# Package 'multeR'

August 9, 2023

**Title** Multiple Treatment Effects Regression

**Version** 0.1.0

**Description** Calculate estimators adjusted for the contamination bias in multiple treatment setting with heterogeneous treatment effects.

**Depends** R (>= 4.1.0)

**License** GPL-3

**Encoding** UTF-8

**LazyData** true

**Imports** stats,
Formula,
data.table,
Matrix,
rlang

**Suggests** ggplot2,
testthat (>= 3.0.0),
knitr,
rmarkdown,
formatR

**RoxygenNote** 7.2.3

**URL** https://github.com/SaiChrisZHANG/multe-R

**VignetteBuilder** knitr

**Language** en-US

**BugReports** https://github.com/SaiChrisZHANG/multe-R/issues

**Config/testthat/edition** 3

## R topics documented:

`multe` *Multiple Treatment Effects Regression*

## Description

Calculate estimators adjusted for the contamination bias in multiple treatment setting with heterogeneous treatment effects.

## Usage

```
multe(
  formula,
  data,
  subset,
  na.action,
  vce = "robust",
  base_val,
  decomp = FALSE,
  minmax = FALSE,
  alpha = 0.05,
  save_lambda_as,
  save_tau_as,
  print = TRUE
)
```

## Arguments

| | |
|---|---|
| `formula` | object of class `"formula"` (or one that can be coerced to that class) of the form `outcome ~ treatment \| control` |
| `data` | optional data frame, list or environment (or object coercible by `as.data.frame` to a data frame) containing the outcome and running variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called. |
| `subset` | optional vector specifying a subset of observations to be used in the fitting process. |
| `na.action` | function which indicates what should happen when the data contain `NA`s. The default is set by the `na.action` setting of `options` (usually `na.omit`). Another possible value is `na.fail` |
| `vce` | Specifies the type of standard errors to report, it can be a string equal to<br>**"robust"** Heteroskedasticity-robust standard errors (default).<br>**"oracle"** Heteroskedasticity-robust standard errors, treating propensity scores as known. |
| `base_val` | Specifies the baseline value of the treatment variable, the first unique value of the treatment variable is used as default. |
| `decomp` | Compute contamination bias decomposition. |
| `minmax` | Save saturated group-specific treatment effects as tau and/or implicit ATE regression weights as lambda; computes bias decomposition internally. |

| | |
|---|---|
| alpha | Determines the confidence level, 1-alpha for constructing/optimizing confidence intervals. |
| save_lambda_as | Saves the set of implicit ATE regression weights, with the input as the prefix of variable names. The saved data frame can be merged back to the data set via index. |
| save_tau_as | Saves the saturated group-specific treatment effects, with the input as the prefix of variable names. The saved data frame can be merged back to the data set via index. |
| print | print a summary of the results. |

## Value

Returns a summary of the results, containing

estimation For treatment effect estimation results, where

- est Point estimates of the treatment effect, via 3 methods: ATE (est[,1]), one-at-a-time (est[,2]), and common weights (est[,3]).
- se_po Heteroskedasticity-robust standard errors.
- se_or Oracle standard errors: heteroskedasticity-robust, treating propensity scores as known.
- po_vcov Variance-covariance matrix, heterogeneity-robust.
- or_vcov Variance-covariance matrix, oracle.

decomposition For contamination bias decomposition results, where

- est Point estimates of the contamination bias decomposition, including: coefficients (est[,1]), own effect (est[,2]), contamination bias (est[,3]), and its maximum (est[,4]) and minimum (est[,5]).
- se Standard errors.
- lambda_saved Saved lambdas, the set of implicit ATE regression weights. Only appear when save_lambda_as is specified.
- tauhat_saved Saved lambdas, the saturated group-specific treatment effects. Only appear when save_tau_as is specified.

And in both estimation and decomposition,

n_obs Number of effect observations used for analysis (with weak overlapping strata dropped.

n_trt Number of treatment arms.

Tlevels The label vector treatment arms.

If decomp is not specified, only returns estimation as a list.

## Note

subset is evaluated in the same way as variables in formula, that is first in data and then in the environment of formula.

## References

*Goldsmith-Pinkham, Paul, Peter Hull, and Michal Kolesár. Contamination bias in linear regressions. No. w30108. National Bureau of Economic Research, 2022. doi: 10.3386/w30108*

## Examples

```
# Project STAR dataset
multe(score ~ treatment | school, data = star)
multe(score ~ treatment | school, data = star, decomp = TRUE, minmax = TRUE)
multe(score ~ treatment | school, data = star, decomp = TRUE, save_lambda_as = "lambda")
```

---

`star` *Project STAR data as analyzed in Krueger (1999)*

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## Description

Subset of Project STAR data, focusing on kindergarten effects where differential attribution and other complications with the experimental analysis are minimal. The Project STAR RCT randomized 11600 students in 79 public Tennessee elementary schools to one of three types of classes: regular-sized, small, regular-sized with a teaching aide.

## Usage

```
star
```

## Format

A data frame with 5,868 rows and 4 variables:

**score** Students' test score achievement at the end of kindergarten: calculated as the average percentile of students' math, reading and word recognition score on the Stanford Achievement Test in the experimental sample, following Krueger (1999).

**treatment** Treatment assignment indicator, including 3 values: `"regular"` for the control group of regular-sized kindergarten class, `"small"` for the treatment group of small kindergarten class, `"aide"` for the treatment group of regular-sized class with a teaching aide.

**school** School ID.

**teacher** Teacher ID

## Source

Harvard Dataverse, Project STAR page, https://dataverse.harvard.edu/dataset.xhtml?persistentId=hdl:1902.1/10766

## References

*Krueger, A. B. (1999). Experimental estimates of education production functions. The quarterly journal of economics, 114(2), 497-532. doi: 10.1162/003355399556052*

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