Binomial probit: `probit`

```
. 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
Log likelihood = -1027.0616                       Pseudo R2       =     0.1889
```

work	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
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

Marginal effects: `mfx`

```
. mfx compute
Marginal effects after probit
      y  = Pr(work) (predict)
         =  .71835948
```

variable	dy/dx	Std. Err.	z	P>|z|	[	95% C.I.	]	X
age	.011721	.00142	8.25	0.000	.008935	.014507		36.208
married*	.150478	.02641	5.70	0.000	.098716	.20224		.6705
children	.1510059	.00922	16.38	0.000	.132939	.169073		1.6445
educat~n	.0197024	.0037	5.32	0.000	.012442	.026963		13.084

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Average marginal effects: `margeff`

```
. margeff, dummies(married) count
Average marginal effects on Prob(work==1) after probit
Variables treated as counts:           age children education
```

work	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	.0100178	.0011512	8.70	0.000	.0077615	.0122742
married	.1292759	.0225035	5.74	0.000	.0851698	.173382
children	.1181349	.0057959	20.38	0.000	.106775	.1294947
education	.0167698	.0030558	5.49	0.000	.0107806	.0227591

Binomial logit: `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     .0437774    .0720833
     married |   .7417775   .1264704     5.87   0.000     .4939001    .9896549
    children |   .7644882   .0515287    14.84   0.000     .6634938    .8654827
   education |   .0982513   .0186522     5.27   0.000     .0616936    .1348089
       _cons |  -4.159247   .3320397   -12.53   0.000    -4.810033   -3.508462
------------------------------------------------------------------------------
```

```
. mfx compute
Marginal effects after logit
      y  = Pr(work) (predict)
         =  .72678588
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.      z    P>|z|  [    95% C.I.   ]       X
---------+--------------------------------------------------------------------
     age |   .0115031      .00142     8.08   0.000   .008713  .014293    36.208
 married*|   .1545671      .02703     5.72   0.000   .101592  .207542     .6705
children |    .151803      .00938    16.19   0.000   .133425  .170181    1.6445
educat~n |   .0195096       .0037     5.27   0.000    .01226   .02676    13.084
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

```
. mfx compute, at(children=0)
warning: no value assigned in at() for variables age married education;
   means used for age married education
Marginal effects after logit
      y  = Pr(work) (predict)
         =  .43074191
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.      z    P>|z|  [    95% C.I.   ]       X
---------+--------------------------------------------------------------------
     age |   .0142047      .00178     7.97   0.000    .01071    .0177    36.208
 married*|   .1762562      .02825     6.24   0.000   .120897  .231615     .6705
children |   .1874551      .01115    16.82   0.000   .165609  .209301         0
educat~n |   .0240915      .00458     5.26   0.000   .015115  .033068    13.084
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

Ordered probit: oprobit

```
. 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
Log likelihood = -127.27146                     Pseudo R2       =     0.0434
```

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			-.8852931	.5146825
/cut2	1.185726	.3882098			.4248489	1.946603
/cut3	1.908412	.4164895			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

Truncated regression: truncreg

```
. 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		
Model	7326995.15	4	1831748.79	Number of obs =	150
Residual	94793104.2	145	653745.546	F(4, 145) =	2.80
				Prob > F =	0.0281
				R-squared =	0.0717
				Adj R-squared =	0.0461
Total	102120099	149	685369.794	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                      Number of obs =    150
         upper =       +inf                      Wald chi2(4)  =  10.05
Log likelihood = -1200.9157                      Prob > chi2   = 0.0395
```

whrs	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
eq1						
kl6	-803.0042	321.3614	-2.50	0.012	-1432.861	-173.1474
k618	-172.875	88.72898	-1.95	0.051	-346.7806	1.030579
wa	-8.821123	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						
_cons	983.7262	94.44303	10.42	0.000	798.6213	1168.831

Censored regression: `tobit`

```
. use womenwk,clear
. regress lwf age married children education
```

Source	SS	df	MS	Number of obs =	2000
Model	937.873188	4	234.468297	F(4, 1995) =	134.21
Residual	3485.34135	1995	1.74703827	Prob > F =	0.0000
				R-squared =	0.2120
				Adj R-squared =	0.2105
Total	4423.21454	1999	2.21271363	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
```

```
. mfx compute, predict(pr(0,.))
Marginal effects after tobit
      y  = Pr(lwf>0) (predict, pr(0,.))
         =  .81920975
```

variable	dy/dx	Std. Err.	z	P>|z|	[	95% C.I.	]	X
age	.0073278	.00083	8.84	0.000	.005703	.008952		36.208
married*	.0706994	.01576	4.48	0.000	.039803	.101596		.6705
children	.0682813	.00479	14.26	0.000	.058899	.077663		1.6445
educat~n	.0161499	.00216	7.48	0.000	.011918	.020382		13.084

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx compute, predict(e(0,.))
Marginal effects after tobit
      y  = E(lwf|lwf>0) (predict, e(0,.))
         =  2.3102021
```

variable	dy/dx	Std. Err.	z	P>|z|	[	95% C.I.	]	X
age	.0314922	.00347	9.08	0.000	.024695	.03829		36.208
married*	.2861047	.05982	4.78	0.000	.168855	.403354		.6705
children	.2934463	.01908	15.38	0.000	.256041	.330852		1.6445
educat~n	.0694059	.00912	7.61	0.000	.051531	.087281		13.084

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Regression with selection: `heckman`

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

Heckman selection model (regression model with sample selection)

Number of obs	= 2000
Censored obs	= 657
Uncensored obs	= 1343
Wald chi2(3)	= 454.78
Prob > chi2	= 0.0000

Log likelihood = -1052.857

	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 (regression model with sample selection)

Number of obs	= 2000
Censored obs	= 657
Uncensored obs	= 1343
Wald chi2(6)	= 737.21
Prob > chi2	= 0.0000

	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`

```
. 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
Prob > chi2	= 0.0000

Log likelihood = -2063.066

	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