Using Macro %truncated to Fit Zero-truncated Poisson and Negative Binomial Models

This example demonstrates how to use %truncated to model zero-truncated Poisson (XTP) and negative binomial (ZTNB) data.

1 Data set

We use the following code to simulate a data set following a Poisson model.

```sas
data A;
call streaminit(2014); /* set random number seed */
do i = 0 to 1000;
x1 = rand('NORMAL');
x2 = rand('UNIFORM');
y = rand('POISSON',exp(.5+x1-x2));
output;
end;
run;
```

2 Model and Code

The macro takes the following arguments:

a. data. The data set to be analyzed;
b. response. The outcome variable;
c. model. A list of the terms in the linear predictor. Intercept is automatically added. Use of "|" and "*" for interactions is allowed.
d. dist. By default, the macro fits a ZTP model. One can specify dist=nb to fit a ZTNB model.

The macro will not check the outcome variable. Only observations with positive outcomes are used in the analysis; observations with 0 outcomes are automatically excluded. For example, there are a total of 1001 subjects in data A. However, there are 386 subjects with 0 in the outcome variable y, so only 615 subjects are used in the analyses of the following two zero-truncated models.

First we fit the data set A with the following ZTP model

\[ y|(x_1, x_2) \sim ZTP(\exp(\beta_0 + \beta_1 x_1 + \beta_2 x_2)). \]

Code: %truncated(data=a,response=y,model=x1 x2)

Then, we fit the data set A with the following ZTNB model

\[ y|(x_1, x_2) \sim ZTNB(\exp(\beta_0 + \beta_1 x_1 + \beta_2 x_2)). \]

Code: %truncated(data=a,response=y,model=x1 x2,dist=nb)
3 Output

This macro outputs the output from the NLMIXED procedure, including information about the data set, dependent variable, optimization technique, iteration history, convergence status, as well as the parameter estimates. All the parameters have a prefix “beta_” and the intercept is “beta_1”.

The output for the ZTP model is

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Standard Error</th>
<th>DF</th>
<th>t Value</th>
<th>Pr &gt;</th>
<th>Alpha</th>
<th>Lower</th>
<th>Upper</th>
<th>Gradient</th>
</tr>
</thead>
<tbody>
<tr>
<td>beta_x1</td>
<td>1.0068</td>
<td>0.03025</td>
<td>615</td>
<td>33.28</td>
<td>&lt;.0001</td>
<td>0.05</td>
<td>0.9474</td>
<td>1.0662</td>
<td>-0.00009</td>
</tr>
<tr>
<td>beta_x2</td>
<td>-0.9516</td>
<td>0.09681</td>
<td>615</td>
<td>-9.83</td>
<td>&lt;.0001</td>
<td>0.05</td>
<td>-1.1417</td>
<td>-0.7614</td>
<td>-0.00008</td>
</tr>
<tr>
<td>beta_1</td>
<td>0.5376</td>
<td>0.06052</td>
<td>615</td>
<td>8.88</td>
<td>&lt;.0001</td>
<td>0.05</td>
<td>0.4187</td>
<td>0.6564</td>
<td>-0.00012</td>
</tr>
</tbody>
</table>

The output for the ZTNB model is

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Gradient</th>
</tr>
</thead>
<tbody>
<tr>
<td>beta_x1</td>
<td>1.0068</td>
<td>-0.16069</td>
</tr>
<tr>
<td>beta_x2</td>
<td>-0.9519</td>
<td>-0.0661</td>
</tr>
<tr>
<td>beta_1</td>
<td>0.5377</td>
<td>-0.06943</td>
</tr>
<tr>
<td>k</td>
<td>9.37E-10</td>
<td>1495976</td>
</tr>
</tbody>
</table>

Note that there is an error message for the ZTNB model, saying that optimization cannot be completed, this is because the data was simulated based on a Poisson distribution.