Package ‘elm’

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Type Package

Title Exact linear regression

Version 0.1

Date 2013-11-17

Description Provides an implementation of exact tests for the coefficients of a linear regression.

Depends R (>= 2.10.0), stats, Rglpk, quadprog

License GPL-2

R topics documented:

`elm-package` *Exact linear models*

Description

Implementation of exact test of linear regressions.

Details

Package:	elm
Type:	Package
Version:	0.1
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License:	GPL-2

~~ An overview of how to use the package, including the most ~~ ~~ important functions ~~

Author(s)

Karl Schlag, Olivier Gossner, Gareth Liu-Evans and Oliver Reiter

References

Olivier Gossner, Karl H. Schlag, "Finite-sample exact tests for linear regressions with bounded dependent variables", Journal of Econometrics, Volume 177, Issue 1, November 2013, Pages 75-84, ISSN 0304-4076, http://dx.doi.org/10.1016/j.jeconom.2013.06.003.

See Also

http://homepage.univie.ac.at/karl.schlag/research/statistics/

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elm *Exact linear models*

Description

Uses exact tests for the coefficients of linear regressions.

Usage

```
elm(Y, X, lower = 0, upper = 1,
    alternative = "greater",
    alpha = 0.05,
    coefs = 2,
    nullvalue = 0,
    upperbetabound = 1,
    lambda = 1, lambdamm = 1,
    qq = 0.0001, qqmm = 0.0001,
    iterations = 1000,
    steppc = 0.1,
    intercept = TRUE,
    silent = FALSE,
    verbose = TRUE,
    na.action = getOption("na.action"))
```

Arguments

`Y`	dependent variable, as matrix.
`X`	independent variable, as matrix.
`lower, upper`	the theoretical lower and upper bounds on the data outcomes known ex-ante before gathering the data.
`alternative`	the hypothesis to be tested, "less" or "greater" (default).
`alpha`	the type I error.
`coefs`	index of the coefficient to be tested. The program assumes that the first coefficient (i.e. the first column) is the intercept, thus the numbering of the coefficients begins with 2. If a range of coefficients is given, e.g. `coefs = 2:4`, the program will test all these coefficients.

`nullvalue` the critical value for the null hypothesis. If a range of coefficients is given (see above) and there is only one null value, the program uses the same null value in all tests. If you want to test different null values, you have to supply a vector of the same length as the coefficients that you want to test. E.g. `coefs = 2:4, nullvalue = c(0, 0.3, -.7)`

`upperbetabound` the upper bound of beta in the set of the alternative hypothesis. The program tries to find a beta in `[nullvalue, upperbetabound]` which brings the typeII error to 0.5. If `upperbetabound` is set to `NULL`, it will try to guess a usable `upperbetabound` and slowly increase (`steppc` controls the increases) it until it finds an optimal beta. This can be, however, computationally expensive.

`steppc` Controls the size of the steps taken in finding the optimal beta. The stepwise increase is `upperbetabound` * `steppc`. Default is 0.1.

`intercept` If set to `TRUE`, the program will look for an intercept in the design matrix and will include one should there be no intercept. If `FALSE`, the program will estimate the linear model without an intercept. This is, however, not recommended.

`lambda`

`lambdamm`

`iterations` number of iterations of the Bernoulli Test

`qq`

`qqmm`

`silent` Should warnings during the procedure be displayed? Default is FALSE.

`verbose` If FALSE, it prints only essential summary of the test. Default is TRUE.

`na.action` How to cope with missing values. Uses system-default as default value.

Details

This function computes several exact tests for the coefficient of a linear regression. For an explanation as to how the tests are constructed, please refer to the paper mentioned below.

Author(s)

Karl Schlag, Olivier Gossner, Gareth Liu-Evans and Oliver Reiter

References

Olivier Gossner, Karl H. Schlag, "Finite-sample exact tests for linear regressions with bounded dependent variables", Journal of Econometrics, Volume 177, Issue 1, November 2013, Pages 75-84, ISSN 0304-4076, http://dx.doi.org/10.1016/j.jeconom.2013.06.003.

See Also

http://homepage.univie.ac.at/karl.schlag/research/statistics.html

Examples

```
## step example
n <- 40
h <- 0.7
Y <- sample(c(0, 1), size = n, replace = TRUE)
X <- cbind(1, runif(n = n) < h)
elm(Y, X, 0, 1, coefs = 2, nullvalue = 0, upperbetabound = NULL)
```

elmCI *Exact linear models*

Description

Computes the bounds of confidence intervals from a run of `elm`

Usage

```
elmCI(elm, alpha = 0.05, coefs = 2,
      dispWarnings = FALSE,
      useTest = NULL)
```

Arguments

`elm`	test results from a previous `elm`-run.
`alpha`	the confidence level of the interval is 1 - `alpha`
`coefs`	the index of the coefficients to be tested
`dispWarnings`	indicator whether warnings should be displayed during the run of `elmCI`. Default is `FALSE`, since the root-finding algorithms sometimes searches out-of-bounds, which can result in a large amount of warnings.
`useTest`	By default (`NULL`), the test that minimizes the typeII error in the run of `elm` is used to calculate the bound of the confidence interval. If you have doubts about the location of the bound, you can use this switch to coerce the program to use one of the four tests available. "1" is the Nonstandardized OLS, "2" the Bernoulli OLS, "3" the Nonstandardized MM and "4" corresponds to the Bernoulli MM test. After using this option, it is recommended to rerun `elm` with the bound specified by the user and compare it to the bound by the original test. See the examples for an illustration of this point (TODO).

Details

This program computes the bound of a confidence interval, given the results of a run of `elm`. At this stage, it is only possible to derive the bound corresponding to the alternative chosen in the run of `elm`. That means, if `alternative = "greater"` was specified, the program will look for the lower bound of the regression coefficient. For the upper bound, the results of a run of `elm` with `alternative = "less"` will be needed. Two sided confidence interval are as of now not implemented. Please run the program at `alpha/2` with both alternatives.

Author(s)

Karl Schlag, Olivier Gossner, Gareth Liu-Evans and Oliver Reiter

References

Olivier Gossner, Karl H. Schlag, "Finite-sample exact tests for linear regressions with bounded dependent variables", Journal of Econometrics, Volume 177, Issue 1, November 2013, Pages 75-84, ISSN 0304-4076, http://dx.doi.org/10.1016/j.jeconom.2013.06.003.

See Also

http://homepage.univie.ac.at/karl.schlag/research/statistics.html

Examples

```
## step example
n <- 40
h <- 0.3
Y <- sample(c(0, 1), size = n, replace = TRUE)
X <- cbind(1, runif(n = n) < h)

## first lower bound:
result.lower <- elm(Y, X, 0, 1, coefs = 2, nullvalue = 0, upperbetabound =
  NULL, alternative = "greater")
## see what the results look like
result.lower
## compute lower bound for the coefficient
elmCI(result.lower, alpha = 0.025)

## now upper bound:
result.upper <- elm(Y, X, 0, 1, coefs = 2, nullvalue = 0, upperbetabound =
  NULL, alternative = "greater")
## see what the results look like
result.upper
## compute upper bound for the coefficient
elmCI(result.upper, alpha = 0.025)
```

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