Package 'sreg'

June 25, 2024

Type Package

Title Stratified Randomized Experiments

Version 1.0.0

Description Estimate average treatment effects (ATEs) in stratified randomized experiments. 'sreg' is designed to accommodate scenarios with multiple treatments and cluster-level treatment assignments, and accommodates optimal linear covariate adjustment based on baseline observable characteristics. 'sreg' computes estimators and standard errors based on Bugni, Canay, Shaikh (2018) <doi:10.1080/01621459.2017.1375934>; Bugni, Canay, Shaikh, Tabord-Meehan (2024+) <doi:10.48550/arXiv.2204.08356>; and Jiang, Linton, Tang, Zhang (2023+) <doi:10.48550/arXiv.2201.13004>.

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Encoding UTF-8

LazyData true

RoxygenNote 7.2.3

Imports dplyr, extraDistr, rlang, tidyr, cli

Suggests haven, knitr, rmarkdown, testthat (>= 3.0.0)

Depends R (>= 2.10)

Config/testthat/edition 3

VignetteBuilder knitr

URL https://github.com/jutrifonov/sreg

BugReports https://github.com/jutrifonov/sreg/issues

NeedsCompilation no

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Contents

`AEJapp` *Replication data for: Iron Deficiency and Schooling Attainment in Peru (Chong et al, 2016)*

Description

The data is taken from Chong et al. (2016), who study the effect of iron deficiency anemia (i.e., anemia caused by a lack of iron) on school-age children's educational attainment and cognitive ability in Peru.

Usage

```
data("AEJapp")
```

Format

A data frame with 215 observations on the 62 variables.

Source

Chong, A., Cohen, I., Field, E., Nakasone, E., and Torero, M. (2016). Replication data for: Iron Deficiency and Schooling Attainment in Peru. Nashville, TN: American Economic Association [publisher], 2016. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2019-10-12. doi:10.3886/E113624V1.

References

Chong, A., Cohen, I., Field, E., Nakasone, E., and Torero, M. (2016). Iron Deficiency and Schooling Attainment in Peru. *American Economic Journal: Applied Economics*, 8(4), 222–255. doi:10.1257/app.20140494.

Examples

```
data(AEJapp)
```

print.sreg *Print* sreg *Objects*

Description

Print the summary table of estimation results for sreg objects.

Usage

```
## S3 method for class 'sreg'
print(x, ...)
```

Arguments

x	An object of class sreg.
...	Additional arguments passed to other methods.

Value

No return value, called for side effects.

Examples

```
data <- sreg.rgen(n = 200, tau.vec = c(0.1), n.strata = 4, cluster = TRUE)
Y <- data$Y
S <- data$S
D <- data$D
X <- data.frame("x_1" = data$x_1, "x_2" = data$x_2)
result <- sreg(Y, S, D, G.id = NULL, Ng = NULL, X)
print(result)
```

sreg *Estimate Average Treatment Effects (ATEs) and Corresponding Standard Errors*

Description

Estimate the ATE(s) and the corresponding standard error(s) for a (collection of) treatment(s) relative to a control.

Usage

```
sreg(Y, S = NULL, D, G.id = NULL, Ng = NULL, X = NULL, HC1 = TRUE)
```

Arguments

Y	a numeric $n \times 1$ vector/matrix/data.frame/tibble of the observed outcomes
S	a numeric $n \times 1$ vector/matrix/data.frame/tibble of strata indicators indexed by $\{1, 2, 3, \ldots\}$; if NULL then the estimation is performed assuming no stratification
D	a numeric $n \times 1$ vector/matrix/data.frame/tibble of treatments indexed by $\{0, 1, 2, \ldots\}$, where D $= 0$ denotes the control
G.id	a numeric $n \times 1$ vector/matrix/data.frame/tibble of cluster indicators; if NULL then estimation is performed assuming treatment is assigned at the individual level
Ng	a numeric $n \times 1$ vector/matrix/data.frame/tibble of cluster sizes; if NULL then Ng is assumed to be equal to the number of available observations in every cluster
X	a matrix/data.frame/tibble with columns representing the covariate values for every observation; if NULL then the estimator without linear adjustments is applied. (Note: sreg cannot use individual-level covariates for covariate adjustment in cluster-randomized experiments. Any individual-level covariates will be aggregated to their cluster-level averages)
HC1	a TRUE/FALSE logical argument indicating whether the small sample correction should be applied to the variance estimator

Value

An object of class sreg that is a list containing the following elements:

- tau.hat: a $1 \times |\mathcal{A}|$ vector of ATE estimates, where $|\mathcal{A}|$ represents the number of treatments
- se.rob: a $1 \times |\mathcal{A}|$ vector of standard errors estimates, where $|\mathcal{A}|$ represents the number of treatments
- t.stat: a $1 \times |\mathcal{A}|$ vector of t-statistics, where $|\mathcal{A}|$ represents the number of treatments
- p.value: a $1 \times |\mathcal{A}|$ vector of corresponding p-values, where $|\mathcal{A}|$ represents the number of treatments
- CI.left: a $1 \times |\mathcal{A}|$ vector of the left bounds of the 95% as. confidence interval
- CI.right: a $1 \times |\mathcal{A}|$ vector of the right bounds of the 95% as. confidence interval
- data: an original data of the form data.frame(Y, S, D, G.id, Ng, X)
- lin.adj: a data.frame representing the covariates that were used in implementing linear adjustments

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References

Bugni, F. A., Canay, I. A., and Shaikh, A. M. (2018). Inference Under Covariate-Adaptive Randomization. *Journal of the American Statistical Association*, 113(524), 1784–1796, doi:10.1080/01621459.2017.1375934.

Bugni, F., Canay, I., Shaikh, A., and Tabord-Meehan, M. (2024+). Inference for Cluster Randomized Experiments with Non-ignorable Cluster Sizes. *Forthcoming in the Journal of Political Economy: Microeconomics*, doi:10.48550/arXiv.2204.08356.

Jiang, L., Linton, O. B., Tang, H., and Zhang, Y. (2023+). Improving Estimation Efficiency via Regression-Adjustment in Covariate-Adaptive Randomizations with Imperfect Compliance. *Forthcoming in Review of Economics and Statistics*, doi:10.48550/arXiv.2204.08356.

Examples

```
library("sreg")
library("dplyr")
library("haven")
### Example 1. Simulated Data.
data <- sreg.rgen(n = 1000, tau.vec = c(0), n.strata = 4, cluster = FALSE)
Y <- data$Y
S <- data$S
D <- data$D
X <- data.frame("x_1" = data$x_1, "x_2" = data$x_2)
result <- sreg(Y, S, D, G.id = NULL, Ng = NULL, X)
print(result)
### Example 2. Empirical Data.
?AEJapp
data("AEJapp")
data <- AEJapp
head(data)
Y <- data$gradesq34
D <- data$treatment
S <- data$class_level
data.clean <- data.frame(Y, D, S)
data.clean <- data.clean %>%
  mutate(D = ifelse(D == 3, 0, D))
Y <- data.clean$Y
D <- data.clean$D
S <- data.clean$S
table(D = data.clean$D, S = data.clean$S)
result <- sreg(Y, S, D)
print(result)
pills <- data$pills_taken
age <- data$age_months
data.clean <- data.frame(Y, D, S, pills, age)
data.clean <- data.clean %>%
```

```
  mutate(D = ifelse(D == 3, 0, D))
Y <- data.clean$Y
D <- data.clean$D
S <- data.clean$S
X <- data.frame("pills" = data.clean$pills, "age" = data.clean$age)
result <- sreg(Y, S, D, G.id = NULL, X = X)
print(result)
```

`sreg.rgen` *Generate a Pseudo-Random Sample under the Stratified Block Randomization Design*

Description

The function generates the observed outcomes, treatment assignments, strata indicators, cluster indicators, cluster sizes, and covariates for estimating the treatment effect within the context of a stratified block randomization design under the covariate-adaptive randomization (CAR).

Usage

```
sreg.rgen(
  n,
  Nmax = 50,
  n.strata,
  tau.vec = c(0),
  gamma.vec = c(0.4, 0.2, 1),
  cluster = TRUE,
  is.cov = TRUE
)
```

Arguments

`n`	a total number of observations in a sample
`Nmax`	a maximum size of generated clusters (maximum number of observations in a cluster)
`n.strata`	an integer specifying the number of strata
`tau.vec`	a numeric $1 \times \lvert\mathcal{A}\rvert$ `vector` of treatment effects, where $\lvert\mathcal{A}\rvert$ represents the number of treatments
`gamma.vec`	a numeric 1×3 `vector` of parameters corresponding to covariates
`cluster`	a `TRUE/FALSE` argument indicating whether the dgp should use a cluster-level treatment assignment or individual-level
`is.cov`	a `TRUE/FALSE` argument indicating whether the dgp should include covariates or not

Value

An object that is a 'data.frame' with n observations containing the generated values of the following variables:

- `Y`: a numeric $n \times 1$ `vector` of observed outcomes
- `S`: a numeric $n \times 1$ `vector` of strata indicators
- `D`: a numeric $n \times 1$ `vector` of treatments indexed by $\{0, 1, 2, \ldots\}$, where `D` $= 0$ denotes the control
- `G.id`: a numeric $n \times 1$ `vector` of cluster indicators
- `X`: a `data.frame` with columns representing the covariate values for every observation

Examples

```
data <- sreg.rgen(n = 1000, tau.vec = c(0), n.strata = 4, cluster = TRUE)
```

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