

Limited dependent variable estimation in Stata 11 (Spring, 2011): v2

```

. //
. //
. //
. //
. // Binomial probit
. //
. // womenwk from IMEUS
. summarize work age married children education

```

Variable	Obs	Mean	Std. Dev.	Min	Max
work	2000	.6715	.4697852	0	1
age	2000	36.208	8.28656	20	59
married	2000	.6705	.4701492	0	1
children	2000	1.6445	1.398963	0	5
education	2000	13.084	3.045912	10	20

```

. probit work age married children education, nolog
Probit regression
Number of obs = 2000
LR chi2(4) = 478.32
Prob > chi2 = 0.0000
Pseudo R2 = 0.1889
Log likelihood = -1027.0616

```

	work	age	married	children	education	_cons
Coef.		.0347211	.4308575	.4473249	.0583645	-2.467365
Std. Err.		.0042293	.074208	.0287417	.0109742	.1925635
z		8.21	5.81	15.56	5.32	-12.81
P> z		0.000	0.000	0.000	0.000	0.000
[95% Conf. Interval]		.0264318 .0430105	.2854125 .5763025	.3909922 .5036576	.0368555 .0798735	-2.844782 -2.089948

```

. //
. //
. //
. // Marginal effects (AMEs)
. //
. //
. margins, dydx(_all)
Average marginal effects
Model VCE : OIM
Expression : Pr(work), predict()
dy/dx w.r.t. : age married children education

```

	age	married	children	education
dy/dx	.0100768	.1250441	.1298233	.0169386
Delta-method Std. Err.	.0011647	.0210541	.0068418	.0031183
z	8.65	5.94	18.98	5.43
P> z	0.000	0.000	0.000	0.000
[95% Conf. Interval]	.0077941 .0123595	.0837788 .1663094	.1164137 .1432329	.0108269 .0230504

```

. // marginal effects for specific values of explanatory variables
. margins, dydx(_all) over(children)
Average marginal effects
Model VCE : OIM

```



children						
0 0	.0101772	.0012324	8.26	0.000	.0077618	.0125926
0 1	.0128782	.0014693	8.76	0.000	.0099984	.015758
0 2	.0125766	.0014342	8.77	0.000	.0097657	.0153876
0 3	.0111407	.0013874	8.03	0.000	.0084214	.01386
0 4	.0066499	.0009966	6.67	0.000	.0046965	.0086033
0 5	.0030729	.0006206	4.95	0.000	.0018567	.0042892
1 0	.0129026	.0014692	8.78	0.000	.0100231	.0157822
1 1	.011531	.0013277	8.68	0.000	.0089288	.0141333
1 2	.0080563	.0009752	8.26	0.000	.0061449	.0099678
1 3	.0053679	.0008026	6.69	0.000	.0037948	.006941
1 4	.0026145	.0005241	4.99	0.000	.0015873	.0036418
1 5	.0008761	.0002533	3.46	0.001	.0003797	.0013725
married						
married#						
children						
0 0	.1262901	.0185512	6.81	0.000	.0899304	.1626498
0 1	.1598069	.026885	5.94	0.000	.1071133	.2125004
0 2	.1560647	.0290645	5.37	0.000	.0990992	.2130301
0 3	.1382456	.0264296	5.23	0.000	.0864445	.1900466
0 4	.0825189	.0178597	4.62	0.000	.0475147	.1175232
0 5	.0381323	.0104974	3.63	0.000	.0175577	.0587069
1 0	.1601096	.0282537	5.67	0.000	.1047334	.2154858
1 1	.1430895	.0238027	6.01	0.000	.0964371	.1897419
1 2	.0999715	.0154146	6.49	0.000	.0697594	.1301837
1 3	.066611	.0095902	6.95	0.000	.0478146	.0854075
1 4	.0324439	.0054681	5.93	0.000	.0217267	.0431611
1 5	.0108718	.0027682	3.93	0.000	.0054462	.0162974
children						
married#						
children						
0 0	.1311169	.0061968	21.16	0.000	.1189715	.1432624
0 1	.1659147	.0101364	16.37	0.000	.1460477	.1857817
0 2	.1620295	.0104555	15.50	0.000	.1415371	.1825219
0 3	.1435293	.007698	18.64	0.000	.1284415	.1586172
0 4	.0856728	.0051047	16.78	0.000	.0756678	.0956779
0 5	.0395897	.0054331	7.29	0.000	.028941	.0502385
1 0	.166229	.0109681	15.16	0.000	.1447319	.1877261
1 1	.1485584	.0100644	14.76	0.000	.1288326	.1682843
1 2	.1037925	.0056113	18.50	0.000	.0927945	.1147904
1 3	.0691569	.0035835	19.30	0.000	.0621334	.0761803
1 4	.0336839	.0036321	9.27	0.000	.0265651	.0408028
1 5	.0112873	.0024416	4.62	0.000	.0065019	.0160728
education						
married#						
children						
0 0	.0171074	.0032533	5.26	0.000	.0107311	.0234838
0 1	.0216477	.0039896	5.43	0.000	.0138283	.029467
0 2	.0211407	.0038668	5.47	0.000	.0135619	.0287195
0 3	.0187269	.0035581	5.26	0.000	.0117532	.0257007
0 4	.0111781	.0022001	5.08	0.000	.006866	.0154902
0 5	.0051655	.0013474	3.83	0.000	.0025246	.0078063

1 0	.0216887	.0038982	5.56	0.000	.0140483	.029329
1 1	.0193831	.0035977	5.39	0.000	.0123317	.0264345
1 2	.0135423	.0025446	5.32	0.000	.0085549	.0185297
1 3	.0090232	.0018804	4.80	0.000	.0053378	.0127087
1 4	.0043949	.0011037	3.98	0.000	.0022318	.006558
1 5	.0014727	.0004977	2.96	0.003	.0004973	.0024481

```
. //
. //                               Binomial logit
. //
. logit work age married children education, nolog
Logistic regression                Number of obs =      2000
                                   LR chi2(4)      =      476.62
                                   Prob > chi2     =      0.0000
Log likelihood = -1027.9144        Pseudo R2    =      0.1882
```

work	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	.0579303	.007221	8.02	0.000	.0437773	.0720833
married	.7417775	.1264705	5.87	0.000	.4938998	.9896552
children	.7644882	.0515289	14.84	0.000	.6634935	.865483
education	.0982513	.0186522	5.27	0.000	.0616936	.134809
_cons	-4.159247	.3320401	-12.53	0.000	-4.810034	-3.508461

```
. margins, dydx(_all)
Average marginal effects                Number of obs =      2000
Model VCE      : OIM
Expression    : Pr(work), predict()
dy/dx w.r.t.  : age married children education
```

	Delta-method				
	dy/dx	Std. Err.	z	P> z	[95% Conf. Interval]
age	.0099674	.0011682	8.53	0.000	.0076778 .0122569
married	.127629	.021152	6.03	0.000	.0861717 .1690862
children	.1315365	.007073	18.60	0.000	.1176736 .1453994
education	.0169049	.0031243	5.41	0.000	.0107814 .0230285

```
. //
. //                               Ordered logit
. //
. // panel84extract from IMEUS
. // dia: change in Inc/Asset ratio, 1982-1983
. summarize rating83c ia83 dia
```

Variable	Obs	Mean	Std. Dev.	Min	Max
rating83c	98	3.479592	1.17736	2	5
ia83	98	10.11473	7.441946	-13.08016	30.74564
dia	98	.7075242	4.711211	-10.79014	20.05367

```
. tabulate rating83c
```

```
   Bond |
rating, |
```

1983	Freq.	Percent	Cum.
BA_B_C	26	26.53	26.53
BAA	28	28.57	55.10
AA_A	15	15.31	70.41
AAA	29	29.59	100.00
Total	98	100.00	

```
. ologit rating83c ia83 dia, nolog
```

```
Ordered logistic regression
```

```
Number of obs = 98
```

```
LR chi2(2) = 11.54
```

```
Prob > chi2 = 0.0031
```

```
Pseudo R2 = 0.0434
```

```
Log likelihood = -127.27146
```

rating83c	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
ia83	.0939166	.0296196	3.17	0.002	.0358633	.1519699
dia	-.0866925	.0449789	-1.93	0.054	-.1748496	.0014646
/cut1	-.1853053	.3571432			-.8852932	.5146826
/cut2	1.185726	.3882099			.4248488	1.946604
/cut3	1.908412	.4164896			1.092108	2.724717

```
. predict spBA_B_C spBAA spAA_A spAAA
(option pr assumed; predicted probabilities)
```

```
. summarize spAAA,mean
```

```
. list sp* rating83c if spAAA==r(max)
```

	spBA_B_C	spBAA	spAA_A	spAAA	rati-83c
31.	.0388714	.0985567	.1096733	.7528986	AAA

```
. summarize spBA_B_C, mean
```

```
. list sp* rating83c if spBA_B_C==r(max)
```

	spBA_B_C	spBAA	spAA_A	spAAA	rati-83c
67.	.7158453	.1926148	.0449056	.0466343	AAA

```
. //
```

```
. // Poisson regression
```

```
. //
```

```
. use mus17data, clear
```

```
. summarize docvis private medicaid age age2 educyr actlim totchr, sep(0)
```

Variable	Obs	Mean	Std. Dev.	Min	Max
docvis	3677	6.822682	7.394937	0	144
private	3677	.4966005	.5000564	0	1
medicaid	3677	.166712	.3727692	0	1
age	3677	74.24476	6.376638	65	90
age2	3677	5552.936	958.9996	4225	8100

educyr	3677	11.18031	3.827676	0	17
actlim	3677	.333152	.4714045	0	1
totchr	3677	1.843351	1.350026	0	8
. tab docvis					
# doctor visits	Freq.	Percent	Cum.		
0	401	10.91	10.91		
1	314	8.54	19.45		
2	358	9.74	29.18		
3	334	9.08	38.26		
4	339	9.22	47.48		
5	266	7.23	54.72		
6	231	6.28	61.00		
7	202	5.49	66.49		
8	179	4.87	71.36		
9	154	4.19	75.55		
10	108	2.94	78.49		
11	127	3.45	81.94		
12	89	2.42	84.36		
13	85	2.31	86.67		
14	81	2.20	88.88		
15	70	1.90	90.78		
16	51	1.39	92.17		
17	43	1.17	93.34		
18	33	0.90	94.23		
19	27	0.73	94.97		
20	26	0.71	95.68		
21	19	0.52	96.19		
22	21	0.57	96.76		
23	17	0.46	97.23		
24	15	0.41	97.63		
25	6	0.16	97.80		
26	5	0.14	97.93		
27	11	0.30	98.23		
28	4	0.11	98.34		
29	6	0.16	98.50		
30	8	0.22	98.72		
31	2	0.05	98.78		
32	6	0.16	98.94		
33	3	0.08	99.02		
34	3	0.08	99.10		
35	5	0.14	99.24		
36	1	0.03	99.27		
37	2	0.05	99.32		
38	2	0.05	99.37		
39	2	0.05	99.43		
40	4	0.11	99.54		
41	2	0.05	99.59		
42	1	0.03	99.62		
43	2	0.05	99.67		
44	2	0.05	99.73		
47	2	0.05	99.78		
48	2	0.05	99.84		
50	1	0.03	99.86		

54	1	0.03	99.89
59	1	0.03	99.92
73	1	0.03	99.95
106	1	0.03	99.97
144	1	0.03	100.00
<hr/>			
Total	3,677	100.00	

```

. poisson docvis private medicaid age age2 educyr actlim totchr, nolog
Poisson regression                               Number of obs =      3677
                                                LR chi2(7)      =     4477.98
                                                Prob > chi2     =      0.0000
Log likelihood = -15019.64                       Pseudo R2      =      0.1297

```

docvis	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
private	.1422324	.0143311	9.92	0.000	.114144	.1703208
medicaid	.0970005	.0189307	5.12	0.000	.0598969	.134104
age	.2936722	.0259563	11.31	0.000	.2427988	.3445457
age2	-.0019311	.0001724	-11.20	0.000	-.0022691	-.0015931
educyr	.0295562	.001882	15.70	0.000	.0258676	.0332449
actlim	.1864213	.014566	12.80	0.000	.1578726	.2149701
totchr	.2483898	.0046447	53.48	0.000	.2392864	.2574933
_cons	-10.18221	.9720115	-10.48	0.000	-12.08732	-8.277101

```

. // std errors may be biased in presence of overdispersion
. poisson docvis i.private i.medicaid age age2 educyr i.actlim totchr, ///
> nolog robust
Poisson regression                               Number of obs =      3677
                                                Wald chi2(7)    =      720.43
                                                Prob > chi2     =      0.0000
Log pseudolikelihood = -15019.64                 Pseudo R2      =      0.1297

```

docvis	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
1.private	.1422324	.036356	3.91	0.000	.070976	.2134889
1.medicaid	.0970005	.0568264	1.71	0.088	-.0143773	.2083783
age	.2936722	.0629776	4.66	0.000	.1702383	.4171061
age2	-.0019311	.0004166	-4.64	0.000	-.0027475	-.0011147
educyr	.0295562	.0048454	6.10	0.000	.0200594	.039053
1.actlim	.1864213	.0396569	4.70	0.000	.1086953	.2641474
totchr	.2483898	.0125786	19.75	0.000	.2237361	.2730435
_cons	-10.18221	2.369212	-4.30	0.000	-14.82578	-5.538638

```

. // average marginal effects
. margins, dydx(_all)
Average marginal effects                       Number of obs =      3677
Model VCE      : Robust
Expression     : Predicted number of events, predict()
dy/dx w.r.t.  : 1.private 1.medicaid age age2 educyr 1.actlim totchr

```

	Delta-method dy/dx	Std. Err.	z	P> z	[95% Conf. Interval]
<hr/>					
<hr/>					





```

. //
. use musl7data_z, replace
. summarize er age actlim totchr

```

Variable	Obs	Mean	Std. Dev.	Min	Max
er	3677	.2774001	.6929326	0	10
age	3677	74.24476	6.376638	65	90
actlim	3677	.333152	.4714045	0	1
totchr	3677	1.843351	1.350026	0	8

```

. tab er
# Emergency
Room Visits

```

	Freq.	Percent	Cum.
0	2,967	80.69	80.69
1	515	14.01	94.70
2	128	3.48	98.18
3	40	1.09	99.27
4	15	0.41	99.67
5	8	0.22	99.89
6	2	0.05	99.95
7	1	0.03	99.97
10	1	0.03	100.00
Total	3,677	100.00	

```

. poisson er age actlim totchr, nolog
Poisson regression
Log likelihood = -2433.4807

```

	Number of obs	=	3677
LR chi2(3)	=	355.22	
Prob > chi2	=	0.0000	
Pseudo R2	=	0.0680	

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
er					
age	.0078597	.0049196	1.60	0.110	-.0017826 .0175021
actlim	.6862348	.0699713	9.81	0.000	.5490935 .8233761
totchr	.2439328	.022543	10.82	0.000	.1997493 .2881162
_cons	-2.709086	.3695379	-7.33	0.000	-3.433367 -1.984805

```

. zip er age actlim totchr, inflate(age actlim totchr) nolog
Zero-inflated Poisson regression
Inflation model = logit
Log likelihood = -2330.582

```

	Number of obs	=	3677
Nonzero obs	=	710	
Zero obs	=	2967	
LR chi2(3)	=	24.74	
Prob > chi2	=	0.0000	

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
er					
age	.0008593	.0080323	0.11	0.915	-.0148837 .0166024
actlim	.2402562	.1207042	1.99	0.047	.0036804 .476832
totchr	.1332187	.0388752	3.43	0.001	.0570247 .2094128
_cons	-.8134282	.6126304	-1.33	0.184	-2.014162 .3873054
inflate					
age	-.0125277	.013236	-0.95	0.344	-.0384698 .0134144

actlim	-0.7789124	.1923261	-4.05	0.000	-1.155865	-.4019602
totchr	-.2172748	.0663943	-3.27	0.001	-.3474053	-.0871444
_cons	2.121419	.9931	2.14	0.033	.1749787	4.067859

```
. //
. //          zero-inflated negative binomial regression
. //
. nbreg er age actlim totchr, nolog
```

```
Negative binomial regression          Number of obs =      3677
                                      LR chi2(3)      =      225.15
Dispersion = mean                    Prob > chi2      =      0.0000
Log likelihood = -2314.4927          Pseudo R2      =      0.0464
```

	er	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
	age	.0088528	.0061341	1.44	0.149	-.0031697 .0208754
	actlim	.6859572	.0848127	8.09	0.000	.5197274 .8521869
	totchr	.2514885	.0292559	8.60	0.000	.1941481 .308829
	_cons	-2.799848	.4593974	-6.09	0.000	-3.700251 -1.899446
	/lnalpha	.4464685	.1091535			.2325315 .6604055
	alpha	1.562783	.1705834			1.26179 1.935577

```
Likelihood-ratio test of alpha=0:  chibar2(01) = 237.98 Prob>=chibar2 = 0.000
. zinb er age actlim totchr, inflate(age actlim totchr) ///
> vuong nolog
```

```
Zero-inflated negative binomial regression          Number of obs =      3677
                                                    Nonzero obs =      710
                                                    Zero obs   =      2967
Inflation model = logit                          LR chi2(3)      =      34.29
Log likelihood = -2304.868                      Prob > chi2      =      0.0000
```

	er	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
er	age	.0035485	.0076344	0.46	0.642	-.0114146 .0185116
	actlim	.2743106	.1768941	1.55	0.121	-.0723954 .6210165
	totchr	.1963408	.0558635	3.51	0.000	.0868504 .3058313
	_cons	-1.822978	.6515914	-2.80	0.005	-3.100074 -.5458825
inflate	age	-.0236763	.0284226	-0.83	0.405	-.0793835 .0320309
	actlim	-4.22705	18.91192	-0.22	0.823	-41.29372 32.83962
	totchr	-.3471091	.2052892	-1.69	0.091	-.7494686 .0552505
	_cons	1.846526	2.071003	0.89	0.373	-2.212565 5.905618
	/lnalpha	.1602371	.235185	0.68	0.496	-.3007171 .6211913
	alpha	1.173789	.2760576			.7402871 1.861144

```
Vuong test of zinb vs. standard negative binomial: z =      1.99 Pr>z = 0.0233
```

```
. //
. //          Truncated regression
```

```

. //
. // laborsub from IMEUS
. use laborsub,clear
. summarize whrs kl6 k618 wa we

```

Variable	Obs	Mean	Std. Dev.	Min	Max
whrs	250	799.84	915.6035	0	4950
kl6	250	.236	.5112234	0	3
k618	250	1.364	1.370774	0	8
wa	250	42.92	8.426483	30	60
we	250	12.352	2.164912	5	17

```

. regress whrs kl6 k618 wa we if whrs>0

```

Source	SS	df	MS	Number of obs =	150
Model	7326995.15	4	1831748.79	F( 4, 145) =	2.80
Residual	94793104.2	145	653745.546	Prob > F =	0.0281
Total	102120099	149	685369.794	R-squared =	0.0717
				Adj R-squared =	0.0461
				Root MSE =	808.55

```


```

whrs	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
kl6	-421.4822	167.9734	-2.51	0.013	-753.4748 -89.48953
k618	-104.4571	54.18616	-1.93	0.056	-211.5538 2.639668
wa	-4.784917	9.690502	-0.49	0.622	-23.9378 14.36797
we	9.353195	31.23793	0.30	0.765	-52.38731 71.0937
_cons	1629.817	615.1301	2.65	0.009	414.0371 2845.597

```

. truncreg whrs kl6 k618 wa we, ll(0) nolog
(note: 100 obs. truncated)
Truncated regression
Limit: lower = 0
      upper = +inf
Log likelihood = -1200.9157

```

whrs	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
kl6	-803.0042	321.3614	-2.50	0.012	-1432.861 -173.1474
k618	-172.875	88.72898	-1.95	0.051	-346.7806 1.030578
wa	-8.821122	14.36848	-0.61	0.539	-36.98283 19.34059
we	16.52873	46.50375	0.36	0.722	-74.61695 107.6744
_cons	1586.26	912.355	1.74	0.082	-201.9233 3374.442
/sigma	983.7262	94.44303	10.42	0.000	798.6213 1168.831

```

. //
. //
. // Censored regression (tobit)
. //
. // womenwk from IMEUS
. use womenwk,clear
. regress lwf age married children education

```

Source	SS	df	MS	Number of obs =	2000
				F( 4, 1995) =	134.21

Model	937.873188	4	234.468297	Prob > F	=	0.0000
Residual	3485.34135	1995	1.74703827	R-squared	=	0.2120
Total	4423.21454	1999	2.21271363	Adj R-squared	=	0.2105
				Root MSE	=	1.3218

  

lwf	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
age	.0363624	.003862	9.42	0.000	.0287885	.0439362
married	.3188214	.0690834	4.62	0.000	.1833381	.4543046
children	.3305009	.0213143	15.51	0.000	.2887004	.3723015
education	.0843345	.0102295	8.24	0.000	.0642729	.1043961
_cons	-1.077738	.1703218	-6.33	0.000	-1.411765	-.7437105

```
. tobit lwf age married children education, ll(0)
```

```
Tobit regression               Number of obs   =       2000
                               LR chi2(4)         =       461.85
                               Prob > chi2        =       0.0000
Log likelihood = -3349.9685     Pseudo R2      =       0.0645
```

lwf	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
age	.052157	.0057457	9.08	0.000	.0408888	.0634252
married	.4841801	.1035188	4.68	0.000	.2811639	.6871964
children	.4860021	.0317054	15.33	0.000	.4238229	.5481812
education	.1149492	.0150913	7.62	0.000	.0853529	.1445454
_cons	-2.807696	.2632565	-10.67	0.000	-3.323982	-2.291409
/sigma	1.872811	.040014			1.794337	1.951285

```
Obs. summary:      657 left-censored observations at lwf<=0
                   1343 uncensored observations
                   0 right-censored observations
```

```
. margins, predict(pr(0,.)) dydx(_all)
```

```
Average marginal effects           Number of obs   =       2000
Model VCE      : OIM
Expression     : Pr(lwf>0), predict(pr(0,.))
dy/dx w.r.t.  : age married children education
```

	Delta-method				[95% Conf. Interval]	
	dy/dx	Std. Err.	z	P> z		
age	.0071483	.0007873	9.08	0.000	.0056052	.0086914
married	.0663585	.0142009	4.67	0.000	.0385254	.0941917
children	.0666082	.0044677	14.91	0.000	.0578516	.0753649
education	.0157542	.0020695	7.61	0.000	.0116981	.0198103

```
. //
. //                               Regression with selection (heckman)
. //
. // note sign switch on children from tobit
. // twostep: note children now insignif in wage eqn
. heckman lw education age children, ///
> select(age married children education) nolog
```

```

Heckman selection model      Number of obs   =   2000
(regression model with sample selection)  Censored obs   =    657
                                          Uncensored obs =   1343
                                          Wald chi2(3)   =   454.78
Log likelihood = -1052.857      Prob > chi2     =    0.0000

```

	lw	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
lw							
	education	.0397189	.0024525	16.20	0.000	.0349121	.0445256
	age	.0075872	.0009748	7.78	0.000	.0056767	.0094977
	children	-.0180477	.0064544	-2.80	0.005	-.0306981	-.0053973
	_cons	2.305499	.0653024	35.30	0.000	2.177509	2.43349
select							
	age	.0350233	.0042344	8.27	0.000	.0267241	.0433225
	married	.4547724	.0735876	6.18	0.000	.3105434	.5990014
	children	.4538372	.0288398	15.74	0.000	.3973122	.5103621
	education	.0565136	.0110025	5.14	0.000	.0349492	.0780781
	_cons	-2.478055	.1927823	-12.85	0.000	-2.855901	-2.100208
	/athrho	.3377674	.1152251	2.93	0.003	.1119304	.5636045
	/lnsigma	-1.375543	.0246873	-55.72	0.000	-1.423929	-1.327156
	rho	.3254828	.1030183			.1114653	.5106469
	sigma	.2527024	.0062385			.2407662	.2652304
	lambda	.0822503	.0273475			.0286501	.1358505

```
LR test of indep. eqns. (rho = 0):   chi2(1) =    5.53   Prob > chi2 = 0.0187
```

```
. heckman lw education age children, ///
> select(age married children education) twostep
```

```

Heckman selection model -- two-step estimates  Number of obs   =   2000
(regression model with sample selection)      Censored obs   =    657
                                          Uncensored obs =   1343
                                          Wald chi2(3)   =   405.68
                                          Prob > chi2     =    0.0000

```

	lw	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
lw							
	education	.0427067	.003106	13.75	0.000	.0366191	.0487944
	age	.009322	.0014343	6.50	0.000	.0065108	.0121333
	children	-.0019549	.0115202	-0.17	0.865	-.0245341	.0206242
	_cons	2.124787	.1249789	17.00	0.000	1.879833	2.369741
select							
	age	.0347211	.0042293	8.21	0.000	.0264318	.0430105
	married	.4308575	.074208	5.81	0.000	.2854125	.5763025
	children	.4473249	.0287417	15.56	0.000	.3909922	.5036576
	education	.0583645	.0109742	5.32	0.000	.0368555	.0798735
	_cons	-2.467365	.1925635	-12.81	0.000	-2.844782	-2.089948

mills							
lambda		.1822815	.0638285	2.86	0.004	.05718	.307383
rho		0.66698					
sigma		.27329216					
lambda		.18228151	.0638285				

```
. //
. //                               Binomial probit with selection (heckprob)
. //
. // hmda from IMEUS
. summarize approve fanfred loanamt vacancy med_income appr_value ///
> black appl_income debt_inc_r, sep(0)
```

Variable	Obs	Mean	Std. Dev.	Min	Max
approve	2380	.8802521	.3247347	0	1
fanfred	2095	.3331742	.4714608	0	1
loanamt	2380	139.1353	83.42097	2	980
vacancy	2380	.4365546	.4960626	0	1
med_income	2380	.8294118	.3762278	0	1
appr_value	2380	198.5426	152.9863	25	4316
black	2380	.142437	.3495712	0	1
appl_income	2380	13.9406	116.9485	0	999.9994
debt_inc_r	2380	33.08136	10.72573	0	300

```
. heckprob fanfred loanamt vacancy med_income appr_value, ///
> sel(approve= black appl_income debt_inc_r) nolog
Probit model with sample selection           Number of obs   =   2380
                                             Censored obs     =   285
                                             Uncensored obs   =   2095
                                             Wald chi2(4)    =   80.69
Log likelihood = -2063.066                 Prob > chi2      =   0.0000
```

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
fanfred						
loanamt	-.0026434	.0008029	-3.29	0.001	-.0042169	-.0010698
vacancy	-.2163306	.0609798	-3.55	0.000	-.3358488	-.0968124
med_income	.2671338	.0893349	2.99	0.003	.0920407	.4422269
appr_value	-.0014358	.0005099	-2.82	0.005	-.0024351	-.0004364
_cons	.1684829	.1182054	1.43	0.154	-.0631954	.4001612
approve						
black	-.7343534	.081858	-8.97	0.000	-.8947921	-.5739147
appl_income	-.0006596	.000236	-2.80	0.005	-.0011221	-.0001971
debt_inc_r	-.0262367	.0036441	-7.20	0.000	-.033379	-.0190944
_cons	2.236424	.1319309	16.95	0.000	1.977844	2.495004
/athrho	-.6006626	.271254	-2.21	0.027	-1.132311	-.0690146
rho	-.5375209	.1928809			-.8118086	-.0689052

```
LR test of indep. eqns. (rho = 0):   chi2(1) =    4.99   Prob > chi2 = 0.0255
```