Test of random parameters negative binomial (RPNB) and Negative binomial (NB)

With the Limdep commands and model estimation outputs shown below, it is seen that the final specification of the RPNB converges at –746.81 and the NB of this model (with no random parameters) converges at –751.74. This gives:

$$X^2 = -2[LL(\beta_{NB}) - LL(\beta_{RPNB})],$$
$$X^2 = -2[-751.74 - (-746.81)],$$
$$X^2 = 9.86$$

This X^2 statistic is χ^2 distributed with degrees of freedom equal to number of additional parameters estimated in the RPNB, which is 4. On page 471 of the text, you can see that the 95% confidence level with 4 degrees of freedom is 9.4877. Since 9.86 > 9.4877 we are more than 95% confident that the NB and RPNB are not equal. Thus the RPNB is statistically superior.

Limdep Commands

```
read;nvar=40;nobs=296;;FILE=D: \Class-614-2011.txt$
create;if(x27=3) rural=1$
create;if(x30=3) asian=1$
create;if(x24=1) fem=1$
create;if(x26<30) young=1$
create;if(x29>3) coll=1$
create;if(x33<5) few=1$

--> negbin;lhs=x13;rhs=one,rural,asian,fem,young,few,x34
    ;rpm;pts=200;halton
    ;fcn=fem(n),young(n),few(n),x34(n)$

Normal exit from iterations. Exit status=0.

+---------------------------------------------+
| Random Coefficients  NegBnReg Model         |
| Maximum Likelihood Estimates                |
| Model estimated: Nov 15, 2013 at 08:31:07AM.|
| Dependent variable                  X13     |
| Weighting variable                 None     |
| Number of observations              296     |
| Iterations completed                 32     |
| Log likelihood function       -746.8082     |
| Number of parameters                 12     |
| Info. Criterion: AIC =          5.12708     |
|   Finite Sample: AIC =          5.13081     |
| Restricted log likelihood     -2497.538     |
| McFadden Pseudo R-squared      .7009822     |
| Chi squared                   3501.459     |
| Degrees of freedom                   4     |
| Prob[ChiSqd > value] =         .0000000     |
| Sample is  1 pds and     296 individuals.   |
| Negative binomial regression model          |
| Simulation based on 200 Halton draws        |
+---------------------------------------------+
```

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Nonrandom parameters					
Constant	1.18207361	.13994069	8.447	.0000	
RURAL	.27102292	.08298950	3.266	.0011	.30405405
ASIAN	.35293674	.08624695	4.092	.0000	.28040541
Means for random parameters					
FEM	.09155077	.07332281	1.249	.2118	.44256757
YOUNG	-.18304337	.08061173	-2.271	.0232	.62837838
FEW	.10100466	.11994889	.842	.3998	.88851351
X34	.00760069	.06934993	.110	.9127	.24324324
Scale parameters for dists. of random parameters					
FEM	.04990488	.05374401	.929	.3531	
YOUNG	.51415253	.04757515	10.807	.0000	
FEW	.29591845	.03700335	7.997	.0000	
X34	.34446700	.05905644	5.833	.0000	
Dispersion parameter for NegBin distribution					
ScalParm	7.69454919	1.71702575	4.481	.0000	

--> negbin;lhs=x13;rhs=one,rural,asian,fem,young,few,x34$

Normal exit from iterations. Exit status=0.

Negative Binomial Regression	
Maximum Likelihood Estimates	
Model estimated: Nov 15, 2013 at 08:30:26AM.	
Dependent variable	X13
Weighting variable	None
Number of observations	296
Iterations completed	12
Log likelihood function	-751.7379
Number of parameters	8
Info. Criterion: AIC =	5.13336
Finite Sample: AIC =	5.13506
Info. Criterion: BIC =	5.23310
Info. Criterion:HQIC =	5.17330
Restricted log likelihood	-880.2936
McFadden Pseudo R-squared	.1460373
Chi squared	257.1115
Degrees of freedom	1
Prob[ChiSqd > value] =	.0000000
NegBin form 2; Psi(i) = theta	

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Constant	1.20391597	.19596754	6.143	.0000	
RURAL	.23567029	.10606378	2.222	.0263	.30405405
ASIAN	.21916471	.11112577	1.972	.0486	.28040541
FEM	.00893202	.09491621	.094	.9250	.44256757
YOUNG	-.07644791	.11257273	-.679	.4971	.62837838
FEW	.23830489	.15466400	1.541	.1234	.88851351
X34	.05717323	.07893942	.724	.4689	.24324324
Dispersion parameter for count data model					
Alpha	.42587102	.05216710	8.164	.0000	