

Package ‘mhurdle’

September 18, 2018

Version 1.1-8

Date 2018-09-17

Title Multiple Hurdle Tobit Models

Depends R (>= 2.10), methods, Formula, truncreg, maxLik, survival,
texreg

Description Estimation of models with zero left-censored variables.
Null values may be caused by a selection process (Cragg
(1971) <doi:10.2307/1909582>), insufficient resources
(Tobin (1958) <doi:10.2307/1907382>) or infrequency of
purchase (Deaton and Irish (1984)
<doi:10.1016/0047-2727(84)90067-7>).

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URL <https://www.R-project.org>

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Repository CRAN

Repository/R-Forge/Project mhurdle

Repository/R-Forge/Revision 75

Repository/R-Forge/DateTimeStamp 2018-09-18 13:53:04

Date/Publication 2018-09-18 17:00:07 UTC

NeedsCompilation yes

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 Interview

Interview

Description

a cross section from 2014

number of observations : 1000

observation : households

country : United-States

Usage

`data(Interview)`

Format

A dataframe containing :

month the month of the interview,

size the number of person in the household,

cu the number of consumption units in the household,

income the income of the household for the 12 month before the interview,

linc the logarithme of the net income per consumption unit divided by its mean,

linc2 the square of link,

smsa does the household live in a SMSA (yes or no),

sex the sex of the reference person of the household (male and female),

race the race of the head of the household, one of white, black, indian, asian, pacific and multirace,

hispanic is the reference person of the household is hispanic (no or yes),

educ the number of year of education of the reference person of the household,

age the age of the reference person of the household - 50,

age2 the square of age

car cars in the household,

food food,

alcohol ,

housing ,

apparel ,

transport ,

health ,

entertainment ,

perscare ,
reading ,
education ,
tobacco ,
miscexp ,
cashcont ,
insurance ,
shows ,
foodaway ,
vacations .

Source

Consumer Expenditure Survey (CE), program of the US Bureau of Labor Statistics <http://www.bls.gov/cex/>, interview survey.

 mhurdle

Estimation of limited dependent variable models

Description

mhurdle fits a large set of models relevant when the dependent variable is 0 for a part of the sample.

Usage

```

mhurdle(formula, data, subset, weights, na.action,
         start = NULL,
         dist = c("ln", "n", "bc", "ihs"),
         h2 = FALSE,
         scaled = TRUE,
         corr = FALSE, robust = TRUE,
         check.grad = FALSE, ...)
## S3 method for class 'mhurdle'
coef(object,
      which = c("all", "h1", "h2", "h3", "h4", "sd", "corr", "tr", "pos"), ...)
## S3 method for class 'mhurdle'
vcov(object,
      which = c("all", "h1", "h2", "h3", "h4", "sd", "corr", "tr", "pos"), ...)
## S3 method for class 'mhurdle'
logLik(object, naive = FALSE, ...)
## S3 method for class 'mhurdle'
print(x, digits = max(3, getOption("digits") - 2),
      width = getOption("width"), ...)
## S3 method for class 'mhurdle'

```

```
summary(object, ...)
## S3 method for class 'summary.mhurdle'
print(x, digits = max(3, getOption("digits") - 2),
      width = getOption("width"), ...)

## S3 method for class 'mhurdle'
fitted(object,
        which = c("all", "zero", "positive"), ...)
## S3 method for class 'mhurdle'
predict(object, newdata = NULL, ...)
## S3 method for class 'mhurdle'
update(object, new, ...)
```

Arguments

formula	a symbolic description of the model to be fitted,
data	a <code>data.frame</code> ,
newdata	a <code>data.frame</code> for which the predictions should be computed,
subset	see lm ,
weights	see lm ,
na.action	see lm ,
start	starting values,
dist	the distribution of the error of the consumption equation: one of "n" (normal), "ln" (log-normal) "bc" (box-cox normal) and "ihs" (inverse hyperbolic sinus transformation),
h2	if TRUE the second hurdle is effective, it is not otherwise,
scaled	if TRUE, the dependent variable is divided by its geometric mean,
corr	a boolean indicating whether the errors of the different equations are correlated or not,
robust	transformation of the structural parameters in order to avoid numerical problems,
check.grad	if TRUE, a matrix containing the analytical and the numerical gradient for the starting values are returned,
naive	a boolean, if TRUE, the likelihood of the naive model is returned,
object,x	an object of class "mhurdle",
new	an updated formula for the update method,
digits	see print ,
width	see print ,
which	which coefficients or covariances should be extracted ? Those of the selection ("h1"), consumption ("h2") or purchase ("h3") equation, the other coefficients "other" (the standard error and the coefficient of corr), the standard error ("sigma") or the coefficient of correlation ("rho"),
...	further arguments.

Details

mhurdle fits models for which the dependent variable is zero for a part of the sample. Null values of the dependent variable may occur because of one or several mechanisms : good rejection, lack of resources and purchase infrequency. The model is described using a three-parts formula : the first part describes the selection process if any, the second part the regression equation and the third part the purchase infrequency process. $y \sim 0 \mid x_1 + x_2 \mid z_1 + z_2$ means that there is no selection process. $y \sim w_1 + w_2 \mid x_1 + x_2 \mid 0$ and $y \sim w_1 + w_2 \mid x_1 + x_2$ describe the same model with no purchase infrequency process. The second part is mandatory, it explains the positive values of the dependent variable. The `dist` argument indicates the distribution of the error term. If `dist = "n"`, the error term is normal and (at least part of) the zero observations are also explained by the second part as the result of a corner solution. Several models described in the literature are obtained as special cases :

A model with a formula like $y \sim 0 \mid x_1 + x_2$ and `dist="n"` is the Tobit model proposed by Tobin (1958). $y \sim w_1 + w_2 \mid x_1 + x_2$ and `dist="1"` or `dist="t"` is the single hurdle model proposed by Cragg (1971). With `dist="n"`, the double hurdle model also proposed by Cragg (1971) is obtained. With `corr="h1"` we get the correlated version of this model described by Blundell (1987). $y \sim 0 \mid x_1 + x_2 \mid z_1 + z_2$ is the P-Tobit model of Deaton and Irish (1984), which can be a single hurdle model if `dist="t"` or `dist="1"` or a double hurdle model if `dist="n"`.

Value

an object of class `c("mhurdle", "maxLik")`.

A "mhurdle" object has the following elements :

coefficients the vector of coefficients,

vcov the covariance matrix of the coefficients,

fitted.values a matrix of fitted values, the first column being the probability of 0 and the second one the mean values for the positive observations,

logLik the log-likelihood,

gradient the gradient at convergence,

model a data.frame containing the variables used for the estimation,

coef.names a list containing the names of the coefficients in the selection equation, the regression equation, the infrequency of purchase equation and the other coefficients (the standard deviation of the error term and the coefficient of correlation if `corr = TRUE`),

formula the model formula, an object of class `Formula`,

call the call,

rho the lagrange multiplier test of no correlation.

References

Blundell R, Meghir C (1987). Bivariate Alternatives to the Tobit Model. *Journal of Econometrics*, 34, 179-200.

Cragg JG (1971). Some Statistical Models for Limited Dependent Variables with Applications for the Demand for Durable Goods. *Econometrica*, 39(5), 829-44.

Deaton A, Irish M (1984). A Statistical Model for Zero Expenditures in Household Budgets. *Journal of Public Economics*, 23, 59-80.

Tobin J (1958). Estimation of Relationships for Limited Dependent Variables. *Econometrica*, 26(1), 24-36.

Examples

```
data("Interview", package = "mhurdle")

# independent double hurdle model
idhm <- mhurdle(vacations ~ car + size | linc + linc2 | 0, Interview,
               dist = "ln", h2 = TRUE, method = "bfgs")

# dependent double hurdle model
ddhm <- mhurdle(vacations ~ car + size | linc + linc2 | 0, Interview,
               dist = "ln", h2 = TRUE, method = "bfgs", corr = TRUE)

# a double hurdle p-tobit model
ptm <- mhurdle(vacations ~ 0 | linc + linc2 | car + size, Interview,
               dist = "ln", h2 = TRUE, method = "bfgs", corr = TRUE)
```

rsq

R squared and pseudo R squared

Description

This function computes the R squared for multiple hurdle models. The measure is a pseudo coefficient of determination or may be based on the likelihood.

Usage

```
rsq(object, type = c("coefdet", "lratio"),
     adj = FALSE, r2pos = c("rss", "ess", "cor"))
```

Arguments

object	an object of class "mhurdle",
type	one of "coefdet" or "lratio" to select a pseudo coefficient of correlation or a Mc Fadden like measure based on the likelihood function,
adj	if TRUE a correction for the degrees of freedom is performed,
r2pos	only for pseudo coefficient of determination, should the positive part of the R squared be computed using the residual sum of squares ("rss"), the explained sum of squares ("ess") or the coefficient of correlation between the fitted values and the response (cor).

Value

a numerical value

References

McFadden D (1974). The Measurement of Urban Travel Demand. *Journal of Public Economics*, 3, 303-328.

Examples

```
data("Interview", package = "mhurdle")
# independent double hurdle model
idhm <- mhurdle(vacations ~ car + size | linc + linc2 | 0, Interview,
               dist = "ln", h2 = TRUE, method = "bfgs")
rsq(idhm, type = "lratio")
rsq(idhm, type = "coefdet", r2pos = "rss")
```

 vuongtest

Vuong test for non-nested models

Description

The Vuong test is suitable to discriminate between two non-nested models.

Usage

```
vuongtest(x, y,
          type = c("non-nested", "nested", "overlapping"),
          hyp = FALSE,
          variance = c("centered", "uncentered"),
          matrix = c("large", "reduced")
        )
```

Arguments

x	a first fitted model of class "mhurdle",
y	a second fitted model of class "mhurdle",
type	the kind of test to be computed,
hyp	a boolean, TRUE if one of the models is assumed to be the true model,
variance	the variance is estimated using the centered or uncentered expression,
matrix	the W matrix can be computed using the general expression large or the reduced matrix reduced (only relevant for the nested case),

Value

an object of class "htest"

References

Vuong Q.H. (1989) Likelihood ratio tests for model selection and non-nested hypothesis, *Econometrica*, vol.57(2), pp.307-33.

See Also

vuong in package pscl.

Examples

```
data("Interview", package = "mhurdle")
# dependent double hurdle model
dhm <- mhurdle(vacations ~ car + size | linc + linc2 | 0, Interview,
               dist = "ln", h2 = TRUE, method = "bhhh", corr = TRUE)

# a double hurdle p-tobit model
ptm <- mhurdle(vacations ~ 0 | linc + linc2 | car + size, Interview,
               dist = "ln", h2 = TRUE, method = "bhhh", corr = TRUE)
vuongtest(dhm, ptm)
```

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