WWS 509 Generalized Linear Models: Precept 9
Ordered Logit Models

Kristin E. Bietsch

Office of Population Research, Princeton University

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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 Do not cite this data!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 **1** equation
  - Therefore, it is more **parsimonious** than a multinomial or a hierarchical logit model
- We will be focusing on the **cummulative** distribution of the response
  - Look at if the response falls in the j-th category or **below**.
- If x_{ik} increases by one, then all transformed cumulative probabilities increase by β_k.
  - By focusing on the cumulative probabilities we can postulate a **single** effect.
- Models can also be interpreted in terms of a **latent** variable.

Interpretation

1. What are two ways that we can interpret the coefficients?
   - In terms of the underlying logistic scale and odds
2. Interpret having electricity on how close your water is to you.
   - In terms of the underlying logistic scale: $\frac{1.881642}{\frac{\pi}{\sqrt{3}}} = 1.0375212$, the difference in how close your water is to you between having electricity and not with the same status of toilets is 1.03 standard deviations
   - in terms of odds, $e^{1.881642} = 6.5641301$, the odds of reporting water in the home (relative to in the yard or in public) are 556% higher among residents with electricity but the same toilet status. The odds of reporting water in the home or yard (relative to in public) are 556% higher among residents with electricity but the same toilet status
3. Repeat this for sharing a toilet.
   - In terms of the underlying logistic scale: $\frac{-.512978}{\frac{\pi}{\sqrt{3}}} = -.28285495$, the difference in how close your water is to you between having to share a toilet and not with the same status of electricity is -.28285495 standard deviations
   - In terms of odds, $e^{-.512978}$=.59870996, the odds of reporting water in the home (relative to in the yard or in public) are 40% lower among residents with shared toilet but the same electricity status. The odds of reporting water in the home or yard (relative to in public) are 40% lower among residents with shared toilet but the same electricity status
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?
   - Use the cutpoints: invlogit(1.063665), invlogit(1.666083)-invlogit(1.063665), 1-invlogit(1.666083)
   - .74339031 .09766258 .15894712
5. What about for those with electricity and their own toilet?
   - Use the cutpoints: invlogit(1.063665-1.881642), invlogit(1.666083-1.881642)-invlogit(1.063665-1.881642), 1- invlogit(1.666083-1.881642)
   - .30619326 .1401247 .55368205
6. What about those with no electricity and who share a toilet?
   - Use the cutpoints: invlogit(1.063665 +.512978), invlogit(1.666083+.512978)-invlogit(1.063665+.512978), 1-invlogit(1.666083+.512978)
   - .82872856 .0696248 .10164664

Remember the other types of models?

Multinomial Logit Model

1. How does Stata know which group I want as the comparison group?
   - The baseoutcome option
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?
   - $e^{1.569986} = 4.8065809$
   - $e^{2.027441} = 7.5946268$
3. Do you see anything interesting about toilets in this model?
   - Yes, when comparing public to yard, having your own toilet is not a statistically significant predictor.

Sequential Logit Model

1. How did I model this sequential model?
   - I first look at having water on the property, then those that have water on the property, I look at having it inside the house versus in the yard.
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?
   - $e^{1.898086} = 6.6731099$ The odds are 567% higher.
   - $e^{.5400706} = 1.716128$ The odds are 71% higher.