

```

# Multinomial Probit and Logit Models in R
# Copyright 2013 by Ani Katchova

# install.packages("mlogit")
library(mlogit)

mydata<- read.csv("C:/Econometrics/Data/multinomial_fishing1.csv")
attach(mydata)

# Descriptive statistics
table(mode)

# Reshaping the data from wide to long format
#mydata$mode<-as.factor(mydata$mode)
mldata<-mlogit.data(mydata, varying=4:15, choice="mode", shape="wide")
mldata[1:20,]

# Multinomial logit model coefficients
mlogit.model1 <- mlogit(mode ~ 1 | income, data=mldata, reflevel="charter")
summary(mlogit.model1)

# Multinomial logit model coefficients (with different base outcome)
mlogit.model2 <- mlogit(mode ~ 1 | income, data = mldata, reflevel="pier")
summary(mlogit.model2)

# Multinomial logit model odds ratios
exp(coef(mlogit.model1))

# Conditional logit model
clogit.model1 <- mlogit(mode ~ price+catch | income, data = mldata, reflevel="charter")
summary(clogit.model1)

clogit.model2 <- mlogit(mode ~ price+catch | income, data = mldata, reflevel="pier")
summary(clogit.model2)

# Setting mean values for variables to use for marginal effects
m <- mlogit(mode ~ price+catch | income, data = mldata, reflevel="charter")
z <- with(mldata, data.frame(price = tapply(price, index(m)$salt, mean),
                             catch = tapply(catch, index(m)$salt, mean), income =
mean(income)))

# Multinomial logit model marginal effects
effects(mlogit.model1, covariate = "income", data = z)

# Conditional logit model marginal effects
effects(clogit.model1, covariate = "income", data = z)
effects(clogit.model1, covariate = "price", data = z)
effects(clogit.model1, covariate = "catch", data = z)

# Multinomial probit model coefficients
#mprobit.model1 <- mlogit(mode ~ 1 | income, data = mldata, reflevel="charter",
probit=TRUE)
#summary(mprobit.model1)

```

```
# Hausman-McFadden test of independence of irrelevant alternatives
m1<- mlogit(mode ~ 1 | income, data = mldata, reflevel="beach")
m2<- mlogit(mode ~ 1 | income, data = mldata, reflevel="beach", alt.subset=c("beach",
"pier", "private"))
hmftest(m1, m2)
```

```

> # Multinomial Probit and Logit Models in R
> # Copyright 2013 by Ani Katchova
>
> # install.packages("mlogit")
> library(mlogit)
Loading required package: Formula
Loading required package: statmod
Loading required package: lmtest
Loading required package: zoo

Attaching package: 'zoo'

The following object(s) are masked from 'package:base':

    as.Date, as.Date.numeric

Loading required package: maxLik
Loading required package: miscTools
Loading required package: MASS
>
> mydata<- read.csv("C:/Econometrics/Data/multinomial_fishing1.csv")
> attach(mydata)
>
> # Descriptive statistics
> table(mode)
mode
  beach charter    pier private
   134     452    178     418
>
> # Reshaping the data from wide to long format
> #mydata$mode<-as.factor(mydata$mode)
> mldata<-mlogit.data(mydata, varying=4:15, choice="mode", shape="wide")
> mldata[1:20,]
      mode price catchrate income model alt d catch chid
1.beach FALSE 157.930    0.5391 7.083332    4 beach 0 0.0678    1
1.charter TRUE 182.930    0.5391 7.083332    4 charter 1 0.5391    1
1.pier FALSE 157.930    0.5391 7.083332    4 pier 0 0.0503    1
1.private FALSE 157.930    0.5391 7.083332    4 private 0 0.2601    1
2.beach FALSE 15.114    0.4671 1.250000    4 beach 0 0.1049    2
2.charter TRUE 34.534    0.4671 1.250000    4 charter 1 0.4671    2
2.pier FALSE 15.114    0.4671 1.250000    4 pier 0 0.0451    2
2.private FALSE 10.534    0.4671 1.250000    4 private 0 0.1574    2
3.beach FALSE 161.874    0.2413 3.750000    3 beach 0 0.5333    3
3.charter FALSE 59.334    0.2413 3.750000    3 charter 0 1.0266    3
3.pier FALSE 161.874    0.2413 3.750000    3 pier 0 0.4522    3
3.private TRUE 24.334    0.2413 3.750000    3 private 1 0.2413    3
4.beach FALSE 15.134    0.0789 2.083333    2 beach 0 0.0678    4
4.charter FALSE 84.930    0.0789 2.083333    2 charter 0 0.5391    4
4.pier TRUE 15.134    0.0789 2.083333    2 pier 1 0.0789    4
4.private FALSE 55.930    0.0789 2.083333    2 private 0 0.1643    4
5.beach FALSE 106.930    0.1082 4.583332    3 beach 0 0.0678    5
5.charter FALSE 71.014    0.1082 4.583332    3 charter 0 0.3240    5
5.pier FALSE 106.930    0.1082 4.583332    3 pier 0 0.0503    5
5.private TRUE 41.514    0.1082 4.583332    3 private 1 0.1082    5
>

```

```
> # Multinomial logit model coefficients
> mlogit.model1 <- mlogit(mode ~ 1 | income, data=mldata, reflevel="charter")
> summary(mlogit.model1)
```

Call:

```
mlogit(formula = mode ~ 1 | income, data = mldata, reflevel = "charter",
       method = "nr", print.level = 0)
```

Frequencies of alternatives:

```
charter  beach  pier private
0.38240 0.11337 0.15059 0.35364
```

nr method

4 iterations, 0h:0m:0s

$g'(-H)^{-1}g = 8.32E-07$

gradient close to zero

Coefficients :

	Estimate	Std. Error	t-value	Pr(> t)
beach:(intercept)	-1.341291	0.194517	-6.8955	5.367e-12 ***
pier:(intercept)	-0.527141	0.177784	-2.9651	0.003026 **
private:(intercept)	-0.602371	0.136096	-4.4261	9.597e-06 ***
beach:income	0.031640	0.041846	0.7561	0.449591
pier:income	-0.111763	0.043979	-2.5413	0.011046 *
private:income	0.123546	0.027911	4.4265	9.577e-06 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Log-Likelihood: -1477.2

McFadden R²: 0.013736

Likelihood ratio test : chisq = 41.145 (p.value = 6.0931e-09)

>

```
> # Multinomial logit model coefficients (with different base outcome)
```

```
> mlogit.model2 <- mlogit(mode ~ 1 | income, data = mldata, reflevel="pier")
```

```
> summary(mlogit.model2)
```

Call:

```
mlogit(formula = mode ~ 1 | income, data = mldata, reflevel = "pier",
       method = "nr", print.level = 0)
```

Frequencies of alternatives:

```
pier  beach charter private
0.15059 0.11337 0.38240 0.35364
```

nr method

4 iterations, 0h:0m:0s

$g'(-H)^{-1}g = 8.32E-07$

gradient close to zero

Coefficients :

	Estimate	Std. Error	t-value	Pr(> t)
beach:(intercept)	-0.814150	0.228632	-3.5610	0.0003695 ***
charter:(intercept)	0.527141	0.177784	2.9651	0.0030262 **
private:(intercept)	-0.075229	0.183240	-0.4106	0.6814007
beach:income	0.143403	0.053288	2.6911	0.0071223 **

```

charter:income      0.111763    0.043979    2.5413 0.0110455 *
private:income      0.235309    0.043668    5.3886 7.101e-08 ***

```

```

Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

Log-Likelihood: -1477.2

McFadden R^2: 0.013736

Likelihood ratio test : chisq = 41.145 (p.value = 6.0931e-09)

>

> # Multinomial logit model odds ratios

> exp(coef(mlogit.model1))

```

      beach:(intercept)      pier:(intercept) private:(intercept)
              0.2615077              0.5902901              0.5475121
      beach:income          pier:income          private:income
              1.0321457              0.8942561              1.1315023

```

attr(,"fixed")

```

      beach:(intercept)      pier:(intercept) private:(intercept)
              FALSE              FALSE              FALSE
      beach:income          pier:income          private:income
              FALSE              FALSE              FALSE

```

>

>

> # Conditional logit model

```

> clogit.model1 <- mlogit(mode ~ price+catch | income, data = mldata,
  refllevel="charter")

```

> summary(clogit.model1)

Call:

```

mlogit(formula = mode ~ price + catch | income, data = mldata,
  refllevel = "charter", method = "nr", print.level = 0)

```

Frequencies of alternatives:

```

charter  beach  pier private
0.38240 0.11337 0.15059 0.35364

```

nr method

7 iterations, 0h:0m:0s

g'(-H)^-1g = 1.37E-05

successive function values within tolerance limits

Coefficients :

```

              Estimate Std. Error t-value Pr(>|t|)
beach:(intercept) -1.6943657  0.2240506 -7.5624 3.952e-14 ***
pier:(intercept)  -0.9164063  0.2072648 -4.4214 9.805e-06 ***
private:(intercept) -1.1670869  0.1590475 -7.3380 2.169e-13 ***
price              -0.0251166  0.0017317 -14.5042 < 2.2e-16 ***
catch              0.3577820  0.1097733  3.2593 0.001117 **
beach:income        0.0332917  0.0503409  0.6613 0.508403
pier:income         -0.0942854  0.0500600 -1.8834 0.059640 .
private:income       0.1227315  0.0286306  4.2867 1.813e-05 ***

```

```

Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

Log-Likelihood: -1215.1

McFadden R^2: 0.18868

```

Likelihood ratio test : chisq = 565.17 (p.value = < 2.22e-16)
>
> clogit.model2 <- mlogit(mode ~ price+catch | income, data = mldata, reflevel="pier")
> summary(clogit.model2)

```

Call:

```

mlogit(formula = mode ~ price + catch | income, data = mldata,
       reflevel = "pier", method = "nr", print.level = 0)

```

Frequencies of alternatives:

```

      pier      beach charter private
0.15059 0.11337 0.38240 0.35364

```

```

nr method
7 iterations, 0h:0m:0s
g'(-H)^-1g = 1.37E-05
successive function values within tolerance limits

```

Coefficients :

	Estimate	Std. Error	t-value	Pr(> t)
beach:(intercept)	-0.7779594	0.2204939	-3.5283	0.0004183 ***
charter:(intercept)	0.9164063	0.2072648	4.4214	9.805e-06 ***
private:(intercept)	-0.2506806	0.2039395	-1.2292	0.2190004
price	-0.0251166	0.0017317	-14.5042	< 2.2e-16 ***
catch	0.3577820	0.1097733	3.2593	0.0011170 **
beach:income	0.1275771	0.0506395	2.5193	0.0117582 *
charter:income	0.0942854	0.0500600	1.8834	0.0596396 .
private:income	0.2170169	0.0500582	4.3353	1.456e-05 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Log-Likelihood: -1215.1

McFadden R^2: 0.18868

Likelihood ratio test : chisq = 565.17 (p.value = < 2.22e-16)

```

>
>
> # Setting mean values for variables to use for marginal effects
> m <- mlogit(mode ~ price+catch | income, data = mldata, reflevel="charter")
> z <- with(mldata, data.frame(price = tapply(price, index(m)$salt, mean),
+                               catch = tapply(catch, index(m)$salt, mean), income =
mean(income)))
>
> # Multinomial logit model marginal effects
> effects(mlogit.model1, covariate = "income", data = z)
      charter      beach      pier      private
-1.201367e-02  7.495845e-05 -2.065980e-02  3.259851e-02
>
> # Conditional logit model marginal effects
> effects(clogit.model1, covariate = "income", data = z)
      charter      beach      pier      private
-0.0217339246 -0.0007214181 -0.0093059734  0.0317613161
> effects(clogit.model1, covariate = "price", data = z)
      charter      beach      pier      private
charter -0.0062430047  6.091542e-04  7.642235e-04  0.0048696270
beach    0.0006091541 -1.249124e-03  8.681094e-05  0.0005531588

```

```

pier      0.0007642234  8.681094e-05 -1.545008e-03  0.0006939736
private   0.0048696270  5.531588e-04  6.939737e-04 -0.0061167595
> effects(clogit.modell, covariate = "catch", data = z)
      charter      beach      pier      private
charter  0.088930726 -0.008677316 -0.010886256 -0.069367154
beach    -0.008677329  0.017793621 -0.001236612 -0.007879681
pier     -0.010886272 -0.001236612  0.022008455 -0.009885571
private -0.069367164 -0.007879671 -0.009885559  0.087132394
>
> # Multinomial probit model coefficients
> #mprobit.modell1 <- mlogit(mode ~ 1 | income, data = mldata, reflevel="charter",
probit=TRUE)
> #summary(mprobit.modell1)
>
>
> # Hausman-McFadden test of independence of irrelevant alternatives
> m1<- mlogit(mode ~ 1 | income, data = mldata, reflevel="beach")
> m2<- mlogit(mode ~ 1 | income, data = mldata, reflevel="beach",
alt.subset=c("beach", "pier", "private"))
> hmfctest(m1, m2)

```

Hausman-McFadden test

```

data:  mldata
chisq = 14.701, df = 4, p-value = 0.005363
alternative hypothesis: IIA is rejected

```