Package ‘ecic’

February 21, 2023

Title Extended Changes-in-Changes

Version 0.0.3

Description Extends the Changes-in-Changes model a la Athey and Imbens (2006) <doi:10.1111/j.1468-0262.2006.00668.x> to multiple cohorts and time periods, which generalizes difference-in-differences estimation techniques to the entire distribution. Computes quantile treatment effects for every possible two-by-two combination in ecic(). Then, aggregating all bootstrap runs adds the standard errors in summary_ecic(). Results can be plotted with plot_ecic() aggregated over all cohort-group combinations or in an event-study style for either individual periods or individual quantiles.

License MIT + file LICENSE

URL https://frederickluser.github.io/ecic/

BugReports https://github.com/frederickluser/ecic/issues

Depends R (>= 2.10)

Imports furrr, future, ggplot2, patchwork, progress, progressr, stats

Suggests tinytest

Encoding UTF-8

LazyData true

RoxygenNote 7.2.3

NeedsCompilation no

Author Frederic Kluser [aut, cre, cph] (<https://orcid.org/0000-0002-4454-7572>)

Maintainer Frederic Kluser <frederic.kluser@unibe.ch>

Repository CRAN

Date/Publication 2023-02-21 10:40:02 UTC

R topics documented:

`dat` *Simulated sample data*

Description

A simulated sample panel data with heterogeneous treatment effects across cohorts and groups.

Usage

```
dat
```

Format

A simulated data frame with 60,000 rows and 5 columns:

countyreal Unit ID

first.treat Cohort

year Period

time_to_treat Period - Cohort

lemp dependent variable

Source

Simulation data

ecic — *Estimate a changes-in-changes model with multiple periods and cohorts*

Description

Calculates a changes-in-changes model as in Athey and Imbens (2006) for multiple periods and cohorts.

Usage

```
ecic(
  yvar = NULL,
  gvar = NULL,
  tvar = NULL,
  ivar = NULL,
  dat = NULL,
  myProbs = seq(0.1, 0.9, 0.1),
  nMin = 40,
  boot = c(”weighted”, ”normal”, ”no”),
  nReps = 10,
  weight_n0 = c(”n1”, ”n0”),
  weight_n1 = c(”n1”, ”n0”),
  quant_algo = 1,
  es = FALSE,
  n_digits = NULL,
  periods_es = NULL,
  save_to_temp = FALSE,
  progress_bar = c(”progress”, ”void”, ”cli”),
  nCores = 1
)
```

Arguments

`yvar` Dependent variable.

`gvar` Group variable. Can be either a string (e.g., "first_treated") or an expression (e.g., first_treated). In a staggered treatment setting, the group variable typically denotes treatment cohort.

`tvar` Time variable. Can be a string (e.g., "year") or an expression (e.g., year).

`ivar` Individual Index variable. Can be a string (e.g., "country") or an expression (e.g., country). Only needed to check cohort sizes.

`dat` The data set.

`myProbs` Quantiles that the quantile treatment effects should be calculated for.

`nMin` Minimum observations per groups. Small groups are deleted.

`boot` Bootstrap. Resampling is done over the entire data set ("normal"), but might be weighted by period-cohort size ("weighted"). If you do not want to calculate standard error, set boot = "no".

`nReps` Number of bootstrap replications.

`weight_n0` Weight for the aggregation of the CDFs in the control group. `n1` uses cohort sizes (Alternative: `n0`).

`weight_n1` Weight for the aggregation of the CDFs in the treatment group. `n1` uses cohort sizes (Alternative: `n0`).

`quant_algo` Quantile algorithm (see Wikipedia for definitions).

`es` Event Study (Logical). If TRUE, a quantile treatment effect is estimated for each event-period.

`n_digits` Rounding the dependent variable before aggregating the empirical CDFs reduces the size of the imputation grid. This can significantly reduce the amount of RAM used in large data sets and improve running time, while reducing precision (Use with caution).

`periods_es` Periods of the event study.

`save_to_temp` Logical. If TRUE, results are temporarily saved. This reduces the RAM needed, but increases running time.

`progress_bar` Whether progress bar should be printed (select "void" for no progress bar or "cli" for another type of bar).

`nCores` Number of cores used. If set > 1, bootstrapping will run in parallel.

Value

An `ecic` object.

References

Athey, Susan and Guido W. Imbens (2006). *Identification and Inference in Nonlinear Difference-in-Differences Models*. doi:10.1111/j.14680262.2006.00668.x

Examples

```
# Example 1. Using the small mpdta data in the did package
data(dat, package = "ecic")
dat = dat[dat$first.treat <= 1983 & dat$countyreal <= 1000,] # small data for fast run

mod_res =
  summary(
  ecic(
    yvar  = lemp,         # dependent variable
    gvar  = first.treat,  # group indicator
    tvar  = year,         # time indicator
    ivar  = countyreal,   # unit ID
    dat   = dat,          # dataset
    boot  = "normal",     # bootstrap proceduce ("no", "normal", or "weighted")
    nReps = 3             # number of bootstrap runs
    )
    )

# Basic Plot
ecic_plot(mod_res)


# Example 2. Load some larger sample data
data(dat, package = ”ecic”)

# Estimate a basic model with the package's sample data
mod_res =
  summary(
  ecic(
    yvar  = lemp,         # dependent variable
    gvar  = first.treat,  # group indicator
    tvar  = year,         # time indicator
    ivar  = countyreal,   # unit ID
    dat   = dat,          # dataset
    boot  = ”weighted”,   # bootstrap proceduce (”no”, ”normal”, or ”weighted”)
    nReps = 20            # number of bootstrap runs
  )
  )

# Basic Plot
ecic_plot(mod_res)

# Example 3. An Event-Study Example
mod_res =
  summary(
  ecic(
    es    = TRUE,         # aggregate for every event period
    yvar  = lemp,         # dependent variable
    gvar  = first.treat,  # group indicator
    tvar  = year,         # time indicator
    ivar  = countyreal,   # unit ID
    dat   = dat,          # dataset
    boot  = ”weighted”,   # bootstrap proceduce (”no”, ”normal”, or ”weighted”)
    nReps = 20            # number of bootstrap runs
  )
  )

# Plots
ecic_plot(mod_res) # aggregated in one plot
ecic_plot(mod_res, es_type = ”for_quantiles”) # individually for every quantile
ecic_plot(mod_res, es_type = ”for_periods”)   # individually for every period
```

ecic_plot *Plot an extended changes-in-changes model*

Description

Plots the results of the ecic model, either along the percentiles or in an event-study fashion.

Usage

```
ecic_plot(
  object,
  es_type = c("aggregated", "for_quantiles", "for_periods"),
  perc_plot = NULL,
  periods_plot = NULL,
  xlab = NULL,
  ylab = "QTE \n",
  ylim = NULL,
  size = 2,
  zero_line = FALSE,
  legend_title = "Percentiles"
)
```

Arguments

object An ecic_table object.

es_type If an event study was estimated with ecic, you can choose the style of the ES plot. "aggregated" puts everything in one plot. "for_quantiles" generates one plot for each percentile. "for_periods" generates one plot for each period.

perc_plot Which percentiles to plot.

periods_plot Which periods to plot.

xlab Alternative x-axis label

ylab Alternative y-axis label.

ylim Define the y-axis limits.

size Size of the point estimates.

zero_line Add a horizontal line at zero.

legend_title Change the title of the legend.

Value

A ggplot2 object.

`print.ecic` *Print ecic objects*

Description

Prints an `ecic` model while making attributes invisible.

Usage

```
## S3 method for class 'ecic'
print(x, ..., details = FALSE)
```

Arguments

`x` An `ecic` object.

`...` further arguments

`details` logical. Set to TRUE to print background information for every bootstrap run and Changes-in-Changes model.

Value

An `ecic` print object.

`summary.ecic` *Summary for a changes-in-changes regression with multiple periods and cohorts*

Description

Summarizes an `ecic` object by aggregating the bootstrap runs. Works also in an event-study fashion.

Usage

```
## S3 method for class 'ecic'
summary(object, ...)
```

Arguments

`object` An `ecic` object.

`...` further arguments.

Value

An `ecic_table` object.

Index