

# Package ‘cstar’

July 2, 2014

**Type** Package

**Title** Substantive significance testing for regression estimates and marginal effects.

**Version** 1.0

**Date** 2014-05-13

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**Description** Functions that allow a researcher to examine the robustness of the substantive significance of their findings. Implements ideas set out in Esarey and Danneman (2014).

**License** GPL-2

**Suggests** MASS

**NeedsCompilation** no

**Repository** CRAN

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cstar-package	<i>Functions to examine the substantive robustness of regression-based results.</i>
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### Description

Researchers care not only about the statistical significance of results, but also their substantive significance. This package implements a set of tools that allow researchers to use Bayesian decision-theoretic techniques set out in Esarey and Danneman (2014) to determine the substantive robustness of regression-based results. Specifically, given a set of regression results, a researcher can determine the minimum substantively meaningful relationship supported by his or her evidence under a variety levels of risk aversion.

### Details

Package: cstar  
Type: Package  
Version: 1.0  
Date: 2014-05-13  
License: GPL-2

### Author(s)

Justin Esarey Maintainer: Justin Esarey <justin@justinesarey.com>

### References

Esarey and Danneman (2014). A Quantitative Method for Substantive Robustness Assessment. Political Science Research and Methods.

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cstar	<i>Compute cstar from least squares results</i>
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### Description

cstar computes the minimum actionable effect size under a kinked linear loss function with user-specified degree of risk aversion.

### Usage

```
cstar(regobject, r)
```

**Arguments**

regobject      Results from a run of a linear regression model, e.g. from the `lm()` command.  
r                The degree of loss aversion; must be a non-negative number. This parameter maps to gamma in Esarey and Danneman (2014).

**Value**

A vector of expected values for the utility of acting on the evidence encapsulated by the betas and standard errors of the estimated regression, given the researcher's stated level of loss aversion.

**References**

Esarey and Danneman (2014). A Quantitative Method for Substantive Robustness Assessment. Political Science Research and Methods.

**Examples**

```
# generate synthetic OLS data
x <- rnorm(50)
error <- rnorm(50)
y <- 1 + 1.5*x + error

# estimate model
OLSmodel <- lm(y~x)

# obtain expected utility of acting on validity of beta,
# conditional on a loss-aversion factor of 2
cstar(OLSmodel, 2)

# examine the sensitivity to choice of loss-aversion factor
loss_aversion_values <- c(1, 2, 3, 4)
eu <- NULL
for(i in loss_aversion_values){
  eu <- c(eu, cstar(OLSmodel, i)[2])
}
plot(loss_aversion_values, eu)
```

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cstari

*Compute cstar from published least squares results*

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**Description**

cstari computes the minimum actionable effect size under a kinked linear loss function with user-specified degree of risk aversion. It computes this value from a beta, its associated standard error, and the degrees of freedom of a regression, and gamma, e.g. enables researchers to compute this quantity from a table of published results.

**Usage**

```
cstari(b, v, degfr, r)
```

**Arguments**

b	The beta of interest from a linear regression model.
v	The standard error associated with the beta of interest.
degfr	The degrees of freedom of the regression.
r	The degree of loss aversion; must be a non-negative number. This parameter maps to gamma in Esarey and Danneman (2014).

**Value**

The expected value for the utility of acting on the evidence encapsulated by the beta and standard error of the estimated regression, given the researcher's stated level of loss aversion.

**References**

Esarey and Danneman (2014). A Quantitative Method for Substantive Robustness Assessment. Political Science Research and Methods.

**Examples**

```
cstari(2.5, 1, 50, 2)
```

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cstarme	<i>Compute cstar for simulated marginal effects</i>
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**Description**

cstarme computes the minimum actionable effect size of a simulated marginal effect under a kinked linear loss function with user-specified degree of loss.

**Usage**

```
cstarme(sims, r)
```

**Arguments**

sims	A vector of simulated marginal effects. See Details.
r	The degree of loss aversion; must be a non-negative number. This parameter maps to gamma in Esarey and Danneman (2014).

**Details**

sims can be any vector of simulated marginal effects. For example, the change in predicted probability of an outcome as we change the level of a predictor in a logistic regression model.

**Value**

A vector of expected values for the utility of acting on the evidence encapsulated by the simulated marginal effects, given the researcher's stated level of loss aversion.

**References**

Esarey and Danneman (2014). A Quantitative Method for Substantive Robustness Assessment. Political Science Research and Methods.

**Examples**

```
# create some logit data
x <- rnorm(50)
xb <- .5 + 2*x
pry <- exp(xb) / (1 + exp(xb))
y <- rbinom(50, 1, pry)

plot(x, y)

# run logistic regression
mod <- glm(y~x, family=binomial(link="logit"))

# extract variance-covariance matrix
VCV <- vcov(mod)

# simulate intercept and B1 from multivariate normal
require(MASS)
simulated_betas <- mvrnorm(n=50, mu=coefficients(mod), Sigma=VCV)

# calculate pr(y=1) for each simulated pair of (intercept, B1);
# do so at x=0 and x=2
pry_x0 <- apply(simulated_betas, 1, function(x){
  exp(x[1] + 0*x[2]) / (1 + exp(x[1] + 0*x[2]))
})
pry_x2 <- apply(simulated_betas, 1, function(x){
  exp(x[1] + 2*x[2]) / (1 + exp(x[1] + 2*x[2]))
})

# compute the simulated change in predicted probability
simulated_marginal_effects <- pry_x2 - pry_x0

# estimate the expected utility of accepting evidence
cstarme(simulated_marginal_effects, 2)
```

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