Feb 7, 2020 Nested Logit with mlogit in R

February 7, 2020

Feb 7, 2020 Nested Logit with mlogit in R
Name: Jikhan Jeong
Ref: https://cran.r-project.org/web/packages/mlogit/vignettes/e2nlogit.html (Author: Kenneth Train and Yves
This is a repo of the above example, no modification. This is for understanding the structure of nested logit

---

[2]:
```
library(mlogit)
library(lmtest)
```

0.0.1 Independent

- 1. **depvar** gives the name of the chosen alternative (dependent varaibles)
- 2. **ich.alt** are the installation cost for the heating portion of the system,
- 3. **icca** is the installation cost for cooling
- 4. **och.alt** are the operating cost for the heating portion of the system
- 5. **occa** is the operating cost for cooling
-

0.1 6. income is the annual income of the household

- **Q1**. Run a nested logit model on the data for two nests and one log-sum coefficient that applies to both nests.
- Nest 1: (gcc,ecc, erc, hpc)
- Nest 2: (gc,ec,er})

[6]:
```
data("HC", package = "mlogit")
```

[8]:
```
HC <- mlogit.data(HC, varying = c(2:8, 10:16), choice = "depvar", shape =␣
↪"wide")
```

[10]:
```
cooling.modes <- index(HC)$alt %in% c('gcc', 'ecc', 'erc', 'hpc')
room.modes <- index(HC)$alt %in% c('erc', 'er')
```

[ ]:
```
# installation / operating costs for cooling are constants,
# only relevant for mixed systems
```

[11]:
```
HC$icca[!cooling.modes] <- 0
HC$occa[!cooling.modes] <- 0
```

[12]:
```
# create income variables for two sets cooling and rooms
HC$inc.cooling <- HC$inc.room <- 0
HC$inc.cooling[cooling.modes] <- HC$income[cooling.modes]
HC$inc.room[room.modes] <- HC$income[room.modes]
```

[13]:
```
# create an intercet for cooling modes
HC$int.cooling <- as.numeric(cooling.modes)
```

[14]:
```
# estimate the model with only one nest elasticity
nl <- mlogit(depvar ~ ich + och +icca + occa + inc.room + inc.cooling + int.
 ↪cooling | 0, HC,
             nests = list(cooling = c('gcc','ecc','erc','hpc'),
             other = c('gc', 'ec', 'er')), un.nest.el = TRUE) # un.nest.el =␣
 ↪True = the same log sume
summary(nl)
```

```
Call:
mlogit(formula = depvar ~ ich + och + icca + occa + inc.room +
    inc.cooling + int.cooling | 0, data = HC, nests = list(cooling = c("gcc",
    "ecc", "erc", "hpc"), other = c("gc", "ec", "er")), un.nest.el = TRUE)

Frequencies of alternatives:
   ec   ecc    er   erc    gc   gcc   hpc
0.004 0.016 0.032 0.004 0.096 0.744 0.104

bfgs method
11 iterations, 0h:0m:0s
g'(-H)^-1g = 7.26E-06
successive function values within tolerance limits

Coefficients :
             Estimate Std. Error z-value  Pr(>|z|)
ich         -0.554878   0.144205 -3.8478 0.0001192 ***
och         -0.857886   0.255313 -3.3601 0.0007791 ***
icca        -0.225079   0.144423 -1.5585 0.1191212
occa        -1.089458   1.219821 -0.8931 0.3717882
inc.room    -0.378971   0.099631 -3.8038 0.0001425 ***
inc.cooling  0.249575   0.059213  4.2149 2.499e-05 ***
int.cooling -6.000415   5.562423 -1.0787 0.2807030
iv           0.585922   0.179708  3.2604 0.0011125 **
---
```

```
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Log-Likelihood: -178.12
```

B. Test the hypothesis that the log-sum coefficient is 1.0 (the value that it takes for a standard logit model.) Can the hypothesis that the true model is standard logit be rejected?

- T-test
-

0.2 The critical value of t for 95% confidence is 1.96. So we can reject the hypothesis at 95% confidence.

[16]:
```
(coef(nl)['iv'] - 1) / sqrt(vcov(nl)['iv', 'iv'])
# vcov :  variance-covariance matrix of the main parameters of a fitted model␣
↪object.
```

iv: -2.30417141089605

[17]:
```
nl3 <- update(nl, un.nest.el = FALSE)
```

[18]:
```
lrtest(nl, nl3)
```

#Df	LogLik	Df	Chisq	Pr(>Chisq)
8	-178.1247	NA	NA	NA
9	-178.0368	1	0.1758243	0.6749866

[19]:
```
summary(nl3)
```

```
Call:
mlogit(formula = depvar ~ ich + och + icca + occa + inc.room +
    inc.cooling + int.cooling | 0, data = HC, nests = list(cooling = c("gcc",
    "ecc", "erc", "hpc"), other = c("gc", "ec", "er")), un.nest.el = FALSE)

Frequencies of alternatives:
   ec   ecc    er   erc    gc   gcc   hpc
0.004 0.016 0.032 0.004 0.096 0.744 0.104

bfgs method
4 iterations, 0h:0m:0s
g'(-H)^-1g =  1.18
last step couldn't find higher value

Coefficients :
             Estimate Std. Error z-value  Pr(>|z|)
ich         -0.562283   0.146145 -3.8474 0.0001194 ***
```

```
och          -0.895493   0.271861 -3.2939 0.0009880 ***
icca         -0.267062   0.150310 -1.7767 0.0756103 .
occa         -1.338514   1.264215 -1.0588 0.2897042
inc.room     -0.381441   0.096658 -3.9463 7.937e-05 ***
inc.cooling   0.259932   0.062085  4.1867 2.830e-05 ***
int.cooling -4.821927   5.528796 -0.8721 0.3831277
iv:cooling    0.611529   0.188736  3.2401 0.0011947 **
iv:other      0.378394   0.133617  2.8319 0.0046270 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Log-Likelihood: -178.04
```