Package 'censReg'

May 8, 2026

Version 0.5-38

Date 2024-04-20

Title Censored Regression (Tobit) Models

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BugReports https://r-forge.r-project.org/projects/sampleselection/

Depends R (>= 2.4.0), maxLik (>= 0.7-3)

Imports glmmML (>= 0.81-6), sandwich (>= 2.2-6), miscTools (>= 0.6-11), stats (>= 2.15.0), plm

Suggests AER, lmtest (>= 0.9-27)

Enhances sampleSelection

Description Maximum Likelihood estimation of censored regression (Tobit) models with cross-sectional and panel data.

License GPL (>= 2)

URL http://www.sampleSelection.org

NeedsCompilation no

Repository CRAN

Date/Publication 2024-05-20 17:30:10 UTC

Contents

censReg *Censored Regression (Tobit) Model*

Description

Fitting a model with a censored dependent variable.

Usage

```
censReg( formula, left = 0, right = Inf, data = sys.frame( sys.parent()),
   subset = NULL, start = NULL, nGHQ = 8, logLikOnly = FALSE, ... )

## S3 method for class 'censReg'
print( x, logSigma = TRUE, digits = 4, ... )
```

Arguments

formula	an object of class "formula": a symbolic description of the model to be fitted.
left	left limit for the censored dependent variable; if set to -Inf, the dependent variable is assumed to be not left-censored; defaults to zero (classical Tobit model).
right	right limit for the censored dependent variable; if set to Inf, the dependent variable is assumed to be not right-censored; defaults to Inf (classical Tobit model).
data	an optional data frame. If argument data is of class "pdata.frame", a panel-model is estimated.
subset	an optional vector specifying a subset of observations to be used in the fitting process.
start	an optional vector of initial parameters for the ML estimation (intercept, slope parameters, logarithm of the standard deviation of the individual effects (only for random-effects panel data models), and logarithm of the standard deviation of the general disturbance term); if start is not specified, initial values are taken from an OLS estimation or (uncensored) random-effects panel data estimation.
nGHQ	number of points used in the Gauss-Hermite quadrature, which is used to compute the log-likelihood value in case of the random effects model for panel data.
logLikOnly	logical. If TRUE, the model is not estimated but the log-likelihood contributions of all observations/individuals and the corresponding gradients calculated at the parameters specified by argument start are returned.
x	object of class censReg (returned by censReg).
logSigma	logical value indicating whether the variance(s) of the model should be printed logarithmized (see coef.censReg).
digits	positive integer specifiying the minimum number of significant digits to be printed (see print.default).
...	additional arguments for censReg are passed to maxLik; additional arguments for print.censReg are currently ignored.

Details

The model is estimated by Maximum Likelihood (ML) assuming a Gaussian (normal) distribution of the error term. The maximization of the likelihood function is done by function `maxLik` of the **maxLik** package. An additional argument `method` can be used to specify the optimization method used by `maxLik`, e.g.\ `"Newton-Raphson"`, `"BHHH"`, `"BFGS"`, `"SANN"` (for simulated annealing), or `"NM"` (for Nelder-Mead).

Value

If argument `logLikOnly` is `FALSE` (default), `censReg` returns an object of class `"censReg"` inheriting from class `"maxLik"`. The returned object contains the same components as objects returned by `maxLik` and additionally the following components:

`call`	the matched call.
`terms`	the model terms.
`nObs`	a vector containing 4 integer values: the total number of observations, the number of left-censored observations, the number of uncensored observations, and the number of right-censored observations.
`df.residual`	degrees of freedom of the residuals.
`start`	vector of starting values.
`left`	left limit of the censored dependent variable.
`right`	right limit of the censored dependent variable.
`xMean`	vector of mean values of the explanatory variables.

In contrast, if argument `logLikOnly` is `TRUE`, `censReg` returns a vector of the log-likelihood contributions of all observations/individuals. This vector has an attribute `"gradient"`, which is a matrix containing the gradients of the log-likelihood contributions with respect to the parameters.

Note

When the censored regression model is estimated, the log-likelihood function is maximized with respect to the coefficients and the *logarithm(s)* of the variance(s).

Author(s)

Arne Henningsen

References

Greene, W.H. (2008): *Econometric Analysis*, Sixth Edition, Prentice Hall, p. 871-875.

Kleiber, C. and Zeileis, A. (2008): *Applied Econometrics with R*, Springer, p. 141-143.

Tobin, J. (1958): Estimation of Relationships for Limited Dependent Variables. *Econometrica* 26, p. 24-36.

See Also

`summary.censReg`, `coef.censReg`, `tobit`, `selection`

Examples

```
## Kleiber & Zeileis ( 2008 ), page 142
data( "Affairs", package = "AER" )
estResult <- censReg( affairs ~ age + yearsmarried + religiousness +
   occupation + rating, data = Affairs )
print( estResult )

## Kleiber & Zeileis ( 2008 ), page 143
estResultBoth <- censReg( affairs ~ age + yearsmarried + religiousness +
   occupation + rating, data = Affairs, right = 4 )
print( estResultBoth )
```

`coef.censReg` *Coefficients, their Covariances, and Log-Likelihood Values of Censored Regression Models*

Description

These functions extract the coefficient vectors, the corresponding covariance matrices, and log-likelihood values from censored regression models.

Usage

```
## S3 method for class 'censReg'
coef( object, logSigma = TRUE, ... )

## S3 method for class 'censReg'
vcov( object, logSigma = TRUE, ... )

## S3 method for class 'censReg'
logLik( object, ... )
```

Arguments

`object`	object of class `"censReg"` (returned by `censReg`).
`logSigma`	logical value indicating whether the variance(s) of the model should be returned logarithmized.
`...`	currently not used.

Value

`coef.censReg` returns a vector of the estimated coefficients.

`vcov.censReg` returns the covariance matrix of the estimated coefficients.

`logLik.censReg` returns an object of class `"logLik"`. This object is the log-likelihood value of the estimated model and has an attribute `"df"` that gives the degrees of freedom, i.e.\ the number of estimated parameters.

Note

When the censored regression model is estimated, the log-likelihood function is maximized with respect to the coefficients and the *logarithm(s)* of the variance(s). Hence, if argument `logSigma` is `FALSE`, the variance(s) of the model is/are calculated by applying the exponential function to the estimated logarithmized variance(s) and the covariance matrix of all parameters is calculated by the Delta method.

Author(s)

Arne Henningsen

See Also

`censReg`, `summary.censReg`, and `coef.summary.censReg`

Examples

```
## Kleiber & Zeileis ( 2008 ), page 142
data( "Affairs", package = "AER" )
estResult <- censReg( affairs ~ age + yearsmarried + religiousness +
   occupation + rating, data = Affairs )
coef( estResult )
coef( estResult, logSigma = FALSE )
vcov( estResult )
vcov( estResult, logSigma = FALSE )
logLik( estResult )
```

---

coef.summary.censReg *Coefficients of Censored Regression Models and their Statistical Properties*

Description

This function returns the estimated coefficients of censored regression models as well as their standard errors, z-values, and P-values.

Usage

```
## S3 method for class 'summary.censReg'
coef( object, logSigma = TRUE, ... )
```

Arguments

`object`	object of class `"summary.censReg"` (returned by `summary.censReg`).
`logSigma`	logical value indicating whether the variance(s) of the model should be returned logarithmized.
`...`	currently not used.

Value

coef.summary.censReg returns an matrix, where each row corresponds to one coefficient and the 4 rows contain the estimated coefficients, their standard errors, z-values, and P-values.

Author(s)

Arne Henningsen

See Also

censReg, summary.censReg and coef.censReg

Examples

```
## Kleiber & Zeileis ( 2008 ), page 142
data( "Affairs", package = "AER" )
estResult <- censReg( affairs ~ age + yearsmarried + religiousness +
   occupation + rating, data = Affairs )
coef( summary( estResult ) )
```

---

margEff.censReg *Marginal Effects in Censored Regression Models*

Description

The margEff method computes the marginal effects of the explanatory variables on the expected value of the dependent variable evaluated. Please note that this functionality is currently not available for panel data models.

Usage

```
## S3 method for class 'censReg'
margEff( object, xValues = NULL, vcov = NULL,
   calcVCov = TRUE, returnJacobian = FALSE, vcovLogSigma = TRUE, ... )

## S3 method for class 'margEff.censReg'
summary( object, ... )
```

Arguments

object	argument object of the margEff method must be an object of class "censReg" (returned by censReg); argument object of the summary method must be an object of class "margEff.censReg" (returned by margEff.censReg).
xValues	vector that specifies the values of the explanatory variables (including the intercept if it is included in the model), at which the marginal effects should be calculated. The number and order of the elements of this vector must correspond to the number and order of the estimated coefficients (without sigma). If this argument is NULL (or not specified), argument xValues is set to the mean values of the explanatory variables.

vcov	a symmetric matrix that specifies the variance covariance matrix of the estimated coefficients that should be used to calculate the variance covariance matrix and the standard errors of the marginal effects. If this argument is NULL (the default), the variance covariance matix is obtained by vcov(object).
calcVCov	logical. If TRUE, the approximate variance covariance matrices of the marginal effects is calculated and returned as an attribute (see below).
returnJacobian	logical. If TRUE, the Jacobian of the marginal effects with respect to the coefficients is returned as an attribute (see below).
vcovLogSigma	logical. TRUE (the default) indicates that the last row and last column of the variance covariance matrix provided by argument vcov indicate the (co)variances of the logarithm of the sigma coefficient, while FALSE indicates that this row and this column indicate the (co)variances of the (non-logarithic) sigma coefficient. If argument vcov is NULL, argument vcovLogSigma is ignored.
...	currently not used.

Value

margEff.censReg returns an object of class "margEff.censReg", which is a vector of the marginal effects of the explanatory variables on the expected value of the dependent variable evaluated at the mean values of the explanatory variables. The returned object has an attribute df.residual, which is equal to the degrees of freedom of the residuals.

If argument calcVCov is TRUE, the object returned by margEff.censReg has an attribute vcov, which is a the approximate variance covariance matrices of the marginal effects calculated with the Delta method.

If argument returnJacobian is TRUE, the object returned by margEff.censReghas an attribute jacobian, which is the Jacobian of the marginal effects with respect to the coefficients.

summary.margEff.censReg returns an object of class "summary.margEff.censReg", which is a matrix with four columns, where the first column contains the marginal effects, the second column contains the standard errors of the marginal effects, the third column contains the corresponding t-values, and the fourth columns contains the corresponding P values.

Author(s)

Arne Henningsen

See Also

censReg, coef.censReg, and summary.censReg

Examples

```
## Kleiber & Zeileis ( 2008 ), page 142
data( "Affairs", package = "AER" )
estResult <- censReg( affairs ~ age + yearsmarried + religiousness +
   occupation + rating, data = Affairs )
margEff( estResult )
summary( margEff( estResult ) )
margEff( estResult, xValues = c( 1, 40, 4, 2, 4, 4 ) )
```

summary.censReg *Summary Results of Censored Regression Models*

Description

These methods prepare and print summary results for censored regression models.

Usage

```
## S3 method for class 'censReg'
summary( object, ... )

## S3 method for class 'summary.censReg'
print( x, logSigma = TRUE, digits = 4, ... )
```

Arguments

object	object of class "censReg" (returned by censReg).
x	object of class "summary.censReg" (returned by summary.censReg).
logSigma	logical value indicating whether the variance(s) of the model should be printed logarithmized.
digits	positive integer specifiying the minimum number of significant digits to be printed (passed to printCoefmat).
...	currently not used.

Value

summary.censReg returns an object of class "summary.censReg" inheriting from class "summary.maxLik". The returned object contains the same components as objects returned by summary.maxLik and additionally the following components:

call	the matched call.
nObs	a vector containing 4 integer values: the total number of observations, the number of left-censored observations, the number of uncensored observations, and the number of right-censored observations.

Author(s)

Arne Henningsen

See Also

censReg, coef.summary.censReg, and coef.censReg

Examples

```
## Kleiber & Zeileis ( 2008 ), page 142
data( "Affairs", package = "AER" )
estResult <- censReg( affairs ~ age + yearsmarried + religiousness +
   occupation + rating, data = Affairs )
summary( estResult )
```

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