Package: DistLagHet (via r-universe)

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Type Package

Title Treatment Effect Estimation in Complex Designs

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Description Implements estimation methods for treatment effects in complex designs under parallel-trends assumptions. Based on the methodology of de Chaisemartin and D'Haultfoeuille (2025) <doi:10.48550/arXiv.2508.07808>. Provides three model specifications: base model with K lags, full dynamics model using all available periods, and interactions model with lag interaction terms. Includes C++ optimizations for faster bootstrap estimation.

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LinkingTo Rcpp, RcppEigen

Suggests testthat (>= 3.0.0)

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`estim_RC_model_base` *Base RC Model Estimation (C++ backend)*

Description

Estimates the base RC model with K lags using optimized C++ code. This function uses RcppEigen for fast matrix operations.

Usage

```
estim_RC_model_base(
  K,
  data,
  group_col,
  deltaY_col,
  deltaD_col,
  D_col,
  X_cols,
  weights = NULL,
  same_sample = FALSE
)
```

Arguments

`K`	Integer. Number of lags (required for "base" and "interactions" models, ignored for "full_dynamics"). Default is NULL.
`data`	Data frame containing the panel data.
`group_col`	Character. Name of the column identifying groups (e.g., counties, individuals).
`deltaY_col`	Character. Name of the column for DeltaY (first difference of outcome).
`deltaD_col`	Character. Name of the column for DeltaD (first difference of treatment).
`D_col`	Character. Name of the column for D (treatment level).
`X_cols`	Character vector. Names of columns for covariates.
`weights`	Numeric vector. Optional weights for estimation (default: uniform weights).
`same_sample`	Logical. If TRUE, restrict estimation to groups identified for ALL coefficients simultaneously (default: FALSE). When TRUE, also returns `n_valid_groups`.

Value

A list containing estimation results.

---

estim_RC_model_full *Full Dynamics RC Model Estimation (C++ backend)*

Description

Estimates the RC model with full dynamics (all available periods) using optimized C++ code.

Usage

```
estim_RC_model_full(
  K = NULL,
  data,
  group_col,
  deltaY_col,
  deltaD_col,
  D_col,
  X_cols,
  weights = NULL,
  same_sample = FALSE
)
```

Arguments

K	Integer. Number of lags (required for "base" and "interactions" models, ignored for "full_dynamics"). Default is NULL.
data	Data frame containing the panel data.
group_col	Character. Name of the column identifying groups (e.g., counties, individuals).
deltaY_col	Character. Name of the column for DeltaY (first difference of outcome).
deltaD_col	Character. Name of the column for DeltaD (first difference of treatment).
D_col	Character. Name of the column for D (treatment level).
X_cols	Character vector. Names of columns for covariates.
weights	Numeric vector. Optional weights for estimation (default: uniform weights).
same_sample	Logical. If TRUE, restrict estimation to groups identified for ALL coefficients simultaneously (default: FALSE). When TRUE, also returns `n_valid_groups`.

Value

A list containing estimation results.

estim_RC_model_interactions

RC Model with Interaction Terms (C++ backend)

Description

Estimates the RC model with interaction terms between lags using optimized C++ code.

Usage

```
estim_RC_model_interactions(
  K,
  data,
  group_col,
  deltaY_col,
  deltaD_col,
  D_col,
  X_cols,
  weights = NULL,
  same_sample = FALSE
)
```

Arguments

`K`	Integer. Number of lags (required for "base" and "interactions" models, ignored for "full_dynamics"). Default is NULL.
`data`	Data frame containing the panel data.
`group_col`	Character. Name of the column identifying groups (e.g., counties, individuals).
`deltaY_col`	Character. Name of the column for DeltaY (first difference of outcome).
`deltaD_col`	Character. Name of the column for DeltaD (first difference of treatment).
`D_col`	Character. Name of the column for D (treatment level).
`X_cols`	Character vector. Names of columns for covariates.
`weights`	Numeric vector. Optional weights for estimation (default: uniform weights).
`same_sample`	Logical. If TRUE, restrict estimation to groups identified for ALL coefficients simultaneously (default: FALSE). When TRUE, also returns `n_valid_groups`.

Value

A list containing estimation results.

estim_RC_model_unified

Unified RC Model Estimation with Multiple Specifications

Description

Main wrapper function that allows choosing between different model specifications for estimating treatment effects in complex designs under parallel-trends assumptions. Optionally computes bootstrap standard errors and confidence intervals.

Usage

```
estim_RC_model_unified(
  K = NULL,
  data,
  group_col,
  deltaY_col,
  deltaD_col,
  D_col,
  X_cols,
  weights = NULL,
  model = c("base", "full_dynamics", "interactions"),
  bootstrap = FALSE,
  B = 200,
  conf_level = 0.95,
  verbose = TRUE,
  same_sample = FALSE
)
```

Arguments

K	Integer. Number of lags (required for "base" and "interactions" models, ignored for "full_dynamics"). Default is NULL.
data	Data frame containing the panel data.
group_col	Character. Name of the column identifying groups (e.g., counties, individuals).
deltaY_col	Character. Name of the column for DeltaY (first difference of outcome).
deltaD_col	Character. Name of the column for DeltaD (first difference of treatment).
D_col	Character. Name of the column for D (treatment level).
X_cols	Character vector. Names of columns for covariates.
weights	Numeric vector. Optional weights for estimation (default: uniform weights).
model	Character. One of "base", "full_dynamics", or "interactions". Default is "base".
bootstrap	Logical. If TRUE, compute bootstrap standard errors (default: FALSE).
B	Integer. Number of bootstrap iterations (default: 200, ignored if bootstrap = FALSE).

conf_level	Numeric. Confidence level for bootstrap intervals (default: 0.95, ignored if bootstrap = FALSE).
verbose	Logical. Show bootstrap progress bar (default: TRUE, ignored if bootstrap = FALSE).
same_sample	Logical. If TRUE, restrict estimation to groups identified for ALL coefficients simultaneously (default: FALSE). When TRUE, also returns n_valid_groups.

Value

A list containing:

gamma	Coefficients for covariates
B_hat	Estimated treatment effect coefficients (betas)
Nobs	Number of observations used for each coefficient
model	Model type used
n_valid_groups	Number of groups identified for all coefficients (only if same_sample = TRUE)

If bootstrap = TRUE, also includes:

se	Bootstrap standard errors
t_stat	t-statistics (B_hat / se)
ci_lower	Lower bounds of confidence intervals
ci_upper	Upper bounds of confidence intervals
boot_iterations	Number of successful bootstrap iterations

Examples

```
# Generate example data
data <- generate_did_data(n_groups = 50, n_periods = 5)

# Estimate base model without bootstrap
result <- estim_RC_model_unified(
  K = 2,
  data = data,
  group_col = "group",
  deltaY_col = "delta_Y",
  deltaD_col = "delta_D",
  D_col = "D",
  X_cols = c("X1", "X2"),
  model = "base"
)

# Estimate with bootstrap standard errors
result_boot <- estim_RC_model_unified(
  K = 2,
  data = data,
  group_col = "group",
  deltaY_col = "delta_Y",
```

```
  deltaD_col = "delta_D",
  D_col = "D",
  X_cols = c("X1", "X2"),
  model = "base",
  bootstrap = TRUE,
  B = 200
)

print(result_boot$B_hat)
print(result_boot$se)
```

`generate_did_data` *Generate Synthetic DID Panel Data*

Description

Creates synthetic panel data for testing and examples. The data includes groups, time periods, treatment indicators, outcomes, and covariates.

Usage

```
generate_did_data(
  n_groups = 50,
  n_periods = 5,
  treatment_prob = 0.3,
  seed = 123
)
```

Arguments

`n_groups`	Integer. Number of groups (e.g., counties, individuals). Default is 50.
`n_periods`	Integer. Number of time periods. Default is 5.
`treatment_prob`	Numeric. Probability of treatment switching (0 to 1). Default is 0.3.
`seed`	Integer. Random seed for reproducibility. Default is 123.

Value

A data frame with columns:

`group`	Group identifier
`time`	Time period
`D`	Treatment level
`delta_D`	First difference of treatment
`Y`	Outcome variable
`delta_Y`	First difference of outcome
`X1`, `X2`	Covariates

Examples

```
# Generate data with 30 groups and 4 time periods
data <- generate_did_data(n_groups = 30, n_periods = 4)
head(data)
```

---

summary_RC_model *Print Summary of RC Model Results*

Description

Provides a formatted summary of estimation results, including bootstrap standard errors and confidence intervals if available.

Usage

```
summary_RC_model(result)
```

Arguments

result	A list returned by estim_RC_model_unified or related functions.

Value

Invisibly returns the result object.

Examples

```
data <- generate_did_data()
result <- estim_RC_model_unified(K = 2, data = data, group_col = "group",
                                 deltaY_col = "delta_Y", deltaD_col = "delta_D",
                                 D_col = "D", X_cols = c("X1", "X2"),
                                 model = "base", bootstrap = TRUE)
summary_RC_model(result)
```

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