2*Y2 + 3*Y3;

? Define the logit model for ML procedure and estimate it.
FRML LOGIT Y_2*XB2 + Y_3*XB3 - LOG(1 + EXP(XB2) + EXP(XB3));
FRML XB2 B20+B21*X1+B22*X2;
FRML XB3 B30+B31*X1+B32*X2;
EQSUB LOGIT XB2 XB3;
PARAM B20-B22 B30-B32;
ML (HITER=N,HCOV=NBW) LOGIT; ? Use Newton-Raphson iteration.

? Note: the above can be done more easily with:
LOGIT(HCOV=NBW) Y C X1 X2;

9.7.8. Sample Selection

? Sample Selection model using starting values from OLS and PROBIT
?
ICY = IY = 0;
FRML EQ1 LOG1 = IY0*LCNORM(-ZD) + IY*[LOG(SIGMA) + LNORM(YXBS) +
LCNORM(ZD + RHO*YXBS)/SQRT[1-RHO**2]];
FRML ZD1 ZD = D.C + D.Z; *
FRML YXBS1 YXBS = Y^- (B.C + B.X*X)/SIGMA;
EQSUB(NAME=NAME=SAMPLE) EQ1 YXBS1 ZD1;
PARAM D.C D.Z B.C B.X SIGMA RHO;
PROBIT IY C Z; UNMAKE @COEF D.C D.Z; ? Probit for parameter starting values.
SELECT IY; ? OLSQ over observed data for starting values.
OLSQ Y C X; UNMAKE @COEF B.C B.X; SET SIGMA=\$;
SELECT 1;
ML(HCOV=NBW) SAMPSEL;
? ML on sample selection model over full sample.

? Note: the above can be done more easily with:
SAMPSEL(HCOV=NBW) I Y C Z | Y C X;

9.7.9. Ordered Probit

? Ordered Probit model (4 states)
? Q = XB + U (Q unobserved)
? Y = 1 for Q <= 0
? 2 for 0 < Q <= A1 ( XB < U <= A1-XB )
? 3 for A1 < Q <= A2 ( A1-XB < U <= A2-XB )
? 4 for A2 < Q ( A2-XB < U )
?
? To insure that the ordering satisfies 0 <= A1 <= A2 , parametrize as A1 = D1**2, A2 = A1 + D2**2.
? However, if D1 or D2 tends to zero, numerical problems will arise due to taking the log of zero.
?
? Y1 = Y=1; Y2 = Y=2; Y3 = Y=3; Y4 = Y=4;
?
? FRML EQU1 LOGL = LOG{
? Y1*CNORM(-XB) +
? Y2*[CNORM(A1-XB) - CNORM(-XB)] +
? Y3*[CNORM(A2-XB) - CNORM(A1-XB)] +
? Y4*[1 - CNORM(A2-XB)]
?);
? Y12 = Y1 - Y2; Y23 = Y2 - Y3; Y34 = Y3 - Y4;
FRML EQU1 LOGL = LOG{
? Y12*CNORM(-XB) + Y23*CNORM(A1-XB) +
? Y34*CNORM(A2-XB) + Y4
?};
?
? The model above is more efficient for estimation.
FRML EXB XB = B0 + B1*X1 + B2*X2;
FRML EA1 A1 = D1*D1;
FRML EA2 A2 = A1 + D2*D2;
PARAM B0 B1 B2 D1 .1 D2 .1 ;
?
? Use Probit on Y=1 vs. Y>1 to obtain starting values for B coefficients.
?
? YY = Y > 1;
PROBIT YY C X1 X2;
UNMAKE @COEF B0 B1 B2;
EQSUB(NAME=ORDPROB) EQ1 EA2 EA1 EXB; ? note substitution order
ML(HITER=N,HCOV=NBW) ORDPROB;
?
? Note: the above can be done more easily with:
ORDPROB(HCOV=NBW) Y C X1 X2;

9.7.10. Nested Logit

? Nested Logit using ML, including example of IIA Testing. (See the web site http://www.tspintl.com for a more
? complex example.
?
This example is for the simplest nested logit model, where the top branch is a choice between alternative 1 (with
? characteristics X1) and the lower branch. The lower branch is a choice between alternative 2 (with char. X2) and
? alternative 3 (with char. X3). Alternatives 2 and 3 are correlated; the inclusive value parameter is denoted lambda.
? Note that the coefficients of the lower branch must be multiplied by lambda to obtain estimates that can be
? compared to ordinary MN logit.