Package: plausibounds (via r-universe)

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Title Plausible Bounds for Treatment Path Estimates

Version 1.0.1

Description Enhances dynamic effect plots as suggested in Freyaldenhoven and Hansen (2026) <https://simonfreyaldenhoven.github.io/papers/Plausible_bounds.pdf>. Data-driven smoothing delivers a smooth estimated path with potentially improved point estimation properties and confidence regions covering a surrogate that can be substantially tighter than conventional pointwise or uniform bands.

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Contents

`plausibounds-package` *plausibounds: Plausible Bounds for Treatment Path Estimates*

Description

Enhances dynamic effect plots as suggested in Freyaldenhoven and Hansen (2026). Data-driven smoothing delivers a smooth estimated path with potentially improved point estimation properties and confidence regions covering a surrogate that can be substantially tighter than conventional pointwise or uniform bands.

Main Functions

- `plausible_bounds`: Calculate plausible bounds
- `create_plot`: Create plots of the bounds

Example Datasets

The package includes example datasets to demonstrate the functionality:

- `estimates_constant` and `var_constant`: A simple case with constant estimates and no correlation
- `estimates_bighump` and `var_bighump`: A case with sinusoidal estimates and moderate correlation
- `estimates_smooth` and `var_smooth`: A smooth case with effects that slowly level off and no correlation, from Figure 1 of Freyaldenhoven and Hansen (2026)

`create_plot` *Create Plot for Plausible Bounds*

Description

This function creates a plot of plausible bounds from a plausible_bounds object. The plot displays plausible bounds as the main visualization, with optional pointwise and sup-t bounds overlays. Supports event study designs with pre-treatment periods.

Usage

```
create_plot(
  result,
  show_supt = TRUE,
  show_pointwise = TRUE,
  show_annotations = TRUE
)
```

Arguments

`result`	A plausible_bounds object returned by the plausible_bounds() function
`show_supt`	Whether to show sup-t bounds (default: TRUE)
`show_pointwise`	Whether to show pointwise bounds (default: TRUE)
`show_annotations`	Whether to show annotations with test statistics and ATE (default: TRUE)

Value

A ggplot2 object

Examples

```
# Example with bighump estimates and correlation between estimates
data(estimates_bighump)
data(var_bighump)
result_complex <- plausible_bounds(estimates_bighump[1:4], var_bighump[1:4, 1:4])
plot_complex <- create_plot(result_complex)
```

estimates_bighump *Sinusoidal Estimates with Moderate Correlation*

Description

A dataset containing estimates with a curved sinusoidal pattern in the first 6 periods that then converges to zero for the remaining 30 periods. The effect is a smooth curved trajectory with a large dip before the treatment effect quickly returns to 0. Generated with moderate correlation (rho = 0.5).

Usage

```
estimates_bighump
```

Format

A numeric vector with 36 elements

Source

Generated from simulation with sinusoidal design and moderate correlation (rho = 0.5)

Examples

```
data(estimates_bighump)
data(var_bighump)
result <- plausible_bounds(estimates_bighump[1:4], var_bighump[1:4, 1:4])
create_plot(result)
```

estimates_constant *Constant Estimates*

Description

A dataset containing estimates from a simple constant design, no correlation across horizons.

Usage

```
estimates_constant
```

Format

A numeric vector with 12 elements

Source

Generated from simulation with constant design and no correlation across horizons

Examples

```
data(estimates_constant)
data(var_constant)
result <- plausible_bounds(estimates_constant[1:4], var_constant[1:4, 1:4])
create_plot(result)
```

`estimates_smooth` *Smooth Estimates from Freyaldenhoven and Hansen (2026)*

Description

A dataset containing smooth treatment effect estimates that dip down and then converge to zero. The first 8 observations comprise the preperiods, the next 36 are post-period.

Usage

```
estimates_smooth
```

Format

A numeric vector with 44 elements (8 preperiods, 36 postperiods)

Source

Point estimates from Figure 1 of Freyaldenhoven and Hansen (2026)

Examples

```
data(estimates_smooth)
data(var_smooth)
result <- plausible_bounds(estimates_smooth[9:13], var_smooth[9:13, 9:13])
create_plot(result)
```

`plausible_bounds` *Calculate Plausible Bounds*

Description

This function calculates the plausible bounds for a vector of estimates along with average treatment effect, Wald tests, and optional pointwise/sup-t bounds. Supports pre-treatment periods for event study designs.

Usage

```
plausible_bounds(
  estimates,
  var,
  alpha = 0.05,
  preperiods = 0,
  include_pointwise = TRUE,
  include_supt = TRUE,
  parallel = FALSE,
  n_cores = NULL
)
```

Arguments

estimates	A numeric vector or single-row/single-column matrix of point estimates. If preperiods > 0, the first preperiods elements are pre-treatment estimates, followed by post-treatment estimates.
var	The variance-covariance matrix of the estimates
alpha	Significance level (default: 0.05)
preperiods	Number of pre-treatment periods (default: 0). Period 0 is assumed to be normalized and not included in estimates.
include_pointwise	Whether to include pointwise bounds (default: TRUE)
include_supt	Whether to include sup-t bounds (default: TRUE)
parallel	Whether to use parallel processing for restricted bounds calculation (default: FALSE)
n_cores	Number of cores to use for parallel processing (default: NULL, which uses detectCores() - 1). Only used when parallel = TRUE.

Value

A list containing:

alpha	Significance level
preperiods	Number of pre-treatment periods
wald_test	List with post (and pre if preperiods > 0) Wald test results
restricted_bounds	Data frame with horizon, unrestr_est, restr_est, lower, upper
restricted_bounds_metadata	List with supt_critval, supt_b, degrees_of_freedom, K, lambda1, lambda2, restr_class, best_fit_model
avg_treatment_effect	List with estimate, se, lower, upper
pointwise_bounds	List with lower and upper vectors (if include_pointwise = TRUE)
supt_bounds	List with lower and upper vectors (if include_supt = TRUE)

Examples

```
# Example with constant estimates and no correlation (simple case)
data(estimates_constant)
data(var_constant)
pb <- plausible_bounds(estimates_constant[1:4], var_constant[1:4, 1:4])
print(pb)
summary(pb)
```

`print.plausible_bounds` *Print method for plausible_bounds objects*

Description

Print method for plausible_bounds objects

Usage

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

Arguments

`x`	A plausible_bounds object
`...`	Additional arguments passed to print

Value

Invisibly returns a plausible_bounds object and displays summary of main results

Examples

```
# Example with constant estimates and no correlation (simple case)
data(estimates_constant)
data(var_constant)
pb <- plausible_bounds(estimates_constant[1:4], var_constant[1:4, 1:4])
print(pb)
```

print.summary.plausible_bounds

Print method for summary.plausible_bounds objects

Description

Print method for summary.plausible_bounds objects

Usage

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

Arguments

x	A summary.plausible_bounds object
...	Additional arguments passed to print

Value

Invisibly returns the input summary.plausible_bounds object and displays summary data.frame of restricted estimates and plausible bounds.

Examples

```
# Example with constant design and no correlation
data(estimates_constant)
data(var_constant)
pb <- plausible_bounds(estimates_constant[1:4], var_constant[1:4, 1:4])
pb_df <- summary(pb)
print(pb_df)
```

summary.plausible_bounds

Summary method for plausible_bounds objects

Description

Summary method for plausible_bounds objects

Usage

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

Arguments

object	A plausible_bounds object
...	Additional arguments passed to summary

Value

A data.frame containing the horizon, unrestricted estimates, restricted estimates, and plausible bounds

Examples

```
# Example with constant estimates and no correlation (simple case)
data(estimates_constant)
data(var_constant)
pb <- plausible_bounds(estimates_constant[1:4], var_constant[1:4, 1:4])
print(pb)
summary(pb)
```

---

var_bighump *Variance Matrix for Sinusoidal Estimates*

Description

A variance matrix for the sinusoidal estimates with moderate correlation structure (rho = 0.5). This matrix has non-zero off-diagonal elements representing moderate correlation across time periods.

Usage

```
var_bighump
```

Format

A 36 x 36 matrix

Source

Generated from simulation with sinusoidal design and moderate correlation (rho = 0.5)

Examples

```
data(estimates_bighump)
data(var_bighump)
result <- plausible_bounds(estimates_bighump[1:4], var_bighump[1:4, 1:4])
create_plot(result)
```

var_constant *Variance Matrix for Constant Estimates*

Description

A variance matrix for the constant estimates. This is a diagonal matrix representing no correlation across time periods.

Usage

```
var_constant
```

Format

A 12 x 12 matrix

Source

Generated from simulation with constant design and no correlation across horizons.

Examples

```
data(estimates_constant)
data(var_constant)
result <- plausible_bounds(estimates_constant[1:4], var_constant[1:4, 1:4])
create_plot(result)
```

var_smooth *Variance Matrix for Smooth Estimates*

Description

A variance matrix for the smooth estimates. This matrix captures the correlation structure of the estimates. The first 8 rows and 8 columns comprise the variance matrix for the 8 preperiods.

Usage

```
var_smooth
```

Format

A 44 x 44 matrix

Source

Variance Matrix from Figure 1 of Freyaldenhoven and Hansen (2026)

Examples

```
data(estimates_smooth)
data(var_smooth)
result <- plausible_bounds(estimates_smooth[9:13], var_smooth[9:13, 9:13])
create_plot(result)
```

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