

## Annotated Mplus Output

### Censored Regression

This page shows an example of censored regression with footnotes explaining the output. First an example is shown using Stata, and then an example is shown using Mplus, to help you relate the output you are likely to be familiar with (Stata) to output that may be new to you (Mplus). We suggest that you view this page using two web browsers so you can show the page side by side showing the Stata output in one browser and the corresponding Mplus output in the other browser.

This example is drawn from the Mplus User's Guide (example 3.2) and we suggest that you see the Mplus User's Guide for more details about this example. We thank the kind people at Muthén & Muthén for permission to use examples from their manual.

#### Example Using Stata

Here is a probit regression example using Stata with two continuous predictors **x1** and **x2** used to predict a binary outcome variable, **u1**.

```
infile u1 x1 x3 using http://www.ats.ucla.edu/stat/mplus/output/ex3.2.dat, clear
```

```
summarize u1
```

Variable	Obs	Mean	Std. Dev.	Min	Max
u1	1000	.9240341	1.113079	0 <sup>A</sup>	6.579389

```
tobit u1 x1 x3, ll(0)
```

Tobit regression	Number of obs	=	1000
	LR chi2(2)	=	697.44
	Prob > chi2	=	0.0000
Log likelihood = -1142.8851	Pseudo R2	=	0.2338

u1	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
x1	1.074801 <sup>D</sup>	.0419657	25.61	0.000	.9924498 1.157152
x3	.4947541 <sup>D</sup>	.0378985	13.05	0.000	.4203842 .569124
_cons	.5154865 <sup>E</sup>	.0405066	12.73	0.000	.4359986 .5949743
/sigma	1.071333 <sup>F</sup>	.0316242			1.009276 1.133391

```
Obs. summary:      376 left-censored observations at u1<=0
                  624 uncensored observations
                  0 right-censored observations
```

```
estat ic
```

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	1000	-1491.605	-1142.885 <sup>B</sup>	4	2293.77 <sup>C</sup>	2313.401 <sup>C</sup>

The output is labeled with superscripts to help you relate the later Mplus output to this Stata output. To summarize the output, both predictors in this model, **x1** and **x2**, are significantly related to the outcome variable, **u1**.

#### Mplus Example

Here is the same example illustrated in Mplus based on the [ex3.2.dat](http://www.ats.ucla.edu/stat/mplus/output/ex3.2.dat) data file. Note that by using **estimator=wls**; (weighted least squares) the results are shown in a probit metric. Had we specified something like **estimator=ml**; (maximum likelihood) then the results would be shown in a logit scale.

#### TITLE:

```
this is an example of a censored
regression for a censored dependent
variable with two covariates
```

#### DATA:

```

FILE IS ex3.2.dat;
VARIABLE:
  NAMES ARE y1 x1 x3;
  CENSORED ARE y1 (b);
ANALYSIS:
  ESTIMATOR = MLR;
MODEL:
  y1 ON x1 x3;

```

## SUMMARY OF ANALYSIS

&lt;some output omitted to save space&gt;

Number of observations

1000

&lt;some output omitted to save space&gt;

## SUMMARY OF CENSORED LIMITS

Y1	0.000 <sup>A</sup>
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THE MODEL ESTIMATION TERMINATED NORMALLY

## TESTS OF MODEL FIT

Loglikelihood

H0 Value	-1142.885 <sup>B</sup>
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## Information Criteria

Number of Free Parameters	4
Akaike (AIC)	2293.770 <sup>C</sup>
Bayesian (BIC)	2313.401 <sup>C</sup>
Sample-Size Adjusted BIC	2300.697
(n* = (n + 2) / 24)	




## MODEL RESULTS

		Estimates	S.E.	Est./S.E.
Y1	ON			
	X1	1.075 <sup>D</sup>	0.043	25.101
	X3	0.495 <sup>D</sup>	0.037	13.344
Intercepts				
	Y1	0.515 <sup>E</sup>	0.040	12.810
Residual Variances				
	Y1	1.148 <sup>F</sup>	0.067	17.235

- A. This indicates that the variable **y1** is censored at 0. This is derived from the data, where Mplus notes that the lowest value of **y1** is 0 (it seeks the lowest value because the input specification indicated the censoring was from below). Note how this corresponds to the results of the Stata **summarize** command that found the minimum value of **y1** to be 0.
- B. This is the log likelihood of the model. Note how this corresponds to the **ll(model)** from the Stata **estat ic** command.
- C. These are the AIC and BIC fit indices, and correspond to the values shown from the **estat ic** command from Stata.
- D. These are the regression coefficients showing the relationship between **x1 x2** and **y1**. Such coefficients are interpreted in the same way as an OLS regression coefficient. The difference is that these coefficients attempt to estimate how estimate how strong the coefficient would have been had the censoring not taken place. Note the correspondence between these coefficients and those from Stata.
- E. This is the intercept, the predicted value when all predictors are held constant at 0. Note the correspondence to the value shown in the Stata output.
- F. This is the residual variance in **y1** after accounting for the predictors, and would be analogous to the MSE from an OLS regression. In the Stata output this is reported as **/sigma** and is reported as a standard deviation (as opposed to a variance). Squaring the value from Stata yields  $1.071333^2 = 1.1477544$ , corresponding to the result from Mplus.

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