WWS 509 Generalized Linear Models: Precept 9
Ordered Logit Models

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Introducing the Data

For this precept, I have taken some data from an unnamed African country. Do not cite this data! The outcome of interest is where water is collected. The options I have limited us to are in the dwelling, in the yard, and in public. This might not be the perfect data, but for an introduction it will have to do. For the sake of simplicity, we are only using 2 predictor variables, if the household has electricity and if they share a toilet with another household.

Ordinal Logit Models

- There is just _____ equation
  - Therefore, it is more _____ than a multinomial or a hierarchical logit model
- We will be focusing on the _____ distribution of the response
  - Look at if the response falls in the j-th category or _____.
- If x_{ik} increases by one, then all transformed cumulative probabilities increase by _____.
  - By focusing on the cumulative probabilities we can postulate a _____ effect.
- Models can also be interpreted in terms of a _____ variable.

Interpretation

1. What are two ways that we can interpret the coefficients?
2. Interpret having electricity on how close your water is to you.
3. Repeat this for sharing a toilet.
4. What proportion of respondents would you predict to be in each group of water access for those who do not have electricity but have their own toilet?
5. What about for those with electricity and their own toilet?
6. What about those with no electricity and who share a toilet?

Remember the other types of models?

Multinomial Logit Model

1. How does Stata know which group I want as the comparison group?
2. What is the odds ratio for a person with electricity of having water in the yard compared to in public in this model? Of in the house compared to in public?
3. Do you see anything interesting about toilets in this model?

Sequential Logit Model

1. How did I model this sequential model?
2. What is the odds for someone with electricity of having water on their property compared to someone with no electricity (and the same toilet status)? Of those people, what is the odds that it will be in their home?

Appendices

Ordered Logit Output

```
. ologit water_source electricity share_toilet

Iteration 0:   log likelihood = -1781.7256
Iteration 1:   log likelihood = -1585.0625
Iteration 2:   log likelihood = -1579.6235
Iteration 3:   log likelihood = -1579.5854
Iteration 4:   log likelihood = -1579.5854

Ordered logistic regression                     Number of obs   =       1863
                                                LR chi2(2)      =     404.28
                                                Prob > chi2     =     0.0000
Log likelihood = -1579.5854                     Pseudo R2       =     0.1135

------------------------------------------------------------------------------
water_source |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 electricity |   1.881642   .1096477    17.16   0.000     1.666736    2.096547
share_toilet |   -.512978   .0907311    -5.65   0.000    -.6908077   -.3351483
-------------+----------------------------------------------------------------
       /cut1 |   1.063665   .1022085                      .8633398     1.26399
       /cut2 |   1.666083   .1061882                      1.457958    1.874208
------------------------------------------------------------------------------
```

Multinomial Logit Output

```
mlogit water_source electricity share_toilet, baseoutcome(1)

Iteration 0:   log likelihood = -1781.7256
Iteration 1:   log likelihood = -1584.5094
Iteration 2:   log likelihood = -1577.2981
Iteration 3:   log likelihood = -1577.2097
Iteration 4:   log likelihood = -1577.2097

Multinomial logistic regression                 Number of obs   =       1863
                                                LR chi2(4)      =     409.03
                                                Prob > chi2     =     0.0000
Log likelihood = -1577.2097                     Pseudo R2       =     0.1148

------------------------------------------------------------------------------
water_source |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Public       |  (base outcome)
-------------+----------------------------------------------------------------
Yard         |
 electricity |   1.569986   .1729951     9.08   0.000     1.230922    1.909051
share_toilet |  -.0836952   .0791802    -1.06   0.291    -.2388856    .0714952
       _cons |   -2.40183   .1558904   -15.41   0.000     -2.70737    -2.09629
-------------+----------------------------------------------------------------
Dwelling     |
 electricity |   2.027441   .1276683    15.88   0.000     1.777216    2.277667
share_toilet |  -.6672187   .1062668    -6.28   0.000    -.8754978   -.4589397
       _cons |   -1.41375   .1186425   -11.92   0.000    -1.646285   -1.181215
------------------------------------------------------------------------------
```

Sequential Logit Output

```
. logit water_on_property electricity share_toilet

Iteration 0:   log likelihood = -1288.0245
Iteration 1:   log likelihood = -1100.2359
Iteration 2:   log likelihood = -1097.6342
Iteration 3:   log likelihood =  -1097.626
Iteration 4:   log likelihood =  -1097.626

Logistic regression                                     Number of obs   =       1863
                                                        LR chi2(2)      =     380.80
                                                        Prob > chi2     =     0.0000
Log likelihood =  -1097.626                             Pseudo R2       =     0.1478

------------------------------------------------------------------------------
water_on_p~y |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 electricity |   1.898086   .1115864    17.01   0.000     1.679381    2.116792
share_toilet |  -.3884328   .0851962    -4.56   0.000    -.5554142   -.2214514
       _cons |   -1.13529   .1018953   -11.14   0.000    -1.335001   -.9355786
------------------------------------------------------------------------------

. logit water_in_house electricity share_toilet if water_on_property

Iteration 0:   log likelihood = -493.70116
Iteration 1:   log likelihood = -484.94489
Iteration 2:   log likelihood = -484.84404
Iteration 3:   log likelihood = -484.84389
Iteration 4:   log likelihood = -484.84389

Logistic regression                                     Number of obs   =        876
                                                        LR chi2(2)      =      17.71
                                                        Prob > chi2     =     0.0001
Log likelihood = -484.84389                             Pseudo R2       =     0.0179

------------------------------------------------------------------------------
water_in_h~e |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 electricity |   .5400706   .1990827     2.71   0.007     .1498756    .9302655
share_toilet |  -.2849154   .1006971    -2.83   0.005     -.482278   -.0875528
       _cons |   .7796397   .1867697     4.17   0.000     .4135779    1.145702
------------------------------------------------------------------------------
```