

Package ‘DiDforBigData’

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Title A Big Data Implementation of Difference-in-Differences Estimation with Staggered Treatment

Version 1.0

Description Provides a big-data-friendly and memory-efficient difference-in-differences estimator for staggered (and non-staggered) treatment contexts.

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Depends data.table, sandwich

Suggests ggplot2, knitr, rmarkdown, scales, parallel, fixest, progress

VignetteBuilder knitr

URL <https://setzler.github.io/DiDforBigData/>

BugReports <https://github.com/setzler/DiDforBigData/issues>

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DiD

*Combine DiD estimates across cohorts and event times.***Description**

Estimate DiD for all possible cohorts and event time pairs (g,e), as well as the average across cohorts for each event time (e).

Usage

```
DiD(
  inputdata,
  varnames,
  control_group = "all",
  base_event = -1,
  min_event = NULL,
  max_event = NULL,
  Esets = NULL,
  return_ATTs_only = TRUE,
  parallel_cores = 1
)
```

Arguments

<code>inputdata</code>	A data.table.
<code>varnames</code>	A list of the form <code>varnames = list(id_name, time_name, outcome_name, cohort_name)</code> , where all four arguments of the list must be a character that corresponds to a variable name in <code>inputdata</code> .
<code>control_group</code>	There are three possibilities: <code>control_group="never-treated"</code> uses the never-treated control group only; <code>control_group="future-treated"</code> uses those units that will receive treatment in the future as the control group; and <code>control_group="all"</code> uses both the never-treated and the future-treated in the control group. Default is <code>control_group="all"</code> .
<code>base_event</code>	This is the base pre-period that is normalized to zero in the DiD estimation. Default is <code>base_event=-1</code> .
<code>min_event</code>	This is the minimum event time (e) to estimate. Default is <code>NULL</code> , in which case, no minimum is imposed.
<code>max_event</code>	This is the maximum event time (e) to estimate. Default is <code>NULL</code> , in which case, no maximum is imposed.
<code>Esets</code>	If a list of sets of event times is provided, it will loop over those sets, computing the average <code>ATT_e</code> across event times e. Default is <code>NULL</code> .
<code>return_ATTs_only</code>	Return only the ATT estimates and sample sizes. Default is <code>TRUE</code> .
<code>parallel_cores</code>	Number of cores to use in parallel processing. If greater than 1, it will try to run <code>library(parallel)</code> , so the "parallel" package must be installed. Default is 1.

Value

A list with two components: `results_cohort` is a `data.table` with the DiDge estimates (by event `e` and cohort `g`), and `results_average` is a `data.table` with the DiDe estimates (by event `e`, average across cohorts `g`). If the `Esets` argument is specified, a third component called `results_Esets` will be included in the list of output.

Examples

```
# simulate some data
simdata = SimDiD(sample_size=200, ATTcohortdiff = 2)$simdata

# define the variable names as a list()
varnames = list()
varnames$time_name = "year"
varnames$outcome_name = "Y"
varnames$cohort_name = "cohort"
varnames$id_name = "id"

# estimate the ATT for all cohorts at event time 1 only
DiD(simdata, varnames, min_event=1, max_event=1)
```

DiDge

Estimate DiD for a single cohort (g) and a single event time (e).

Description

Estimate DiD for a single cohort (g) and a single event time (e).

Usage

```
DiDge(
  inputdata,
  varnames,
  cohort_time,
  event_postperiod,
  base_event = -1,
  control_group = "all",
  return_data = FALSE,
  return_ATTs_only = TRUE
)
```

Arguments

`inputdata` A `data.table`.

`varnames` A list of the form `varnames = list(id_name, time_name, outcome_name, cohort_name)`, where all four arguments of the list must be a character that corresponds to a variable name in `inputdata`.

cohort_time	The treatment cohort of reference.
event_postperiod	Number of time periods after the cohort time at which to estimate the DiD.
base_event	This is the base pre-period that is normalized to zero in the DiD estimation. Default is base_event=-1.
control_group	There are three possibilities: control_group="never-treated" uses the never-treated control group only; control_group="future-treated" uses those units that will receive treatment in the future as the control group; and control_group="all" uses both the never-treated and the future-treated in the control group. Default is control_group="all".
return_data	If true, this returns the treated and control differenced data. Default is FALSE.
return_ATTs_only	Return only the ATT estimates and sample sizes. Default is TRUE.

Value

A single-row `data.table()` containing the estimates and various statistics such as sample size. If `return_data=TRUE`, it instead returns a list in which the `data_prepost` entry is the previously-mentioned single-row `data.table()`, and the other argument `data_prepost` contains the constructed data that should be provided to OLS.

Examples

```
# simulate some data
simdata = SimDiD(sample_size=200)$simdata

# define the variable names as a list()
varnames = list()
varnames$time_name = "year"
varnames$outcome_name = "Y"
varnames$cohort_name = "cohort"
varnames$id_name = "id"

# estimate the ATT for cohort 2007 at event time 1
DiDge(simdata, varnames, cohort_time=2007, event_postperiod=1)

# change the base period to -3
DiDge(simdata, varnames, base_event=-3, cohort_time=2007, event_postperiod=1)

# use only the never-treated control group
DiDge(simdata, varnames, control_group = "never-treated", cohort_time=2007, event_postperiod=1)
```

Description

Simulate data from the model $Y_{it} = \alpha_i + \mu_t + ATT \cdot (t \geq G_i) + \epsilon_{it}$, where i is individual, t is year, and G_i is the cohort. The ATT formula is $ATT_{at0} + EventTime \cdot ATT_{growth} + \backslash *cohort_counter \backslash * ATT_{cohortdiff}$, where $cohort_counter$ is the order of treated cohort (first, second, etc.).

Usage

```
SimDiD(
  seed = 1,
  sample_size = 100,
  cohorts = c(2007, 2010, 2012),
  ATTat0 = 1,
  ATTgrowth = 1,
  ATTcohortdiff = 0.5,
  anticipation = 0,
  minyear = 2003,
  maxyear = 2013,
  idvar = 1,
  yearvar = 1,
  shockvar = 1,
  indivAR1 = FALSE,
  time_covars = FALSE,
  clusters = FALSE,
  markets = FALSE,
  randomNA = FALSE,
  missingCohorts = NULL
)
```

Arguments

seed	Set the random seed. Default is seed=1.
sample_size	Number of individuals. Default is sample_size=100.
cohorts	Vector of years at which treatment onset occurs. Default is cohorts=c(2007,2010,2012).
ATTat0	Treatment effect at event time 0. Default is 1.
ATTgrowth	Increment in the ATT for each event time after 0. Default is 1.
ATTcohortdiff	Increment in the ATT for each cohort. Default is 0.5.
anticipation	Number of years prior to cohort to allow 50% treatment effects. Default is anticipation=0.
minyear	Minimum calendar year to include in the data. Default is minyear=2003.
maxyear	Maximum calendar year to include in the data. Default is maxyear=2013.
idvar	Variance of individual fixed effects (α_i). Default is idvar=1.
yearvar	Variance of year effects (μ_i). Default is yearvar=1.
shockvar	Variance of idiosyncratic shocks (ϵ_{it}). Default is shockvar=1.
indivAR1	Each individual's shocks follow an AR(1) process. Default is FALSE.

<code>time_covars</code>	Add 2 time-varying covariates, called "X1" and "X2". Default is FALSE.
<code>clusters</code>	Add 10 randomly assigned clusters, with cluster-specific AR(1) shocks. Default is FALSE.
<code>markets</code>	Add 10 randomly assigned markets, with market-specific shocks that are systematically greater for markets that are treated earlier. Default is FALSE.
<code>randomNA</code>	If TRUE, randomly assign the outcome variable with missing values (NA) in some cases. Default is FALSE.
<code>missingCohorts</code>	If set to a particular cohort (or vector of cohorts), all of the outcomes for that cohort at event time -1 will be set to missing. Default is NULL.

Value

A list with two `data.tables`. The first `data.table` is simulated data with variables (`id`, `year`, `cohort`, `Y`), where `Y` is the outcome variable. The second `data.table` contains the true ATT values, both at the (`event,cohort`) level and by event averaging across cohorts.

Examples

```
# simulate data with default options
SimDiD()
```

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