This example demonstrates how %GEEZIP is used to model pre and post zero inflated count data with continuous covariates.

The data used in this example was simulated. For each observation i, there are three independent continuous covariates $x_{i1,}x_{i2,}x_{i3}$, each of which follows a normal distribution $N(1,1)$. The bivariate pre and post count response $y_i = (y_{i1}, y_{i2})$ satisfies the following marginal ZIP model:

$$y_{it}|x_{i1,}x_{i2,}x_{i3} \sim ZIP(\rho_i, \mu_i)$$

$$logit(\rho_i) = \beta_{u0}$$

$$\log(\mu_i) = \beta_0 + x_{i1}\,\beta_1 + x_{i2}\beta_2 + x_{i3}\beta_3$$

In the simulated data, we set $\beta_{u0} = -1;\ \beta_0 = \beta_1 = \beta_2 = \beta_3 = 1$.

The simulated data used to demonstrate is shown below

```
data mydata;
  input id count time x1 x2 x3 @@;
  datalines;
1     37    1     0.06155278  2.148548496 0.434040304
2     139   1     1.801373099 0.080430585 2.092864909
3     15    1     -0.504148447      1.158435425 0.771048924
4     1     1     -0.686471459      0.355961741 -0.145750225
5     7     1     -0.820546857      0.442175622 1.825474402
6     11    1     0.268240074 0.802493407 0.080893178
7     0     1     -0.493636867      0.375293153 0.573253225
8     8     1     0.72767749  0.070195021 -0.228101346
9     23    1     0.527134111 1.196801133 0.589503425
10    5     1     -1.540530272      1.619615831 1.071691351
11    200   1     0.934676218 1.012937027 2.408493739
12    321   1     1.613109628 1.395561261 1.772718184
13    86    1     -0.665947638      2.601282293 1.476294195
14    0     1     2.58609672  0.070249734 1.204037005
15    75    1     1.633343397 0.058584787 1.501908833
16    4117  1     2.158476338 2.344014304 2.809786812
17    13    1     1.639288732 0.140851515 0.190201761
18    10    1     -0.26405467 0.915985131 0.848716353
19    0     1     -0.132223162      1.041922045 1.864684555
20    4     1     0.284495636 0.100280935 0.238173281
21    0     1     -0.07853971 2.345437551 -0.133841944
22    1543  1     2.815858844 1.584458271 1.939240632
23    106   1     1.815947006 1.204528823 0.510764623
24    6     1     -0.919935918      1.01288542  1.441913079
25    0     1     1.600916988 0.987582435 0.001774726
26    74    1     -0.805464711      0.700728191 3.417625719
27    40    1     1.158006518 0.318182064 1.247635988
28    0     1     1.832724378 1.880785968 0.382622566
29    0     1     0.669880454 0.038102551 0.630297368
30    241   1     1.041165514 1.682074495 1.799590357
31    5     1     1.826781029 -1.936939901      0.954953194
32    45    1     1.298312616 0.588530186 0.835506127
33    952   1     1.205678291 1.122062448 3.524682698
34    2     1     -0.248608134      0.25198281  0.913111879
```

35	109	1	3.102556754	1.124687414	-0.416833253
36	213	1	1.01369739	1.218032003	2.181664059
37	0	1	0.491717946	2.686430712	1.264299687
38	57	1	1.538281573	1.640759419	-0.388871051
39	76	1	0.831307714	1.110495127	1.505124911
40	29	1	0.10000232	2.629723576	-0.495964427
41	0	1	2.237064622	1.201867297	0.516706244
42	2	1	-1.028786768	0.330159096	0.191258677
43	20	1	-0.138692937	1.364370033	0.618534677
44	90	1	1.933672104	1.591918153	-0.197365162
45	0	1	0.492817929	-0.719812154	0.019198246
46	13	1	0.172185728	1.240199677	0.417637589
47	19	1	0.285813009	0.590229573	1.419569923
48	1	1	-0.820661872	-0.38471966	1.124148233
49	26	1	1.394492725	-0.268906917	1.041842922
50	107	1	1.998495218	1.093543328	0.665449117
51	1053	1	0.979190049	2.444203043	2.490915015
52	21	1	1.874292524	0.098065975	0.254254291
53	31	1	1.226109818	0.527391491	0.644971437
54	0	1	2.356911517	0.775583104	1.859593196
55	155	1	2.299232416	2.500828472	-0.728587176
56	65	1	1.217483374	1.481188675	0.497854519
57	26	1	1.48400698	-0.815609677	1.300043223
58	0	1	2.48713067	0.90949837	0.831035604
59	0	1	1.315560455	0.150026561	0.493335813
60	4	1	-0.644685681	1.105909031	-0.442400788
61	534	1	2.321458044	1.370274483	1.559825769
62	13	1	-0.460574532	-0.198342202	2.275644021
63	280	1	1.62745939	2.096186064	0.907013322
64	1	1	-1.462302942	0.131325555	0.808617873
65	60	1	2.628936719	0.134406434	0.446405554
66	32	1	1.294384341	1.18273574	-0.231874576
67	14	1	0.08413495	1.949344126	-0.382151923
68	87	1	-0.411609242	1.708463382	2.053365065
69	3	1	-0.554934502	-0.167479704	-0.131514797
70	0	1	-1.101663245	0.935372333	-0.86894494
71	12	1	0.189842914	2.21741084	-0.788981857
72	0	1	0.740625863	0.794476382	0.71140164
73	0	1	1.715290086	2.143801108	0.816039282
74	0	1	1.252572723	3.022170235	-0.004890403
75	25	1	-0.373922989	0.056760082	2.416334131
76	11	1	1.411277797	-0.3071286	-0.076262558
77	260	1	1.058433007	1.960420741	1.494615753
78	10	1	1.04273236	-0.236274723	0.332190734
79	0	1	1.582046761	1.135317898	0.595587385
80	56	1	1.852239065	0.420771426	0.84740689
81	0	1	-0.095761603	1.702980397	0.906572762
82	0	1	-1.484126124	0.724602174	0.52956048
83	53	1	0.728951443	1.151280293	1.008606828
84	71	1	1.024409437	1.374301981	0.687993842
85	0	1	-1.01518042	0.054318734	1.487828812
86	0	1	-0.172992781	-0.617774526	1.395822374
87	95	1	2.354415617	1.134775138	-0.130221596
88	232	1	3.598660247	1.893259548	-1.095419869
89	16	1	1.708743348	0.830808035	-0.805728862
90	31	1	0.8056603	0.862692183	0.856548543
91	98	1	0.854586785	2.390460476	0.312085051

92	485	1	1.769052428	3.404715908	0.057472015
93	320	1	1.111846819	2.209737982	1.589324759
94	0	1	0.984481251	1.121123717	0.749495271
95	3178	1	2.563733829	2.468397009	2.013996089
96	61	1	2.15334645	0.178267871	0.843308478
97	0	1	-0.127117911	0.564778856	0.038863895
98	182	1	0.905156631	0.819153039	2.571524279
99	60	1	1.390395848	1.56900858	0.487291816
100	3166	1	2.355217089	1.50671147	3.209739736
1	43	2	0.06155278	2.148548496	0.434040304
2	145	2	1.801373099	0.080430585	2.092864909
3	12	2	-0.504148447	1.158435425	0.771048924
4	0	2	-0.686471459	0.355961741	-0.145750225
5	13	2	-0.820546857	0.442175622	1.825474402
6	9	2	0.268240074	0.802493407	0.080893178
7	0	2	-0.493636867	0.375293153	0.573253225
8	5	2	0.72767749	0.070195021	-0.228101346
9	32	2	0.527134111	1.196801133	0.589503425
10	10	2	-1.540530272	1.619615831	1.071691351
11	195	2	0.934676218	1.012937027	2.408493739
12	321	2	1.613109628	1.395561261	1.772718184
13	90	2	-0.665947638	2.601282293	1.476294195
14	0	2	2.58609672	0.070249734	1.204037005
15	62	2	1.633343397	0.058584787	1.501908833
16	4019	2	2.158476338	2.344014304	2.809786812
17	20	2	1.639288732	0.140851515	0.190201761
18	12	2	-0.26405467	0.915985131	0.848716353
19	0	2	-0.132223162	1.041922045	1.864684555
20	7	2	0.284495636	0.100280935	0.238173281
21	0	2	-0.07853971	2.345437551	-0.133841944
22	1569	2	2.815858844	1.584458271	1.939240632
23	94	2	1.815947006	1.204528823	0.510764623
24	15	2	-0.919935918	1.01288542	1.441913079
25	0	2	1.600916988	0.987582435	0.001774726
26	74	2	-0.805464711	0.700728191	3.417625719
27	43	2	1.158006518	0.318182064	1.247635988
28	0	2	1.832724378	1.880785968	0.382622566
29	0	2	0.669880454	0.038102551	0.630297368
30	259	2	1.041165514	1.682074495	1.799590357
31	7	2	1.826781029	-1.936939901	0.954953194
32	43	2	1.298312616	0.588530186	0.835506127
33	934	2	1.205678291	1.122062448	3.524682698
34	5	2	-0.248608134	0.25198281	0.913111879
35	115	2	3.102556754	1.124687414	-0.416833253
36	228	2	1.01369739	1.218032003	2.181664059
37	0	2	0.491717946	2.686430712	1.264299687
38	52	2	1.538281573	1.640759419	-0.388871051
39	95	2	0.831307714	1.110495127	1.505124911
40	28	2	0.10000232	2.629723576	-0.495964427
41	0	2	2.237064622	1.201867297	0.516706244
42	1	2	-1.028786768	0.330159096	0.191258677
43	19	2	-0.138692937	1.364370033	0.618534677
44	84	2	1.933672104	1.591918153	-0.197365162
45	0	2	0.492817929	-0.719812154	0.019198246
46	14	2	0.172185728	1.240199677	0.417637589
47	30	2	0.285813009	0.590229573	1.419569923
48	1	2	-0.820661872	-0.38471966	1.124148233

```
49    24    2    1.394492725 -0.268906917      1.041842922
50    132   2    1.998495218 1.093543328 0.665449117
51    965   2    0.979190049 2.444203043 2.490915015
52    21    2    1.874292524 0.098065975 0.254254291
53    36    2    1.226109818 0.527391491 0.644971437
54    0     2    2.356911517 0.775583104 1.859593196
55    173   2    2.299232416 2.500828472 -0.728587176
56    81    2    1.217483374 1.481188675 0.497854519
57    19    2    1.48400698  -0.815609677      1.300043223
58    0     2    2.48713067  0.90949837  0.831035604
59    0     2    1.315560455 0.150026561 0.493335813
60    2     2    -0.644685681      1.105909031 -0.442400788
61    506   2    2.321458044 1.370274483 1.559825769
62    14    2    -0.460574532      -0.198342202      2.275644021
63    259   2    1.62745939  2.096186064 0.907013322
64    0     2    -1.462302942      0.131325555 0.808617873
65    75    2    2.628936719 0.134406434 0.446405554
66    29    2    1.294384341 1.18273574  -0.231874576
67    15    2    0.08413495  1.949344126 -0.382151923
68    87    2    -0.411609242      1.708463382 2.053365065
69    0     2    -0.554934502      -0.167479704      -0.131514797
70    0     2    -1.101663245      0.935372333 -0.86894494
71    10    2    0.189842914 2.21741084  -0.788981857
72    0     2    0.740625863 0.794476382 0.71140164
73    0     2    1.715290086 2.143801108 0.816039282
74    0     2    1.252572723 3.022170235 -0.004890403
75    25    2    -0.373922989      0.056760082 2.416334131
76    11    2    1.411277797 -0.3071286  -0.076262558
77    242   2    1.058433007 1.960420741 1.494615753
78    8     2    1.04273236  -0.236274723      0.332190734
79    0     2    1.582046761 1.135317898 0.595587385
80    63    2    1.852239065 0.420771426 0.84740689
81    0     2    -0.095761603      1.702980397 0.906572762
82    0     2    -1.484126124      0.724602174 0.52956048
83    65    2    0.728951443 1.151280293 1.008606828
84    53    2    1.024409437 1.374301981 0.687993842
85    9     2    -1.01518042 0.054318734 1.487828812
86    0     2    -0.172992781      -0.617774526      1.395822374
87    70    2    2.354415617 1.134775138 -0.130221596
88    203   2    3.598660247 1.893259548 -1.095419869
89    13    2    1.708743348 0.830808035 -0.805728862
90    29    2    0.8056603   0.862692183 0.856548543
91    94    2    0.854586785 2.390460476 0.312085051
92    500   2    1.769052428 3.404715908 0.057472015
93    389   2    1.111846819 2.209737982 1.589324759
94    0     2    0.984481251 1.121123717 0.749495271
95    3066  2    2.563733829 2.468397009 2.013996089
96    72    2    2.15334645  0.178267871 0.843308478
97    0     2    -0.127117911      0.564778856 0.038863895
98    188   2    0.905156631 0.819153039 2.571524279
99    83    2    1.390395848 1.56900858  0.487291816
100   3220  2    2.355217089 1.50671147  3.209739736
;
run;
```

The macro is used to fit the above data set to estimate the parameter value $\theta = (\beta_{u0}, \beta_0, \beta_1, \beta_2, \beta_3)$ and its corresponding asymptotic variances. The following statements should be used:

```
filename GEEZIP URL
"http://www.ctspedia.org/wiki/pub/CTSpedia/StatToolsTopic051/Rochester_GEEZIP
.sas";
%include GEEZIP;


%GEEZIP(DSName=mydata,
            Outcome=count,
            PredictNum=x1 x2 x3,
            ID=id,
            Time=time,
            OutForm=);
```

The output generated from these statements are the parameter estimate *theta* and the asymptotic standard deviation *sigma*:

theta=(-1.25, 0.81, 1.07, 1.03, 1.07)

sigma=(0.24, 0.14, 0.06, 0.07, 0.05)