Example 43g — Tobit regression

Description

Tobit regression is demonstrated using auto.dta:

. use https://www.stata-press.com/data/r17/auto
   (1978 automobile data)
   . generate wgt = weight/1000

See Structural models 1: Linear regression in [SEM] Intro 5 for background.

Remarks and examples

Remarks are presented under the following headings:

Fitting tobit regression models
Fitting the model with the Builder

Fitting tobit regression models

The first example in [R] tobit is

. tobit mpg wgt, ll(17)

This model corresponds to

Censoring information does not appear in the path diagram by default. It can be added to the path diagram by customizing the appearance of mpg in the Builder. The Builder reports the censoring information for mpg in the Details pane.
To fit this model with \texttt{gsem}, we type

\begin{verbatim}
  . gsem mpg <- wgt, family(gaussian, lensored(17))
\end{verbatim}

Refining starting values:

Grid node 0:  log likelihood = -170.32555

Fitting full model:

Iteration 0:  log likelihood = -170.32555
Iteration 1:  log likelihood = -164.66209
Iteration 2:  log likelihood = -164.25471
Iteration 3:  log likelihood = -164.25438
Iteration 4:  log likelihood = -164.25438

Generalized structural equation model

| Response: mpg | Uncensored = 56 |
| Lower limit: 17 | Left-censored = 18 |
| Family: Gaussian | Right-censored = 0 |
| Link: Identity |

Log likelihood = -164.25438

| Coefficient | Std. err. | z | P>|z| | [95% conf. interval] |
|-------------|-----------|---|-------|-------------------|
| mpg | wgt | -6.87305 | .700257 | -9.82 | 0.000 | -8.245529 | -5.500572 |
| | _cons | 41.49856 | 2.058384 | 20.16 | 0.000 | 37.4642 | 45.53291 |
| var(e.mpg) | 14.78942 | 2.817609 | 10.18 | 0.000 | 10.18085 | 21.48414 |

Notes:
1. The reported coefficients and standard errors (SEs) match those reported by \texttt{tobit}.
2. \texttt{gsem} reports the point estimate of \( e.mpg \) as 14.78942. This is an estimate of \( \sigma^2 \), the error variance. \texttt{tobit} reports an estimated \( \sigma \) as 3.845701. And \( \sqrt{14.78942} = 3.8457 \).

Fitting the model with the Builder

Use the diagram in \textit{Fitting tobit regression models} above for reference.

1. Open the dataset and create the rescaled weight variable.

   In the Command window, type

   \begin{verbatim}
   . use https://www.stata-press.com/data/r17/auto
   . generate wgt = weight/1000
   \end{verbatim}

2. Open a new Builder diagram.

   Select menu item \textbf{Statistics} > \textbf{SEM (structural equation modeling)} > \textbf{Model building and estimation}.

3. Put the Builder in \texttt{gsem} mode by clicking on the \( \text{GSEM} \) button.

4. Create the independent variable.

   a. Select the Add observed variable tool, \( \square \).
   b. Click in the diagram about one-fourth of the way in from the left and half of the way up from the bottom.
   c. In the Contextual Toolbar, use the \textit{Variable} control to select the variable \texttt{wgt}.
5. Create the tobit response.
   a. Select the Add generalized response variable tool, □.
   b. Click about one-third of the way in from the right side of the diagram, to the right of the wgt rectangle.
   c. In the Contextual Toolbar, select Gaussian, Identity in the Family/Link control (it may already be selected).
   d. In the Contextual Toolbar, use the Variable control to select the variable mpg.
   e. In the Contextual Toolbar, click on the Properties... button.
   f. In the resulting Variable properties dialog box, click on the Censoring... button in the Variable tab.
   g. In the resulting Censoring dialog box, select the Left-censored radio button. In the resulting Left censoring box below, select the Constant radio button (it may already be selected), and type 17 in the Constant control.
   h. Click on OK in the Censoring dialog box, and then click on OK in the Variable properties dialog box. The Details pane will now show the censoring information for mpg.

6. Create a path from the independent variable to the dependent variable.
   a. Select the Add path tool, –.
   b. Click in the right side of the wgt rectangle (it will highlight when you hover over it), and drag a path to the left side of the mpg rectangle (it will highlight when you can release to connect the path).

7. Estimate.
   Click on the Estimate button, ▼, in the Standard Toolbar, and then click on OK in the resulting GSEM estimation options dialog box.

   You can open a completed diagram in the Builder by typing
   . webgetsem gsem_tobit

Also see

[SEM] Example 38g — Random-intercept and random-slope models (multilevel)
[SEM] Example 44g — Interval regression
[SEM] Example 45g — Heckman selection model
[SEM] Example 46g — Endogenous treatment-effects model
[SEM] Intro 5 — Tour of models
[SEM] gsem — Generalized structural equation model estimation command