

# Package ‘causalverse’

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**Title** Causality in Clarity

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**Maintainer** The package maintainer <mikenguyen.contact@gmail.com>

**Description** CausalVerse: An R toolkit expediting causal research & analysis. Streamlines complex methodologies, empowering users to unveil causal relationships with precision. Your go-to for insightful causality exploration..

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**Encoding** UTF-8

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ggthemes (>= 4.2.4),  
tidyverse (>= 2.0.0),  
lubridate (>= 1.9.2),  
rio (>= 0.5.29),  
xtable (>= 1.8.4),  
dplyr (>= 1.1.1),  
tidyr (>= 1.3.0),  
scales (>= 1.2.1),  
gridExtra (>= 2.3),  
systemfit (>= 1.1.30),  
Hotelling (>= 1.0.8),  
MatchIt (>= 4.5.4),  
rlang (>= 1.1.1),  
fixest (>= 0.11.1),  
stats (>= 4.2.3),  
PanelMatch (>= 2.0.1)

**VignetteBuilder** knitr

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---

ama_export_fig	<i>Function to export a figure with custom settings</i>
----------------	---

---

## Description

This function exports a ggplot2 figure to a given path. It exports both an archived version with the current date and a current version without a date. The function supports exporting to PDF and JPG formats.

## Usage

```
ama_export_fig(figure, filename, filepath, width = 7, height = 7)
```

## Arguments

figure	A ggplot2 object.
filename	A character string specifying the filename without the extension.
filepath	A character string specifying the directory to save the file.
width	The width of the image in inches (default is 7 inches).
height	The height of the image in inches (default is 7 inches).

## Examples

```
## Not run:
test_plot <- ggplot(mpg, aes(x=displ, y=hwy)) + geom_point() # Create a ggplot2 plot
filename <- "sample_plot" # Define a filename
filepath <- tempdir() # Define a path using a temporary directory
ama_export_fig(test_plot, filename, filepath) # Call the ama_export_fig function

## End(Not run)
```

---

ama_export_tab	<i>Function to export a table with AMA style</i>
----------------	--

---

### Description

This function exports the provided table in both Excel (.xlsx) and LaTeX (.tex) formats. The table is archived with the current date in the filename for the Excel version, while the LaTeX version is saved with just the specified filename.

### Usage

```
ama_export_tab(table, filename, filepath, caption = NULL)
```

### Arguments

table	A data frame or matrix.
filename	A character string specifying the filename without the extension.
filepath	A character string specifying the directory to save the file.
caption	A character string specifying the caption for the table.

### Examples

```
## Not run:
data(mtcars) # Load the mtcars dataset
ama_export_tab(mtcars[1:5, 1:5], "sample_table", tempdir(), "Sample Caption for mtcars")

## End(Not run)
```

---

ama_labs	<i>Custom Label Formatting for ggplot2: American Marketing Association Style</i>
----------	--

---

### Description

This function provides custom label formatting for ggplot2 based on the guidelines set by the American Marketing Association.

### Usage

```
ama_labs(
  title = NULL,
  subtitle = NULL,
  caption = NULL,
  x = NULL,
  y = NULL,
  fill = NULL,
  color = NULL,
  ...
)
```

**Arguments**

title	Plot title.
subtitle	Plot subtitle.
caption	Plot caption.
x	X-axis label.
y	Y-axis label.
fill	Fill legend title.
color	Color legend title.
...	Additional arguments to be passed to <code>ggplot2::labs()</code> .

**Value**

Modified labels for a `ggplot2` plot.

**Examples**

```
## Not run:
library(ggplot2)
ggplot(mtcars, aes(mpg, wt)) + geom_point() +
  ama_labs(title = "Sample Plot") +
  ama_theme()

## End(Not run)
```

---

ama_scale_color	<i>Custom Color Scale for ggplot2: American Marketing Association Style</i>
-----------------	---

---

**Description**

This function provides a custom color scale for `ggplot2` plots based on the guidelines set by the American Marketing Association.

**Usage**

```
ama_scale_color(
  use_color = FALSE,
  palette_name = "OkabeIto",
  grayscale_limits = c(0.2, 0.8)
)
```

**Arguments**

use_color	Logical. If TRUE, uses color, otherwise uses grayscale.
palette_name	Character. Name of the color palette to use.
grayscale_limits	Numeric vector. Limits for the grayscale gradient.

**Value**

A color scale for a ggplot2 plot.

**Examples**

```
## Not run:
library(ggplot2)
ggplot(mtcars, aes(mpg, wt, color = gear)) + geom_point(size = 4) + ama_scale_color()

## End(Not run)
```

---

**ama\_scale\_fill***Custom Fill Scale for ggplot2: American Marketing Association Style*

---

**Description**

This function provides a custom fill scale for ggplot2 plots based on the guidelines set by the American Marketing Association.

**Usage**

```
ama_scale_fill(
  use_color = FALSE,
  palette_name = "OkabeIto",
  grayscale_limits = c(0.2, 0.8)
)
```

**Arguments**

**use\_color** Logical. If TRUE, uses color, otherwise uses grayscale.

**palette\_name** Character. Name of the color palette to use.

**grayscale\_limits** Numeric vector. Limits for the grayscale gradient.

**Value**

A fill scale for a ggplot2 plot.

**Examples**

```
## Not run:
library(ggplot2)
ggplot(mtcars, aes(mpg, wt, fill = gear)) +
  geom_point(shape = 21, size = 4) +
  ama_scale_fill()

## End(Not run)
```

ama\_theme

*Custom Theme for ggplot2: American Marketing Association Style***Description**

This function provides a custom theme for ggplot2 following the guidelines set by the American Marketing Association.

**Usage**

```
ama_theme(
  base_size = 16,
  base_family = "sans",
  title_size = ggplot2::rel(1.2),
  axis_title_size = ggplot2::rel(1.2),
  legend_title_size = ggplot2::rel(0.6),
  legend_text_size = ggplot2::rel(0.6),
  axis_text_size = ggplot2::rel(1),
  ...
)
```

**Arguments**

base_size	Base font size.
base_family	Font family. Use "sans" for Arial and "serif" for Times New Roman.
title_size	Title font size as a relative value.
axis_title_size	Axis title font size as a relative value.
legend_title_size	Legend title font size as a relative value.
legend_text_size	Legend text font size as a relative value.
axis_text_size	Axis text font size as a relative value.
...	Additional theme elements to be passed to ggplot2::theme().

**Value**

A ggplot2 theme.

**Examples**

```
## Not run:
library(ggplot2)
# Using Arial font
ggplot(mtcars, aes(mpg, wt)) + geom_point() + ama_theme()
# Using Times New Roman font
ggplot(mtcars, aes(mpg, wt)) + geom_point() + ama_theme(base_family = "serif")

## End(Not run)
```

---

balance\_scatter\_custom

*Custom function to visualize the balance between treatment and control groups*


---

## Description

Custom function to visualize the balance between treatment and control groups

## Usage

```
balance_scatter_custom(
  matched_set_list,
  set.names = NULL,
  show.legend = TRUE,
  legend.title = "Type",
  legend.position = "right",
  xlim = c(0, 0.8),
  ylim = c(0, 0.8),
  main = "Standardized Mean Difference of Covariates",
  pchs = NULL,
  dot.size = NULL,
  covariates,
  data,
  x.axis.label = "Before Refinement",
  y.axis.label = "After Refinement",
  theme_use = causalverse::ama_theme(),
  ...
)
```

## Arguments

matched_set_list	List of matched sets
set.names	Vector of names for matched sets. Defaults to NULL.
show.legend	Boolean to determine if legend should be shown. Defaults to TRUE.
legend.title	Legend title. Defaults to "Type".
legend.position	Position of legend. Defaults to "right".
xlim	Vector defining x-axis limits. Defaults to c(0, 0.8).
ylim	Vector defining y-axis limits. Defaults to c(0, 0.8).
main	Main title for the plot. Defaults to "Standardized Mean Difference of Covariates".
pchs	Plot characters. Defaults to NULL.
dot.size	Size of dots in the scatter plot. Defaults to NULL.
covariates	Covariates for calculating balance.
data	Dataset for balance calculation.

x.axis.label	x-axis label. Defaults to "Before Refinement".
y.axis.label	y-axis label. Defaults to "After Refinement".
theme_use	Custom theme that follows ggplots2. Defaults to causalverse::ama_theme().
...	Additional arguments passed to the labs() function

## Value

ggplot object

## Examples

```
## Not run:
library(PanelMatch)
# Maha 4-year lag, up to 5 matches
PM.results.maha.4lag.5m <- PanelMatch::PanelMatch(
  lag = 4,
  time.id = "year",
  unit.id = "wbcode2",
  treatment = "dem",
  refinement.method = "mahalanobis",
  data = PanelMatch::dem,
  match.missing = TRUE,
  covs.formula = ~ I(lag(tradewb, 1:4)) + I(lag(y, 1:4)),
  size.match = 5,
  qoi = "att",
  outcome.var = "y",
  lead = 0:4,
  forbid.treatment.reversal = FALSE,
  use.diagonal.variance.matrix = TRUE
)

# Maha 4-year lag, up to 10 matches
PM.results.maha.4lag.10m <- PanelMatch::PanelMatch(
  lag = 4,
  time.id = "year",
  unit.id = "wbcode2",
  treatment = "dem",
  refinement.method = "mahalanobis",
  data = PanelMatch::dem,
  match.missing = TRUE,
  covs.formula = ~ I(lag(tradewb, 1:4)) + I(lag(y, 1:4)),
  size.match = 10,
  qoi = "att",
  outcome.var = "y",
  lead = 0:4,
  forbid.treatment.reversal = FALSE,
  use.diagonal.variance.matrix = TRUE
)

# Using the function
balance_scatter_custom(
  matched_set_list = list(PM.results.maha.4lag.5m$att, PM.results.maha.4lag.10m$att),
  set.names = c("Maha 4 Lag 5 Matches", "Maha 4 Lag 10 Matches"),
  data = dem,
  covariates = c("y", "tradewb")
)
```



```
## End(Not run)
```

---

```
plot_coef_par_trends  Plot Coefficients of Parallel Trends
```

---

## Description

This function generates coefplots or iplots based on fixest outputs, allowing the user to visualize interaction coefficients with ease.

## Usage

```
plot_coef_par_trends(
  data,
  dependent_vars,
  time_var,
  unit_treatment_status,
  unit_id_var,
  plot_type = "coefplot",
  combined_plot = TRUE,
  legend_position = "bottomleft",
  legend_title = "Legend Title",
  legend_args = list(),
  plot_args = list()
)
```

## Arguments

<code>data</code>	Data frame containing the data to be used in the model.
<code>dependent_vars</code>	Named list of dependent variables to model and their respective labels.
<code>time_var</code>	Name of the time variable in the data.
<code>unit_treatment_status</code>	Name of the treatment status variable.
<code>unit_id_var</code>	Name of the unit identification variable.
<code>plot_type</code>	Type of plot to generate. Either "coefplot" or "ipplot".
<code>combined_plot</code>	Logical indicating whether to combine plots for all dependent variables.
<code>legend_position</code>	Position of the legend on the plot.
<code>legend_title</code>	Title for the legend.
<code>legend_args</code>	List of additional arguments to customize the legend.
<code>plot_args</code>	List of additional arguments to customize the plot.

## Value

A plot visualizing interaction coefficients.

**Examples**

```

## Not run:
library(fixest)
data("base_did")

# Sample call to the function:
plot_coef_par_trends(
  data = base_did,
  dependent_vars = c(y = "Outcome 1", x1 = "Outcome 2"),
  time_var = "period",
  unit_treatment_status = "treat",
  unit_id_var = "id",
  plot_type = "coefplot",
  combined_plot = TRUE,
  plot_args = list(main = "Interaction coefficients Plot"),
  legend_title = "Metrics",
  legend_position = "bottomleft"
)

plot_coef_par_trends(
  data = base_did,
  dependent_vars = c(y = "Outcome 1", x1 = "Outcome 2"),
  time_var = "period",
  unit_treatment_status = "treat",
  unit_id_var = "id",
  plot_type = "coefplot",
  combined_plot = FALSE
)

## End(Not run)

```

---

plot\_covariate\_balance\_pretrend

*Plot Covariate Balance Over Pre-Treatment Period*


---

**Description**

This function visualizes the covariate balance over the pre-treatment period. It's particularly designed for outputs from methods like PanelMatch.

**Usage**

```

plot_covariate_balance_pretrend(
  balance_data,
  y_limits = c(-1, 1),
  theme_use = causalverse::ama_theme(),
  xlab = "Time to Treatment",
  ylab = "Balance (in SD unit)",
  main_title = "Covariate Balance Over Pre-Treatment Period",
  legend_title = "Covariate",
  show_legend = TRUE,
  ...
)

```

**Arguments**

balance_data	A matrix containing the covariate balance data over the pre-treatment period.
y_limits	A numeric vector of length 2 defining the y-axis limits.
theme_use	A ggplot2 theme. By default, it uses <code>causalverse::ama_theme()</code> .
xlab	A string indicating the label for the x-axis.
ylab	A string indicating the label for the y-axis.
main_title	A string for the main title of the plot.
legend_title	A string for the legend title.
show_legend	A logical; if TRUE, the legend is displayed, otherwise, it's hidden.
...	Additional arguments passed to the ggplot labs.

**Value**

A ggplot2 object.

**Examples**

```
## Not run:
balance_data_sample <- matrix(rnorm(20), nrow = 5)
plot_covariate_balance_pretrend(balance_data_sample)

## End(Not run)
```

---

```
plot_density_by_treatment
      Plot Density by Treatment
```

---

**Description**

This function creates a list of ggplot density plots for specified variables by treatment groups.

**Usage**

```
plot_density_by_treatment(
  data,
  var_map,
  treatment_var,
  show_legend = TRUE,
  theme_use = ggplot2::theme_minimal(),
  ...
)
```

**Arguments**

<code>data</code>	A data frame containing the variables to plot and a treatment variable.
<code>var_map</code>	A named list mapping the column names in the data to display names for plotting.
<code>treatment_var</code>	A named vector where the name is the treatment column in the data and the value is the legend title.
<code>show_legend</code>	A logical value indicating whether to show the legend. Defaults to TRUE.
<code>theme_use</code>	ggplot2 theme. Defaults to <code>ggplot2::theme_minimal()</code> .
<code>...</code>	Additional arguments to be passed to <code>geom_density</code> .

**Value**

A list of ggplot objects for each variable in `var_map`.

**Examples**

```
## Not run:
data(mtcars)
data <- mtcars %>%
  dplyr::select(mpg, cyl) %>%
  dplyr::rowwise() %>%
  dplyr::mutate(treatment = sample(c(0,1), 1, replace = TRUE)) %>%
  dplyr::ungroup()

plots <- plot_density_by_treatment(
  data = data,
  var_map = list("mpg" = "Var 1",
                 "cyl" = "Var 2"),
  treatment_var = c("treatment" = "Treatment Name\nin Legend")
)

## End(Not run)
```

---

<code>plot_PanelEstimate</code>	<i>Plot Estimated Effects of Treatment Over Time</i>
---------------------------------	--

---

**Description**

This function takes an object (result of `PanelEstimate` or similar) and plots its estimates over time.

**Usage**

```
plot_PanelEstimate(
  pe.object,
  ylab = "Estimated Effect of Treatment",
  xlab = "Time Since Treatment",
  main = "Estimated Effects of Treatment Over Time",
  ylim = NULL,
  theme_use = causalverse::ama_theme(),
  ...
)
```

**Arguments**

pe.object	The object with the estimation results.
ylab	The y-axis label.
xlab	The x-axis label.
main	The main title for the plot.
ylim	The limits for the y-axis.
theme_use	The theme to use for the plot. Defaults to <code>causalverse::ama_theme()</code> .
...	Additional parameters to pass to <code>labs()</code> function.

**Value**

A ggplot object with the desired plot.

**Examples**

```
## Not run:
PM.results.ps.weight <- PanelMatch(lag = 4, time.id = "year", unit.id = "wbcode2",
                                   treatment = "dem", refinement.method = "ps.weight",
                                   data = dem, match.missing = FALSE, listwise.delete = TRUE,
                                   covs.formula = ~ I(lag(tradewb, 1:4)) + I(lag(y, 1:4)),
                                   size.match = 5, qoi = "att", outcome.var = "y",
                                   lead = 0:4, forbid.treatment.reversal = FALSE)

PE.results <- PanelEstimate(sets = PM.results.ps.weight,
                           data = dem,
                           se.method = "bootstrap",
                           number.iterations = 1000,
                           confidence.level = .95)

plot_PanelEstimate(PE.results)

## End(Not run)
```

---

plot\_par\_trends

*Plot Parallel Trends*


---

**Description**

Plots parallel trends for given metrics.

**Usage**

```
plot_par_trends(
  data,
  metrics_and_names,
  treatment_status_var,
  time_var,
  conf_level = 0.95,
  non_negative = FALSE,
  display_CI = TRUE,
```

```

output_format = "plot",
smoothing_method = NULL,
title_prefix = "Parallel Trends for",
theme_use = causalverse::ama_theme()
)

```

### Arguments

<code>data</code>	A data frame containing the data to plot.
<code>metrics_and_names</code>	A named list of metrics to plot.
<code>treatment_status_var</code>	The variable indicating treatment status.
<code>time_var</code>	The variable indicating time.
<code>conf_level</code>	Confidence level for confidence intervals (default is 0.95).
<code>non_negative</code>	Logical; if TRUE, sets negative lower confidence bounds to 0.
<code>display_CI</code>	Logical; if TRUE, displays confidence intervals.
<code>output_format</code>	Format of the output; "plot" returns a list of ggplots, "data.frame" returns a data frame.
<code>smoothing_method</code>	Method to use for smoothing; NULL means no smoothing.
<code>title_prefix</code>	A character string specifying the prefix for the plot title (default is "Parallel Trends for").
<code>theme_use</code>	Custom theme that follows ggplots2

### Value

A list of ggplot objects or a data frame.

### Examples

```

## Not run:
library(tidyverse)
data <- expand.grid(entity = 1:100, time = 1:10) %>%
  dplyr::arrange(entity, time) %>%
  dplyr::mutate(
    treatment = ifelse(entity <= 50, "Treated", "Control"),
    outcome1 = 0.5 * time + rnorm(n(), 0, 2) + ifelse(treatment == "Treated", 0, 0),
    outcome2 = 3 + 0.3 * time + rnorm(n(), 0, 1) + ifelse(treatment == "Treated", 0, 2)
  )
results <- plot_par_trends(
  data = data,
  metrics_and_names = list(outcome1 = "Outcome 1", outcome2 = "Outcome 2"),
  treatment_status_var = "treatment",
  time_var = list(time = "Time"),
  smoothing_method = "loess"
)
library(gridExtra)
gridExtra::grid.arrange(grobs = results, ncol = 1)

## End(Not run)

```

---

plot_treat_time	<i>Plot number of treated units over time or return a dataframe.</i>
-----------------	--

---

## Description

Plot number of treated units over time or return a dataframe.

## Usage

```
plot_treat_time(
  data,
  time_var,
  unit_treat,
  outlier_method = "iqr",
  show_legend = FALSE,
  theme_use = causalverse::ama_theme(),
  legend_title = "Point Type",
  legend_labels = c("Regular", "Outlier"),
  regular_size = 3,
  outlier_size = 5,
  regular_color = "black",
  outlier_color = "red",
  regular_shape = 16,
  outlier_shape = 17,
  title = "Random Time Assignment",
  xlab = "Time",
  ylab = "Number of Treated Units",
  output = "plot",
  ...
)
```

## Arguments

data	Dataframe containing data.
time_var	Time variable for aggregating the number of treated units.
unit_treat	Variable indicating if the unit was treated in a specific time period.
outlier_method	Method for outlier detection ("iqr" or "z-score").
show_legend	Logical indicating whether to show legend.
theme_use	ggplot2 theme to use.
legend_title	Title for legend.
legend_labels	Labels for regular and outlier points.
regular_size	Size of regular points.
outlier_size	Size of outlier points.
regular_color	Color of regular points.
outlier_color	Color of outlier points.
regular_shape	Shape of regular points.
outlier_shape	Shape of outlier points.

<code>title</code>	Plot title.
<code>xlab</code>	X-axis label.
<code>ylab</code>	Y-axis label.
<code>output</code>	Type of output ("plot" or "dataframe").
<code>...</code>	Additional arguments to pass to <code>ggplot2::labs</code> .

**Value**

`ggplot2` object or dataframe.

**Examples**

```
# Example usage:
## Not run:
data <- data.frame(time = c(1,1,2,2,3,3), treat = c(0,1,1,1,0,0))
plot_treat_time(data, time_var = time, unit_treat = treat)
plot_treat_time(data, time_var = time, unit_treat = treat, output = "dataframe")

## End(Not run)
```



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