Censored skew-normal regression with delayed entry

André Moser

November 07, 2017

Reference: Moser A, Clough-Gorr K, Zwahlen M. (2015) Modeling absolute differences in life expectancy with a censored skew-normal regression approach. PeerJ 3:e1162 https://doi.org/10.7717/peerj.1162

```
library(knitr)
library(haven)

source(paste(path, "censn.r", sep=""))
data <- read_dta("http://www.stata-press.com/data/r12/cancer.dta")
data <- data.frame(data)
data$age1 <- data$age+data$studytime
head(data)
```

```
##   studytime died drug age X_st X_d X_t X_t0 age1
## 1         1    1    1  61    1   1   1    0   62
## 2         1    1    1  65    1   1   1    0   66
## 3         2    1    1  59    1   1   2    0   61
## 4         3    1    1  52    1   1   3    0   55
## 5         4    1    1  56    1   1   4    0   60
## 6         4    1    1  67    1   1   4    0   71
```

Modeling results

```
### No censoring, no delayed-entry
mod <- censn(age1~1, ltrun=NULL, data=data, weights = rep(5, nrow(data)))
summary.censn(mod)
```

```
##                         est         se        lci       uci   z-ratio
## location (mu)    71.2726473 0.63028951 70.0373026 72.507992 113.07922
## scale (alpha)     9.9890295 0.50830328  8.9927734 10.985286  19.65171
## skewness (gamma)  0.8824886 0.04790825  0.7885901  0.976387  18.42039
##                  Pr{>|z|}
## location (mu)     0.00000
## scale (alpha)     0.00000
## skewness (gamma)  0.00000
```

```
### selm from package "sn"
modsn <- selm(age1~1, family = "SN", data=data, opt.method="BFGS", weights = rep(5, nrow(data)))
summary(modsn)
```

```
## Call: selm(formula = age1 ~ 1, family = "SN", data = data, weights = rep(5,
##     nrow(data)), opt.method = "BFGS")
## Number of observations: 48
## Family: SN
## Estimation method: MLE
## Log-likelihood: -871.9305
## Parameter type: CP
##
## CP residuals:
##     Min      1Q  Median      3Q     Max
## -16.274  -7.274  -1.774   6.226  24.726
##
## Regression coefficients
##      estimate  std.err  z-ratio Pr{>|z|}
## mean  71.2739   0.6305 113.0514        0
##
## Parameters of the SEC random component
##        estimate std.err
## s.d.     9.9907   0.508
## gamma1   0.8826   0.048
```

```
### Censoring, but no delayed-entry
mod <- censn(age1~1, failure=died, ltrun=NULL, data=data, opt.method="BFGS")
summary.censn(mod)
```

```
##                        est         se        lci       uci   z-ratio
## location (mu)    76.5436832 2.64304192 71.3634162 81.723950 28.960450
## scale (alpha)    14.5681889 2.22360640 10.2100005 18.926377  6.551604
## skewness (gamma)  0.9538285 0.04371477  0.8681491  1.039508 21.819364
##                  Pr{>|z|}
## location (mu)     0.00000
## scale (alpha)     0.00000
## skewness (gamma)  0.00000
```

```
### Censoring and delayed entry
mod <- censn(age1~1, failure=died, ltrun=age, data=data)
summary.censn(mod)
```

```
##                        est         se        lci       uci   z-ratio
## location (mu)    74.7369823 2.65210688 69.5389483 79.935016 28.180230
## scale (alpha)    14.4656133 2.14878460 10.2540728 18.677154  6.731998
## skewness (gamma)  0.9584917 0.06323546  0.8345525  1.082431 15.157505
##                  Pr{>|z|}
## location (mu)     0.00000
## scale (alpha)     0.00000
## skewness (gamma)  0.00000
```

```
### Censoring and delayed entry, covariate drug
mod <- censn(age1~factor(drug), failure=died, ltrun=age, data=data)
summary.censn(mod)
```

```
##                         est        se       lci          uci   z-ratio
## location (mu)    56.8852674 4.8720673 47.336191 66.434343740 11.675797
## factor(drug)2    19.0146152 5.6825833  7.876957 30.152273811  3.346122
## factor(drug)3    30.0168067 6.1314072 17.999469 42.034144043  4.895582
## scale (alpha)    11.5008421 2.9451744  5.728406 17.273277886  3.904978
## skewness (gamma) -0.6021632 0.3087461 -1.207294  0.002968023 -1.950351
##                  Pr{>|z|}
## location (mu)     0.00000
## factor(drug)2     0.00082
## factor(drug)3     0.00000
## scale (alpha)     0.00009
## skewness (gamma)  0.05113
```