

Package ‘ERRI’

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Type Package

Title Economic Resilience and Recovery Index

Version 0.1.0

Description Estimates multidimensional economic resilience following a disruption by comparing observed outcomes with a counterfactual path. Components describe shock depth, cumulative loss, recovery time, recovery strength, post-shock stability, and positive transformation. The package supports grouped analysis, residual-bootstrap uncertainty, alternative weighting schemes, ranking probabilities, sensitivity analysis, shock screening, and diagnostic plots. Methods are designed for regional, sectoral, market, and other regularly observed economic time series.

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ERRI-package	<i>ERRI: Economic Resilience and Recovery Index</i>
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Description

Counterfactual measurement of resistance, loss, recovery, stability, and transformation following an economic disruption.

Details

The main function is `erri()`. Bootstrap uncertainty is available through `erri_bootstrap()`, while `erri_sensitivity()` examines dependence on component weights.

Author(s)

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detect_shocks	<i>Screen a Series for a Single Structural Shock</i>
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Description

Evaluates admissible split points using the proportional reduction in residual sum of squares from separate linear trends. This is a screening diagnostic and not a causal identification procedure.

Usage

```
detect_shocks(data, time, outcome, min_segment = 5L,  
              direction = c("any", "down", "up"))
```

Arguments

data	A data frame.
time	Character string naming the ordered time column.
outcome	Character string naming the numeric outcome column.
min_segment	Minimum observations on each side of a candidate split.
direction	Whether to retain any, downward, or upward shifts.

Value

A data frame of candidate times, scores, and estimated level shifts, sorted from strongest to weakest.

Examples

```
dat <- subset(erri_example_data(), region == "North")
head(detect_shocks(dat, "year", "income"))
```

erri

*Estimate the Economic Resilience and Recovery Index***Description**

Constructs a counterfactual path from observations before a shock and measures the magnitude, persistence, and reversal of subsequent deviations.

Usage

```
erri(
  data,
  time,
  outcome,
  shock_time,
  unit = NULL,
  method = c("trend", "mean", "ar1"),
  scale = c("sd", "mean", "none"),
  epsilon = 0.25,
  consecutive = 2L,
  weights = NULL,
  level = 0.95
)
```

Arguments

data	A data frame containing regularly ordered observations.
time	Character string naming the time column.
outcome	Character string naming the numeric outcome column.
shock_time	One common shock time or a named vector of group-specific shock times.
unit	Optional character string naming the grouping column.
method	Counterfactual method: "trend", "mean", or "ar1".
scale	Gap scaling based on the pre-shock standard deviation, absolute mean, or no scaling.
epsilon	Non-negative recovery tolerance in scaled-gap units.
consecutive	Positive number of consecutive observations required to declare recovery.
weights	Named non-negative weights for resistance, loss, recovery, strength, stability, and transformation.
level	Confidence level for counterfactual prediction intervals.

Details

For outcome Y_t , counterfactual Y_t^0 , and pre-shock scale s , the adverse gap is $G_t = (Y_t^0 - Y_t)/s$. Shock depth is the largest positive gap and cumulative loss is the sum of positive post-shock gaps. Recovery occurs when the absolute gap remains within `epsilon` for the specified number of observations. The remaining components measure the rate of gap closure, relative post-shock instability, and positive transformation.

With multiple units, component scores use cross-unit min-max scaling. A single-unit analysis uses bounded absolute transformations. The composite ERRI is the weighted mean of component scores multiplied by 100.

Value

An object of class `erri` containing component estimates, scores, the composite index, trajectories, settings, and fitted models.

Examples

```
dat <- erri_example_data()
fit <- erri(dat, time = "year", outcome = "income",
            unit = "region", shock_time = 2020)
fit
```

erri_bootstrap	<i>Bootstrap Uncertainty for ERRI</i>
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Description

Uses a residual bootstrap of the pre-shock counterfactual model and propagates counterfactual uncertainty to components and ERRI.

Usage

```
erri_bootstrap(object, R = 499L, block_length = 1L, level = 0.95,
               seed = NULL)
```

```
## S3 method for class 'erri_bootstrap'
print(x, digits = 2, ...)
```

Arguments

<code>object</code>	An object returned by <code>erri()</code> .
<code>R</code>	Number of bootstrap replications; at least 20.
<code>block_length</code>	Positive integer residual-block length.
<code>level</code>	Confidence level.
<code>seed</code>	Optional integer seed.

x	An erri_bootstrap object.
digits	Number of digits to display.
...	Additional arguments, currently unused.

Value

An object of class `erri_bootstrap` containing replicate estimates and percentile confidence intervals.

Examples

```
fit <- erri(erri_example_data(), "year", "income", 2020, "region")
boot <- erri_bootstrap(fit, R = 49, seed = 1)
boot
```

erri_example_data	<i>Example Regional Economic Data</i>
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Description

Reads the installed example data containing annual real-income indices for three fictional regions from 2010 through 2025. A disruption begins in 2020 and the regions have heterogeneous recovery paths.

Usage

```
erri_example_data()
```

Value

A data frame with region, year, and income.

Examples

```
dat <- erri_example_data()
head(dat)
```

erri_sensitivity	<i>Weight-Sensitivity Analysis for ERRI</i>
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Description

Generates random non-negative weights on the simplex and recalculates the index and rank of each unit.

Usage

```
erri_sensitivity(object, R = 1000L, seed = NULL)
```

Arguments

object	An object returned by <code>erri()</code> .
R	Number of random weight vectors.
seed	Optional integer seed.

Value

A data frame containing sampled weights, indices, and ranks.

Examples

```
fit <- erri(erri_example_data(), "year", "income", 2020, "region")
sens <- erri_sensitivity(fit, R = 100, seed = 3)
head(sens)
```

plot.erri	<i>Plot an ERRI Trajectory or Index Comparison</i>
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Description

Plots the observed and counterfactual paths with a prediction interval, compares composite indices, or compares component scores.

Usage

```
## S3 method for class 'erri'
plot(x, type = c("trajectory", "index", "components"),
     unit = NULL, ...)
```

Arguments

x	An object returned by <code>erri()</code> .
type	Trajectory, index, or component-score plot.
unit	Unit to display for a trajectory; defaults to the first unit.
...	Additional arguments passed to the base plotting function.

Value

The object invisibly.

Examples

```
fit <- erri(erri_example_data(), "year", "income", 2020, "region")
plot(fit, type = "index")
```

print.erri

Print and Summarize ERRI Results

Description

Displays the principal ERRI component estimates and returns a structured summary.

Usage

```
## S3 method for class 'erri'
print(x, digits = 2, ...)

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

Arguments

x	An object returned by <code>erri()</code> .
digits	Number of digits to display.
object	An object returned by <code>erri()</code> .
...	Additional arguments, currently unused.

Value

The object invisibly for `print`; a summary list for `summary`.

rank_probability	<i>Ranking Probabilities from Bootstrap Estimates</i>
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Description

Calculates pairwise probabilities that one unit's bootstrapped ERRI exceeds another unit's ERRI.

Usage

```
rank_probability(object)
```

Arguments

object An object returned by `erri_bootstrap()`.

Value

A square matrix of pairwise probabilities.

Examples

```
fit <- erri(erri_example_data(), "year", "income", 2020, "region")
boot <- erri_bootstrap(fit, R = 49, seed = 2)
rank_probability(boot)
```

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