Package ‘EconEvalR’

September 22, 2026

Type Package

Title Economic Evaluation Methods for Cost-Benefit, Partial Budgeting, and Cost-Effectiveness Analyses

Version 0.1.0

Description Provides functions for economic evaluation, including Cost-Benefit Analysis, Benefit-Cost Ratio, Net Present Value, Internal Rate of Return, Partial Budgeting, Budget Impact Analysis, Cost-Effectiveness Analysis, Decision Tree Analysis, One-Way, Two-Way, Multi-Way, and Probabilistic Sensitivity Analyses, Expected Value of Perfect Information, and Expected Value of Partial Perfect Information. The implemented methods are based on established approaches in economic evaluation and decision analysis; see Drummond et al. (2015, ISBN:9780199665884), Briggs et al. (2006, ISBN:9780198526629), Boardman et al. (2018, ISBN:9781108415996), and van Hout et al. (1994) <doi:10.1002/hec.4730030505>. The package produces summaries, graphical displays, and reproducible workflows for applications in veterinary science, agriculture, public health, epidemiology, health economics, and related fields.

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URL `https://github.com/vinodhpmd/EconEvalR`

BugReports `https://github.com/vinodhpmd/EconEvalR/issues`

Depends R (>= 4.3.0)

Imports cli (>= 3.6.2), mgcv

Suggests covr, testthat (>= 3.0.0)

Config/roxygen2/version 8.1.0

Config/testthat/edition 3

Encoding UTF-8

Language en-US

NeedsCompilation no

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Repository CRAN

Date/Publication 2026-09-22 07:10:09 UTC

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`as.data.frame.EconBCR` *Convert an EconBCR object to a data frame*

Description

Convert an EconBCR object to a data frame

Usage

```
## S3 method for class 'EconBCR'
as.data.frame(x, ...)
```

Arguments

`x`	An object of class "`EconBCR`".
`...`	Additional arguments (unused).

Value

A data frame with one row containing the benefit, cost, benefit-cost ratio, and decision.

as.data.frame.EconBIA *Convert a Budget Impact Analysis Object to a Data Frame*

Description

Converts an object of class "EconBIA" into a data frame suitable for exporting or further analysis.

Usage

```
## S3 method for class 'EconBIA'
as.data.frame(x, ...)
```

Arguments

x	An object of class "EconBIA".
...	Additional arguments (unused).

Value

A data frame containing the annual budget impact results.

Examples

```
bia <- budget_impact_analysis(
  population = 10000,
  uptake = c(0.10, 0.20, 0.35, 0.45, 0.60),
  current_cost = 1200,
  new_cost = 1500,
  years = 5,
  discount = 0.03
)

df <- as.data.frame(bia)
head(df)
```

as.data.frame.EconCEAC *Convert a Cost-Effectiveness Acceptability Curve Object to a Data Frame*

Description

Convert a Cost-Effectiveness Acceptability Curve Object to a Data Frame

Usage

```
## S3 method for class 'EconCEAC'
as.data.frame(x, ...)
```

Arguments

x	An object of class "EconCEAC".
...	Additional arguments (unused).

Value

A data frame containing the willingness-to-pay thresholds, probabilities of cost-effectiveness, and mean incremental net monetary benefit.

---

as.data.frame.EconCEAF — *Convert a Cost-Effectiveness Acceptability Frontier Object to a Data Frame*

Description

Converts an object of class "EconCEAF" into a data frame suitable for exporting or further analysis.

Usage

```
## S3 method for class 'EconCEAF'
as.data.frame(x, ...)
```

Arguments

x	An object of class "EconCEAF".
...	Additional arguments (unused).

Value

A data frame containing:

WTP Willingness-to-pay threshold.

OptimalStrategy Optimal strategy at each WTP.

Probability Probability that the optimal strategy is cost-effective.

ExpectedNMB Expected Net Monetary Benefit of the optimal strategy.

Examples

```
set.seed(123)

cost <- cbind(
  rnorm(100, 1000, 100),
  rnorm(100, 1200, 120),
  rnorm(100, 1400, 150)
)

effect <- cbind(
  rnorm(100, 0.70, 0.05),
  rnorm(100, 0.80, 0.05),
  rnorm(100, 0.90, 0.05)
)

ceaf <- cost_effectiveness_acceptability_frontier(
  cost = cost,
  effect = effect,
  wtp = c(0, 50000, 100000)
)

df <- as.data.frame(ceaf)
head(df)
```

---

as.data.frame.EconEVPI

Convert an Expected Value of Perfect Information Object to a Data Frame

---

Description

Converts an object of class "EconEVPI" into a data frame suitable for exporting or further analysis.

Usage

```
## S3 method for class 'EconEVPI'
as.data.frame(x, ...)
```

Arguments

x	An object of class "EconEVPI".
...	Additional arguments (unused).

Value

A data frame containing:

WTP Willingness-to-pay threshold.

EVPI Expected Value of Perfect Information.

ExpectedPerfectInformation Expected value under perfect information, $E[\max(NMB)]$.

ExpectedCurrentInformation Expected value under current information, $\max(E[NMB])$.

Examples

```
set.seed(123)

cost <- cbind(
  rnorm(100, 1000, 100),
  rnorm(100, 1200, 120),
  rnorm(100, 1500, 140)
)

effect <- cbind(
  rnorm(100, 0.70, 0.05),
  rnorm(100, 0.82, 0.05),
  rnorm(100, 0.92, 0.05)
)

evpi <- expected_value_perfect_information(
  cost = cost,
  effect = effect,
  wtp = c(0, 50000, 100000)
)

df <- as.data.frame(evpi)
head(df)
```

`as.data.frame.EconEVPPI` *Convert an Expected Value of Partial Perfect Information Object to a Data Frame*

Description

Convert an Expected Value of Partial Perfect Information Object to a Data Frame

Usage

```
## S3 method for class 'EconEVPPI'
as.data.frame(x, ...)
```

Arguments

`x`	An object of class "`EconEVPPI`".
`...`	Additional arguments (unused).

Value

A data frame.

`as.data.frame.EconPSA` *Convert a Probabilistic Sensitivity Analysis Object to a Data Frame*

Description

Convert a Probabilistic Sensitivity Analysis Object to a Data Frame

Usage

```
## S3 method for class 'EconPSA'
as.data.frame(x, ...)
```

Arguments

`x`	An object of class "`EconPSA`".
`...`	Additional arguments (unused).

Value

A data frame containing every Monte Carlo simulation.

`as.data.frame.EconTornado` *Convert a Tornado Diagram Object to a Data Frame*

Description

Convert a Tornado Diagram Object to a Data Frame

Usage

```
## S3 method for class 'EconTornado'
as.data.frame(x, ...)
```

Arguments

`x`	An object of class "`EconTornado`".
`...`	Additional arguments (unused).

Value

A data frame.

`as.data.frame.EconTree` *Convert a Decision Tree Analysis Object to a Data Frame*

Description

Converts an object of class "EconTree" into a data frame suitable for exporting or further analysis.

Usage

```
## S3 method for class 'EconTree'
as.data.frame(x, ...)
```

Arguments

x	An object of class "EconTree".
...	Additional arguments (unused).

Value

A data frame containing the terminal node results.

Examples

```
strategy <- c(
  "Treatment A",
  "Treatment B",
  "Treatment C"
)

probability <- c(0.30, 0.45, 0.25)
cost <- c(1200, 1800, 2400)
effectiveness <- c(0.70, 0.82, 0.91)

tree <- decision_tree_analysis(
  strategy,
  probability,
  cost,
  effectiveness
)

df <- as.data.frame(tree)
head(df)
```

`benefit_cost_ratio` *Benefit-Cost Ratio*

Description

Computes the Benefit-Cost Ratio (BCR) for an investment, intervention, or project.

Usage

```
benefit_cost_ratio(benefit, cost)
```

Arguments

`benefit`	Numeric. Total discounted benefits.
`cost`	Numeric. Total discounted costs.

Details

The Benefit-Cost Ratio is calculated as

$$BCR = \frac{Benefit}{Cost}$$

Value

An object of class `"EconBCR"`.

Examples

```
benefit_cost_ratio(
  benefit = 150000,
  cost = 100000
)
```

`budget_impact_analysis` *Budget Impact Analysis*

Description

Performs a Budget Impact Analysis (BIA) by comparing the projected healthcare expenditure under current practice with a new intervention over multiple years.

Usage

```
budget_impact_analysis(
  population,
  uptake,
  current_cost,
  new_cost,
  years = length(uptake),
  discount = 0
)
```

Arguments

`population`	Numeric scalar representing the eligible population.
`uptake`	Numeric vector representing the annual uptake proportions (0-1) of the new intervention.
`current_cost`	Numeric scalar giving the annual cost per patient under current practice.
`new_cost`	Numeric scalar giving the annual cost per patient under the new intervention.
`years`	Integer giving the number of years.
`discount`	Annual discount rate (default = 0).

Details

The function calculates, for each year:

- Eligible population
- Number treated
- Current budget
- New budget
- Incremental budget impact
- Discounted budget impact
- Cumulative discounted impact

Value

An object of class `"EconBIA"`.

Examples

```
bia <- budget_impact_analysis(
    population = 10000,
    uptake = c(0.10,0.20,0.35,0.45,0.60),
    current_cost = 1200,
    new_cost = 1500,
    years = 5,
    discount = 0.03
)
```

```
print(bia)
summary(bia)
plot(bia)
as.data.frame(bia)
```

`cost_effectiveness` *Cost Effectiveness Analysis*

Description

Performs a cost-effectiveness analysis (CEA) for two or more competing strategies by comparing their costs and effectiveness.

Usage

```
cost_effectiveness(strategy, cost, effectiveness)
```

Arguments

`strategy`	Character vector of strategy names.
`cost`	Numeric vector of costs.
`effectiveness`	Numeric vector of effectiveness.

Details

Cost-effectiveness analysis (CEA) compares alternative interventions in terms of their costs and effectiveness. It provides the basis for identifying efficient interventions and supports subsequent analyses such as Incremental Cost-Effectiveness Ratio (ICER), dominance analysis, cost-effectiveness acceptability curves (CEAC), and expected value of information analyses.

This function summarizes the observed costs and effectiveness for each strategy to facilitate economic evaluation and decision making.

Value

An object of class `"EconCEA"`.

References

Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW (2015). *Methods for the Economic Evaluation of Health Care Programmes*. 4th ed. Oxford University Press.

Briggs AH, Claxton K, Sculpher MJ (2006). *Decision Modelling for Health Economic Evaluation*. Oxford University Press.

Sanders GD, Neumann PJ, Basu A, Brock DW, Feeny D, Krahn M, Kuntz KM, Meltzer DO, Owens DK, Prosser LA, Salomon JA, Sculpher MJ, Trikalinos TA, Russell LB, Siegel JE, Ganiats TG (2016). Recommendations for Conduct, Methodological Practices, and Reporting of Cost-effectiveness Analyses. *JAMA*, 316(10), 1093–1103. doi:10.1001/jama.2016.12195

Examples

```
cea <- cost_effectiveness(
  strategy = c("Current", "Treatment A", "Treatment B"),
  cost = c(1000, 1300, 1700),
  effectiveness = c(0.60, 0.75, 0.90)
)

print(cea)
summary(cea)
plot(cea)
as.data.frame(cea)
```

`cost_effectiveness_acceptability_curve`
Cost-Effectiveness Acceptability Curve

Description

Computes the Cost-Effectiveness Acceptability Curve (CEAC) using probabilistic sensitivity analysis (PSA) results across a range of willingness-to-pay (WTP) thresholds.

Usage

```
cost_effectiveness_acceptability_curve(
  incremental_cost,
  incremental_effect,
  wtp = seq(0, 1e+05, by = 1000)
)
```

Arguments

`incremental_cost`
: Numeric vector of incremental costs.

`incremental_effect`
: Numeric vector of incremental effectiveness values.

`wtp`
: Numeric vector of willingness-to-pay thresholds.

Details

The Cost-Effectiveness Acceptability Curve (CEAC) summarizes the probability that an intervention is cost-effective for different willingness-to-pay (WTP) thresholds.

The Incremental Net Monetary Benefit (INMB) is calculated as

$$INMB = \lambda \times \Delta E - \Delta C$$

where

- λ = Willingness-to-pay threshold.
- ΔE = Incremental effectiveness.
- ΔC = Incremental cost.

The CEAC is obtained by calculating the proportion of probabilistic sensitivity analysis simulations for which the Incremental Net Monetary Benefit is positive ($INMB > 0$) at each willingness-to-pay threshold.

CEACs provide a graphical summary of decision uncertainty and are widely used in health economic evaluation.

Value

An object of class "EconCEAC".

References

Fenwick E, Claxton K, Sculpher M (2001). Representing Uncertainty: The Role of Cost-Effectiveness Acceptability Curves. *Health Economics*, 10(8), 779–787. doi:10.1002/hec.635

Briggs AH, Claxton K, Sculpher MJ (2006). *Decision Modelling for Health Economic Evaluation*. Oxford University Press.

Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW (2015). *Methods for the Economic Evaluation of Health Care Programmes*. 4th ed. Oxford University Press.

Examples

```
set.seed(1)

cost <- rnorm(1000, 500, 100)

effect <- rnorm(1000, 0.35, 0.08)

ceac <- cost_effectiveness_acceptability_curve(
  incremental_cost = cost,
  incremental_effect = effect,
  wtp = seq(0, 5000, 100)
)

print(ceac)
summary(ceac)
plot(ceac)
as.data.frame(ceac)
```

`cost_effectiveness_acceptability_frontier`
Cost-Effectiveness Acceptability Frontier

Description

Computes the Cost-Effectiveness Acceptability Frontier (CEAF) for multiple competing strategies using probabilistic sensitivity analysis (PSA) results.

Usage

```
cost_effectiveness_acceptability_frontier(
  cost,
  effect,
  wtp = seq(0, 1e+05, by = 1000)
)
```

Arguments

`cost`	A numeric matrix of costs. Rows represent probabilistic sensitivity analysis simulations and columns represent competing strategies.
`effect`	A numeric matrix of effectiveness values having the same dimensions as `cost`.
`wtp`	A numeric vector of willingness-to-pay (WTP) thresholds.

Details

The Cost-Effectiveness Acceptability Frontier (CEAF) identifies the strategy with the highest expected Net Monetary Benefit (NMB) at each willingness-to-pay (WTP) threshold and estimates the probability that this strategy is cost-effective.

Net Monetary Benefit (NMB) is calculated as

$$NMB = \lambda \times Effect - Cost$$

where

- λ = Willingness-to-pay threshold.

For each willingness-to-pay threshold:

- Expected Net Monetary Benefit is calculated for each strategy.
- The strategy with the highest expected Net Monetary Benefit is identified.
- The probability that this optimal strategy is cost-effective is estimated.

Unlike the Cost-Effectiveness Acceptability Curve (CEAC), the CEAF focuses on the strategy with the highest expected Net Monetary Benefit and therefore identifies the optimal decision across willingness-to-pay thresholds.

Value

An object of class "EconCEAF".

References

Fenwick E, Claxton K, Sculpher M (2001). Representing Uncertainty: The Role of Cost-Effectiveness Acceptability Curves. *Health Economics*, 10(8), 779–787. doi:10.1002/hec.635

Fenwick E, Claxton K, Briggs A (2001). Cost-Effectiveness Acceptability Curves. *Health Economics*, 10(8), 779–787.

Briggs AH, Claxton K, Sculpher MJ (2006). *Decision Modelling for Health Economic Evaluation*. Oxford University Press.

Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW (2015). *Methods for the Economic Evaluation of Health Care Programmes*. 4th ed. Oxford University Press.

Examples

```
set.seed(123)

cost <- cbind(
  rnorm(1000, 1000, 100),
  rnorm(1000, 1200, 120),
  rnorm(1000, 1400, 150)
)

effect <- cbind(
  rnorm(1000, 0.70, 0.05),
  rnorm(1000, 0.80, 0.05),
  rnorm(1000, 0.90, 0.05)
)

ceaf <- cost_effectiveness_acceptability_frontier(
  cost = cost,
  effect = effect
)

print(ceaf)
summary(ceaf)
plot(ceaf)
as.data.frame(ceaf)
```

---

decision_tree_analysis *Decision Tree Analysis*

Description

Performs a decision tree analysis by calculating the expected cost and expected effectiveness for terminal decision pathways based on their probabilities.

Usage

```
decision_tree_analysis(strategy, probability, cost, effectiveness)
```

Arguments

`strategy`	Character vector of terminal strategy names.
`probability`	Numeric vector of probabilities.
`cost`	Numeric vector of costs.
`effectiveness`	Numeric vector of effectiveness.

Details

Decision tree analysis is a standard decision-analytic technique used to evaluate alternative interventions under uncertainty by combining probabilities with associated costs and health outcomes.

Expected values are calculated as

$$Expected\,Cost = Probability \times Cost$$

and

$$Expected\,Effectiveness = Probability \times Effectiveness$$

The expected values for each terminal strategy can be compared to support evidence-based decision making and economic evaluation.

Value

An object of class `"EconTree"`.

References

Briggs AH, Claxton K, Sculpher MJ (2006). *Decision Modelling for Health Economic Evaluation*. Oxford University Press.

Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW (2015). *Methods for the Economic Evaluation of Health Care Programmes*. 4th ed. Oxford University Press.

Sonnenberg FA, Beck JR (1993). Markov Models in Medical Decision Making: A Practical Guide. *Medical Decision Making*, 13(4), 322–338. doi:10.1177/0272989X9301300409

Examples

```
strategy <- c(
  "Treatment A",
  "Treatment B",
  "Treatment C"
)

probability <- c(
  0.30,
```

```
    0.45,
    0.25
  )

  cost <- c(
    1200,
    1800,
    2400
  )

  effectiveness <- c(
    0.70,
    0.82,
    0.91
  )

  tree <- decision_tree_analysis(
    strategy,
    probability,
    cost,
    effectiveness
  )

  print(tree)
  summary(tree)
  plot(tree)
  as.data.frame(tree)
```

---

discounted_payback_period

Discounted Payback Period

Description

Calculates the discounted payback period of an investment by accounting for the time value of money.

Usage

```
discounted_payback_period(cashflow, rate)
```

Arguments

cashflow	Numeric vector of cash flows. The first value should represent the initial investment (negative), followed by subsequent cash inflows and/or outflows.
rate	Discount rate expressed as a decimal (e.g., 0.10 for 10%).

Details

The discounted payback period is the time required for the cumulative discounted cash inflows to recover the initial investment. Each future cash flow is first converted to its present value using the specified discount rate.

The present value of each cash flow is calculated as

$$PV = \frac{CF_t}{(1+r)^t}$$

where

- CF_t = Cash flow at time period t.
- r = Discount rate.
- t = Time period.

When the investment is recovered during a period, linear interpolation is used to estimate the fractional discounted payback period.

Unlike the conventional payback period, the discounted payback period accounts for the time value of money, although it does not consider cash flows occurring after the investment has been recovered.

Value

An object of class `"EconDiscountedPayback"`.

References

Boardman AE, Greenberg DH, Vining AR, Weimer DL (2018). *Cost-Benefit Analysis: Concepts and Practice*. 5th ed. Cambridge University Press.

Brealey RA, Myers SC, Allen F (2020). *Principles of Corporate Finance*. 13th ed. McGraw-Hill Education.

Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW (2015). *Methods for the Economic Evaluation of Health Care Programmes*. 4th ed. Oxford University Press.

Examples

```
dpb <- discounted_payback_period(
  cashflow = c(-50000, 12000, 15000, 18000, 20000),
  rate = 0.10
)

print(dpb)
```

discount_cashflow *Discount Cash Flows*

Description

Discounts one or more future cash flows to their present values using a specified discount rate.

Usage

```
discount_cashflow(cashflow, rate, period)
```

Arguments

`cashflow`	Numeric vector of cash flows.
`rate`	Discount rate expressed as a decimal (e.g., 0.10 for 10%).
`period`	Integer vector of time periods corresponding to each cash flow.

Details

Discounted cash flow (DCF) analysis converts future cash flows into their present values by accounting for the time value of money.

The present value of each cash flow is calculated as

$$PV = \frac{CF_t}{(1+r)^t}$$

where

- CF_t = Cash flow at time period t.
- r = Discount rate.
- t = Time period.

Discounting is widely used in economic evaluation, investment appraisal, and cost-benefit analysis to compare costs and benefits occurring at different points in time.

Value

An object of class `"EconDCF"`.

References

Boardman AE, Greenberg DH, Vining AR, Weimer DL (2018). *Cost-Benefit Analysis: Concepts and Practice*. 5th ed. Cambridge University Press.

Brealey RA, Myers SC, Allen F (2020). *Principles of Corporate Finance*. 13th ed. McGraw-Hill Education.

Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW (2015). *Methods for the Economic Evaluation of Health Care Programmes*. 4th ed. Oxford University Press.

Examples

```
discount_cashflow(
  cashflow = c(1000, 1200, 1500),
  rate = 0.10,
  period = 1:3
)
```

`dominance_analysis` *Dominance Analysis*

Description

Identifies strongly dominated strategies based on their costs and effectiveness.

Usage

```
dominance_analysis(strategy, cost, effectiveness)
```

Arguments

`strategy`	Character vector of strategy names.
`cost`	Numeric vector of costs.
`effectiveness`	Numeric vector of effectiveness.

Details

Dominance analysis is used in cost-effectiveness analysis to identify strategies that are economically inefficient.

A strategy is considered strongly dominated if another strategy has both a lower cost and an equal or greater level of effectiveness.

Strongly dominated strategies are excluded from further economic evaluation because they are always less efficient than at least one competing strategy.

Value

An object of class `"EconDominance"`.

References

Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW (2015). *Methods for the Economic Evaluation of Health Care Programmes*. 4th ed. Oxford University Press.

Briggs AH, Claxton K, Sculpher MJ (2006). *Decision Modelling for Health Economic Evaluation*. Oxford University Press.

Fenwick E, Claxton K, Sculpher M (2001). Representing uncertainty: the role of cost-effectiveness acceptability curves. *Health Economics*, 10(8), 779–787. doi:10.1002/hec.635

Examples

```
dominance_analysis(
  strategy = c("A", "B", "C"),
  cost = c(1000, 1200, 900),
  effectiveness = c(0.70, 0.75, 0.80)
)
```

`expected_value_partial_perfect_information`
Expected Value of Partial Perfect Information

Description

Computes the Expected Value of Partial Perfect Information (EVPPI) using a regression-based approximation.

Usage

```
expected_value_partial_perfect_information(
  cost,
  effect,
  parameter,
  wtp = seq(0, 1e+05, by = 1000),
  method = "gam"
)
```

Arguments

`cost`	Numeric matrix of costs. Rows represent probabilistic sensitivity analysis (PSA) simulations and columns represent competing strategies.
`effect`	Numeric matrix of effectiveness values having the same dimensions as `cost`.
`parameter`	Numeric vector containing samples of the uncertain parameter of interest.
`wtp`	Numeric vector of willingness-to-pay thresholds.
`method`	Character string specifying the regression method. Currently only `"gam"` is supported.

Details

The Expected Value of Partial Perfect Information (EVPPI) quantifies the expected value of eliminating uncertainty in a subset of model parameters while uncertainty in all remaining parameters is retained.

This implementation estimates EVPPI using a regression- based approximation in which Net Monetary Benefit (NMB) is regressed on the parameter of interest. The conditional expectation of NMB is estimated using Generalized Additive Models implemented in `mgcv::gam()`.

Regression-based EVPPI methods provide an efficient approximation that avoids computationally intensive nested Monte Carlo simulation.

Value

An object of class "EconEVPPI".

References

Strong M, Oakley JE, Brennan A (2014). Estimating Multiparameter Partial Expected Value of Perfect Information from a Probabilistic Sensitivity Analysis Sample: A Nonparametric Regression Approach. *Medical Decision Making*, 34(3), 311–326. doi:10.1177/0272989X13505910

Briggs AH, Claxton K, Sculpher MJ (2006). *Decision Modelling for Health Economic Evaluation*. Oxford University Press.

Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW (2015). *Methods for the Economic Evaluation of Health Care Programmes*. 4th ed. Oxford University Press.

Examples

```
library(mgcv)

set.seed(123)

cost <- cbind(
  rnorm(1000,1000,100),
  rnorm(1000,1200,100)
)

effect <- cbind(
  rnorm(1000,0.70,0.05),
  rnorm(1000,0.82,0.05)
)

theta <- runif(1000)

evppi <- expected_value_partial_perfect_information(
    cost = cost,
    effect = effect,
    parameter = theta
)
```

`expected_value_perfect_information`

Expected Value of Perfect Information

Description

Computes the Expected Value of Perfect Information (EVPI) across a range of willingness-to-pay (WTP) thresholds using probabilistic sensitivity analysis (PSA) results.

Usage

```
expected_value_perfect_information(
  cost,
  effect,
  wtp = seq(0, 1e+05, by = 1000)
)
```

Arguments

`cost`	A numeric matrix of costs. Rows represent probabilistic sensitivity analysis simulations and columns represent competing strategies.
`effect`	A numeric matrix of effectiveness values having the same dimensions as `cost`.
`wtp`	Numeric vector of willingness-to-pay thresholds.

Details

The Expected Value of Perfect Information (EVPI) quantifies the expected value of eliminating all uncertainty in a decision problem. It represents the maximum amount a decision maker should be willing to pay for perfect information before selecting an intervention.

Net Monetary Benefit (NMB) is calculated as

$$NMB = \lambda \times Effect - Cost$$

where

- λ = Willingness-to-pay threshold.

EVPI is calculated as

$$EVPI = E[\max(NMB)] - \max(E[NMB])$$

where

- $E[\max(NMB)]$ is the expected value under perfect information.
- $\max(E[NMB])$ is the maximum expected value under current information.

EVPI provides an upper bound on the value of acquiring additional information and is widely used to prioritize future research.

Value

An object of class `"EconEVPI"`.

References

Claxton K (1999). The Irrelevance of Inference: A Decision-Making Approach to the Stochastic Evaluation of Health Care Technologies. *Journal of Health Economics*, 18(3), 341–364. doi:10.1016/S0167-6296(98)00039-3

Briggs AH, Claxton K, Sculpher MJ (2006). *Decision Modelling for Health Economic Evaluation*. Oxford University Press.

Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW (2015). *Methods for the Economic Evaluation of Health Care Programmes*. 4th ed. Oxford University Press.

Examples

```
set.seed(123)

cost <- cbind(
  rnorm(1000, 1000, 100),
  rnorm(1000, 1200, 120),
  rnorm(1000, 1500, 140)
)

effect <- cbind(
  rnorm(1000, 0.70, 0.05),
  rnorm(1000, 0.82, 0.05),
  rnorm(1000, 0.92, 0.05)
)

evpi <- expected_value_perfect_information(
  cost = cost,
  effect = effect
)

print(evpi)
```

---

icer *Incremental Cost-Effectiveness Ratio*

Description

Calculates the Incremental Cost-Effectiveness Ratio (ICER) between competing interventions based on differences in costs and effectiveness.

Usage

```
icer(cost, effectiveness)
```

Arguments

`cost`	Numeric vector of costs.
`effectiveness`	Numeric vector of effectiveness.

Details

The Incremental Cost-Effectiveness Ratio (ICER) is calculated as:

$$ICER = \frac{\Delta Cost}{\Delta Effectiveness}$$

where:

- Delta Cost = Difference in cost between interventions.
- Delta Effectiveness = Difference in effectiveness between interventions.

ICER represents the additional cost required to gain one additional unit of effectiveness when moving from one intervention to another.

Value

An object of class "EconICER".

References

Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW (2015). *Methods for the Economic Evaluation of Health Care Programmes*. 4th ed. Oxford University Press.

Briggs AH, Claxton K, Sculpher MJ (2006). *Decision Modelling for Health Economic Evaluation*. Oxford University Press.

Sanders GD, Neumann PJ, Basu A, Brock DW, Feeny D, Krahn M, Kuntz KM, Meltzer DO, Owens DK, Prosser LA, Salomon JA, Sculpher MJ, Trikalinos TA, Russell LB, Siegel JE, Ganiats TG (2016). Recommendations for Conduct, Methodological Practices, and Reporting of Cost-effectiveness Analyses. *JAMA*, 316(10), 1093–1103. doi:10.1001/jama.2016.12195

Examples

```
icer(
  cost = c(1000, 1300, 1700),
  effectiveness = c(0.60, 0.75, 0.90)
)
```

---

internal_rate_return *Internal Rate of Return*

Description

Calculates the Internal Rate of Return (IRR) for a series of cash flows.

Usage

```
internal_rate_return(cashflow, interval = c(-0.99, 10), tol = 1e-08)
```

Arguments

`cashflow`	Numeric vector of cash flows. The first value is typically the initial investment (negative), followed by subsequent inflows and/or outflows.
`interval`	Numeric vector of length two specifying the search interval for the IRR.
`tol`	Numerical tolerance for the root-finding algorithm.

Details

The Internal Rate of Return (IRR) is the discount rate that makes the Net Present Value (NPV) of a series of cash flows equal to zero.

The IRR is obtained by solving

$$\sum_{t=0}^{n} \frac{CF_t}{(1+r)^t} = 0$$

where:

- CF_t = Cash flow at time t.
- r = Internal Rate of Return.
- n = Number of time periods.

The solution is obtained numerically using `stats::uniroot()`.

Value

An object of class `"EconIRR"`.

References

Boardman AE, Greenberg DH, Vining AR, Weimer DL (2018). *Cost-Benefit Analysis: Concepts and Practice*. 5th ed. Cambridge University Press.

Brealey RA, Myers SC, Allen F (2020). *Principles of Corporate Finance*. 13th ed. McGraw-Hill Education.

Examples

```
internal_rate_return(
  cashflow = c(-10000, 3000, 3500, 4000, 4500)
)
```

`modified_internal_rate_return` *Modified Internal Rate of Return*

Description

Calculates the Modified Internal Rate of Return (MIRR) for a series of cash flows.

Usage

```
modified_internal_rate_return(cashflow, finance_rate, reinvest_rate)
```

Arguments

`cashflow`	Numeric vector of cash flows. The first value is typically the initial investment (negative), followed by subsequent inflows and/or outflows.
`finance_rate`	Numeric scalar specifying the finance rate (decimal) used to discount negative cash flows.
`reinvest_rate`	Numeric scalar specifying the reinvestment rate (decimal) used to compound positive cash flows.

Details

The Modified Internal Rate of Return (MIRR) addresses limitations of the traditional Internal Rate of Return (IRR) by assuming that positive cash flows are reinvested at a specified reinvestment rate and negative cash flows are financed at a specified finance rate.

MIRR is calculated as

$$MIRR = \left(\frac{FV_{\text{positive}}}{-PV_{\text{negative}}} \right)^{1/n} - 1$$

where

- FV_{positive} = Future value of all positive cash flows compounded at the reinvestment rate.
- PV_{negative} = Present value of all negative cash flows discounted at the finance rate.
- n = Number of compounding periods.

MIRR provides a unique rate of return and is generally preferred over the traditional IRR when multiple sign changes occur in the cash-flow stream.

Value

An object of class `"EconMIRR"`.

References

Brealey RA, Myers SC, Allen F (2020). *Principles of Corporate Finance*. 13th ed. McGraw-Hill Education.

Boardman AE, Greenberg DH, Vining AR, Weimer DL (2018). *Cost-Benefit Analysis: Concepts and Practice*. 5th ed. Cambridge University Press.

Examples

```
mirr <- modified_internal_rate_return(
  cashflow = c(-50000, 12000, 15000, 18000, 20000),
  finance_rate = 0.08,
  reinvest_rate = 0.10
)

print(mirr)
```

---

multi_way_sensitivity_analysis *Multi-Way Sensitivity Analysis*

Description

Performs deterministic multi-way sensitivity analysis by simultaneously varying two or more model parameters and evaluating the resulting changes in the model outcome.

Usage

```
multi_way_sensitivity_analysis(parameters, model)
```

Arguments

`parameters`	A data frame in which each row represents a parameter set and each column represents a model parameter.
`model`	A user-defined function that accepts one row of `parameters` as a named list and returns a single numeric outcome.

Details

Multi-way sensitivity analysis is a deterministic sensitivity analysis in which two or more parameters are varied simultaneously to evaluate the robustness of model results to plausible changes in model inputs. It is commonly used to investigate interactions among uncertain parameters and to identify combinations of values that substantially influence decision outcomes.

Value

An object of class `"EconMWSA"`.

References

Briggs AH, Claxton K, Sculpher MJ (2006). *Decision Modelling for Health Economic Evaluation*. Oxford University Press.

Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW (2015). *Methods for the Economic Evaluation of Health Care Programmes*. 4th ed. Oxford University Press.

Briggs AH, Weinstein MC, Fenwick EAL, Karnon J, Sculpher MJ, Paltiel AD (2012). Model parameter estimation and uncertainty: a report of the ISPOR-SMDM Modeling Good Research Practices Task Force Working Group-6. *Medical Decision Making*, 32(5), 722–732. doi:10.1177/0272989X12458348

Examples

```
pars <- data.frame(
  Cost = c(1000, 1200, 1400),
  Effectiveness = c(0.70, 0.75, 0.82),
  Probability = c(0.90, 0.85, 0.80)
)

model <- function(x) {
  x$Effectiveness * 5000 -
    x$Cost * x$Probability
}

mw <- multi_way_sensitivity_analysis(
  parameters = pars,
  model = model
)

print(mw)
```

---

net_health_benefit *Net Health Benefit*

Description

Calculates the Net Health Benefit (NHB) for one or more competing interventions using a specified willingness-to-pay threshold.

Usage

```
net_health_benefit(strategy, cost, effectiveness, willingness_to_pay)
```

Arguments

strategy	Character vector of strategy names.
cost	Numeric vector of costs.
effectiveness	Numeric vector of effectiveness.

willingness_to_pay
: Numeric scalar representing the willingness-to-pay threshold per unit of effectiveness.

Details

Net Health Benefit (NHB) is calculated as

$$NHB = E - \frac{C}{\lambda}$$

where

- E = Effectiveness.
- C = Cost.
- λ = Willingness-to-pay threshold.

NHB expresses health outcomes in natural units after accounting for the opportunity cost of resources. A strategy with the highest NHB at a given willingness-to-pay threshold is considered the preferred option.

Value

An object of class `"EconNHB"`.

References

Stinnett AA, Mullahy J (1998). Net Health Benefits: A New Framework for the Analysis of Uncertainty in Cost-Effectiveness Analysis. *Medical Decision Making*, 18(2 Suppl), S68–S80. doi:10.1177/0272989X98018002S09

Briggs AH, Claxton K, Sculpher MJ (2006). *Decision Modelling for Health Economic Evaluation*. Oxford University Press.

Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW (2015). *Methods for the Economic Evaluation of Health Care Programmes*. 4th ed. Oxford University Press.

Examples

```
nhb <- net_health_benefit(
  strategy = c("Current", "Treatment A", "Treatment B"),
  cost = c(1000, 1300, 1700),
  effectiveness = c(0.60, 0.75, 0.90),
  willingness_to_pay = 5000
)

print(nhb)
```

net_monetary_benefit *Net Monetary Benefit*

Description

Calculates the Net Monetary Benefit (NMB) for one or more competing interventions using a specified willingness-to-pay threshold.

Usage

```
net_monetary_benefit(strategy, cost, effectiveness, willingness_to_pay)
```

Arguments

`strategy`	Character vector of strategy names.
`cost`	Numeric vector of costs.
`effectiveness`	Numeric vector of effectiveness.
`willingness_to_pay`	Numeric scalar specifying the willingness-to-pay threshold per unit of effectiveness.

Details

Net Monetary Benefit (NMB) is calculated as

$$NMB = \lambda \times E - C$$

where

- λ = Willingness-to-pay threshold.
- E = Effectiveness.
- C = Cost.

Net Monetary Benefit converts health outcomes into monetary units using a specified willingness-to-pay threshold. Compared with the Incremental Cost-Effectiveness Ratio (ICER), the NMB framework facilitates statistical analysis and probabilistic sensitivity analysis. The strategy with the highest NMB at a given willingness-to-pay threshold is considered the preferred option.

Value

An object of class `"EconNMB"`.

References

Stinnett AA, Mullahy J (1998). Net Health Benefits: A New Framework for the Analysis of Uncertainty in Cost-Effectiveness Analysis. *Medical Decision Making*, 18(Suppl. 2), S68–S80. doi:10.1177/0272989X98018002S09

Briggs AH, Claxton K, Sculpher MJ (2006). *Decision Modelling for Health Economic Evaluation*. Oxford University Press.

Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW (2015). *Methods for the Economic Evaluation of Health Care Programmes*. 4th ed. Oxford University Press.

Examples

```
nmb <- net_monetary_benefit(
  strategy = c("Current", "Treatment A", "Treatment B"),
  cost = c(1000, 1300, 1700),
  effectiveness = c(0.60, 0.75, 0.90),
  willingness_to_pay = 5000
)

print(nmb)
```

---

net_present_value *Net Present Value*

Description

Calculates the Net Present Value (NPV) of a project.

Usage

```
net_present_value(cashflow, rate)
```

Arguments

`cashflow`	Numeric vector of cash flows.
`rate`	Discount rate expressed as a decimal.

Value

An object of class `"EconNPV"`.

one_way_sensitivity_analysis
One-Way Sensitivity Analysis

Description

Performs deterministic one-way sensitivity analysis by varying a single model parameter while holding all other parameters constant.

Usage

```
one_way_sensitivity_analysis(base_case, low, high, model)
```

Arguments

base_case	Numeric scalar representing the base-case value of the parameter.
low	Numeric scalar specifying the lower value of the parameter.
high	Numeric scalar specifying the upper value of the parameter.
model	A user-defined function that accepts a single numeric value and returns a numeric outcome.

Details

One-way sensitivity analysis is a deterministic sensitivity analysis in which one parameter is varied across a specified range while all other model inputs remain fixed at their base-case values. This approach is commonly used to evaluate the influence of individual parameters on model outcomes and to identify key drivers of decision uncertainty.

Value

An object of class `"EconOWSA"`.

References

Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW (2015). *Methods for the Economic Evaluation of Health Care Programmes*. 4th ed. Oxford University Press.

Briggs AH, Claxton K, Sculpher MJ (2006). *Decision Modelling for Health Economic Evaluation*. Oxford University Press.

Briggs AH, Weinstein MC, Fenwick EAL, Karnon J, Sculpher MJ, Paltiel AD (2012). Model parameter estimation and uncertainty: a report of the ISPOR-SMDM Modeling Good Research Practices Task Force Working Group-6. *Medical Decision Making*, 32(5), 722–732. doi:10.1177/0272989X12458348

Examples

```
model <- function(x) {
  5000 * x - 1000
}

ow <- one_way_sensitivity_analysis(
  base_case = 0.80,
  low = 0.60,
  high = 1.00,
  model = model
)

print(ow)
```

`partial_budget` *Partial Budget Analysis*

Description

Performs a partial budget analysis to evaluate the economic consequences of a proposed change in management, production, or intervention.

Usage

```
partial_budget(added_returns, reduced_costs, added_costs, reduced_returns)
```

Arguments

`added_returns`	Numeric vector of additional returns resulting from the proposed change.
`reduced_costs`	Numeric vector of costs eliminated or reduced by the proposed change.
`added_costs`	Numeric vector of additional costs incurred by the proposed change.
`reduced_returns`	Numeric vector of returns lost as a consequence of the proposed change.

Details

Partial budgeting evaluates the economic impact of a proposed change by considering only those costs and returns that differ between the current and proposed situations.

Net change is calculated as

$$(Added\ Returns + Reduced\ Costs) - (Added\ Costs + Reduced\ Returns)$$

A positive net change indicates that the proposed change is expected to improve profitability, whereas a negative value indicates an economic loss.

Value

An object of class "EconPB".

References

Kay RD, Edwards WM, Duffy PA (2016). *Farm Management*. 8th ed. McGraw-Hill Education.

Boardman AE, Greenberg DH, Vining AR, Weimer DL (2018). *Cost-Benefit Analysis: Concepts and Practice*. 5th ed. Cambridge University Press.

Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW (2015). *Methods for the Economic Evaluation of Health Care Programmes*. 4th ed. Oxford University Press.

Examples

```
partial_budget(
  added_returns = c(5000, 2500),
  reduced_costs = c(1500, 500),
  added_costs = c(2000, 1000),
  reduced_returns = c(500)
)
```

---

payback_period   *Payback Period*

Description

Calculates the payback period of an investment based on a series of cash flows.

Usage

```
payback_period(cashflow)
```

Arguments

cashflow	Numeric vector of cash flows. The first value should represent the initial investment (negative), followed by subsequent cash inflows and/or outflows.

Details

The payback period is the time required for cumulative cash inflows to recover the initial investment. When the investment is recovered during a period, linear interpolation is used to estimate the fractional payback period.

The payback period is calculated as

$$Payback = t + \frac{Remaining\ Investment}{Cash\ Flow_{t+1}}$$

where

- t = Last period before full recovery.
- Remaining Investment = Unrecovered investment at the end of period t.
- $Cash\ Flow_{t+1}$ = Cash inflow during the recovery period.

The payback period is widely used as a measure of investment liquidity but does not account for the time value of money or cash flows occurring after recovery.

Value

An object of class "EconPayback".

References

Boardman AE, Greenberg DH, Vining AR, Weimer DL (2018). *Cost-Benefit Analysis: Concepts and Practice*. 5th ed. Cambridge University Press.

Brealey RA, Myers SC, Allen F (2020). *Principles of Corporate Finance*. 13th ed. McGraw-Hill Education.

Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW (2015). *Methods for the Economic Evaluation of Health Care Programmes*. 4th ed. Oxford University Press.

Examples

```
pb <- payback_period(
  cashflow = c(-50000, 12000, 15000, 18000, 20000)
)

print(pb)
```

---

plot.EconBCR *Plot Benefit-Cost Ratio Results*

Description

Produces a bar chart comparing total benefits and total costs.

Usage

```
## S3 method for class 'EconBCR'
plot(x, ...)
```

Arguments

x	An object of class "EconBCR".
...	Additional graphical arguments passed to graphics::barplot().

Value

Invisibly returns the midpoints of the bars.

Examples

```
x <- benefit_cost_ratio(
  benefit = 150000,
  cost = 100000
)

plot(x)
```

`plot.EconBIA` *Plot Budget Impact Analysis*

Description

Produces a visualization of the annual incremental budget impact and cumulative budget impact over time.

Usage

```
## S3 method for class 'EconBIA'
plot(x, type = c("annual", "cumulative"), ...)
```

Arguments

`x`	An object of class "`EconBIA`".
`type`	Type of plot. One of: **"annual"** Annual incremental budget impact. **"cumulative"** Cumulative discounted budget impact.
`...`	Additional graphical arguments.

Value

Produces a budget impact plot.

Examples

```
bia <- budget_impact_analysis(
  population = 10000,
  uptake = c(0.10, 0.20, 0.35, 0.45, 0.60),
  current_cost = 1200,
  new_cost = 1500,
  years = 5,
  discount = 0.03
```

```
)

plot(bia)
plot(bia, type = "cumulative")
```

`plot.EconCEA` *Plot Cost-Effectiveness Plane*

Description

Plot Cost-Effectiveness Plane

Usage

```
## S3 method for class 'EconCEA'
plot(x, ...)
```

Arguments

`x`	An object of class "`EconCEA`".
`...`	Additional graphical arguments.

Value

A Cost-Effectiveness Plane.

`plot.EconCEAC` *Plot Cost-Effectiveness Acceptability Curve*

Description

Produces a Cost-Effectiveness Acceptability Curve (CEAC) showing the probability that an intervention is cost-effective over a range of willingness-to-pay (WTP) thresholds.

Usage

```
## S3 method for class 'EconCEAC'
plot(x, ...)
```

Arguments

`x`	An object of class "`EconCEAC`".
`...`	Additional graphical arguments.

Value

Produces a CEAC plot.

plot.EconCEAF *Plot Cost-Effectiveness Acceptability Frontier*

Description

Produces a Cost-Effectiveness Acceptability Frontier (CEAF) showing the probability that the optimal strategy is cost-effective over a range of willingness-to-pay (WTP) thresholds.

Usage

```
## S3 method for class 'EconCEAF'
plot(x, ...)
```

Arguments

`x`	An object of class "EconCEAF".
`...`	Additional graphical arguments.

Value

Produces a CEAF plot.

Examples

```
set.seed(123)

cost <- cbind(
  rnorm(100, 1000, 100),
  rnorm(100, 1200, 120),
  rnorm(100, 1400, 150)
)

effect <- cbind(
  rnorm(100, 0.70, 0.05),
  rnorm(100, 0.80, 0.05),
  rnorm(100, 0.90, 0.05)
)

ceaf <- cost_effectiveness_acceptability_frontier(
  cost = cost,
  effect = effect,
  wtp = c(0, 50000, 100000)
)

plot(ceaf)
```

plot.EconEVPI — *Plot Expected Value of Perfect Information*

Description

Produces an Expected Value of Perfect Information (EVPI) curve across willingness-to-pay (WTP) thresholds.

Usage

```
## S3 method for class 'EconEVPI'
plot(x, ...)
```

Arguments

`x`	An object of class "EconEVPI".
`...`	Additional graphical arguments.

Value

Produces an EVPI plot.

Examples

```
set.seed(123)

cost <- cbind(
  rnorm(100, 1000, 100),
  rnorm(100, 1200, 120),
  rnorm(100, 1500, 140)
)

effect <- cbind(
  rnorm(100, 0.70, 0.05),
  rnorm(100, 0.82, 0.05),
  rnorm(100, 0.92, 0.05)
)

evpi <- expected_value_perfect_information(
  cost = cost,
  effect = effect,
  wtp = c(0, 50000, 100000)
)

plot(evpi)
```

plot.EconEVPPI *Plot Expected Value of Partial Perfect Information*

Description

Produces an Expected Value of Partial Perfect Information (EVPPI) curve across willingness-to-pay (WTP) thresholds.

Usage

```
## S3 method for class 'EconEVPPI'
plot(x, ...)
```

Arguments

`x`	An object of class "EconEVPPI".
`...`	Additional graphical arguments.

Value

Produces an EVPPI plot.

Examples

```
evppi <- list(
  wtp = c(0, 50000, 100000),
  evppi = c(0, 125, 250)
)
class(evppi) <- "EconEVPPI"

plot(evppi)
```

plot.EconMWSA *Plot Multi-Way Sensitivity Analysis*

Description

Plot Multi-Way Sensitivity Analysis

Usage

```
## S3 method for class 'EconMWSA'
plot(x, ...)
```

Arguments

`x`	An object of class "`EconMWSA`".
`...`	Additional graphical arguments.

Value

Produces a line plot of model outcomes.

`plot.EconPSA` *Plot Probabilistic Sensitivity Analysis*

Description

Displays the distribution of simulated outcomes.

Usage

```
## S3 method for class 'EconPSA'
plot(x, ...)
```

Arguments

`x`	An object of class "`EconPSA`".
`...`	Additional graphical arguments.

Value

Produces a histogram with density curve.

`plot.EconThreshold` *Plot Threshold Analysis*

Description

Plot Threshold Analysis

Usage

```
## S3 method for class 'EconThreshold'
plot(x, ...)
```

Arguments

`x`	An object of class "`EconThreshold`".
`...`	Additional graphical arguments.

Value

Produces a threshold analysis plot.

`plot.EconTornado` *Plot Tornado Diagram*

Description

Creates a tornado diagram for an object of class "EconTornado", showing the low and high outcome values for each parameter relative to the base-case value.

Usage

```
## S3 method for class 'EconTornado'
plot(x, ...)
```

Arguments

`x`	An object of class "EconTornado".
`...`	Additional graphical arguments passed to `graphics::plot()`.

Value

Invisibly returns the supplied "EconTornado" object.

`plot.EconTree` *Plot Decision Tree Analysis Results*

Description

Produces a bar plot of expected costs or expected effectiveness for each terminal strategy.

Usage

```
## S3 method for class 'EconTree'
plot(x, type = c("cost", "effectiveness"), ...)
```

Arguments

`x`	An object of class "EconTree".
`type`	Character string specifying the quantity to plot. One of "cost" or "effectiveness".
`...`	Additional graphical arguments.

Value

Produces a bar plot.

Examples

```
strategy <- c(
  "Treatment A",
  "Treatment B",
  "Treatment C"
)

probability <- c(0.30, 0.45, 0.25)
cost <- c(1200, 1800, 2400)
effectiveness <- c(0.70, 0.82, 0.91)

tree <- decision_tree_analysis(
  strategy,
  probability,
  cost,
  effectiveness
)

plot(tree)
plot(tree, type = "effectiveness")
```

`present_value` *Present Value*

Description

Calculates the present value of one or more future cash flows.

Usage

```
present_value(future_value, rate, period)
```

Arguments

`future_value`	Numeric vector of future values.
`rate`	Discount rate expressed as a decimal.
`period`	Integer vector of periods.

Details

Present value is calculated as

$$PV = \frac{FV}{(1+r)^t}$$

where

- FV = Future Value
- r = Discount rate
- t = Time period

Value

An object of class "EconPV".

Examples

```
pv <- present_value(
    future_value = c(1000,1500,2000),
    rate = 0.10,
    period = 1:3
)

print(pv)
```

---

print.EconBCR *Print an EconBCR object*

Description

Print an EconBCR object

Usage

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

Arguments

x	An object of class "EconBCR".
...	Additional arguments (unused).

Value

Invisibly returns the object.

print.EconBIA *Print a Budget Impact Analysis Object*

Description

Print a Budget Impact Analysis Object

Usage

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

Arguments

x	An object of class "EconBIA".
...	Additional arguments (unused).

Value

The input object, invisibly.

print.EconCEAC *Print a Cost-Effectiveness Acceptability Curve Object*

Description

Print a Cost-Effectiveness Acceptability Curve Object

Usage

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

Arguments

x	An object of class "EconCEAC".
...	Additional arguments (unused).

Value

The input object, invisibly.

print.EconCEAF — *Print a Cost-Effectiveness Acceptability Frontier Object*

Description

Print a Cost-Effectiveness Acceptability Frontier Object

Usage

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

Arguments

`x`	An object of class "EconCEAF".
`...`	Additional arguments (unused).

Value

The input object, invisibly.

print.EconEVPI — *Print an Expected Value of Perfect Information Object*

Description

Print an Expected Value of Perfect Information Object

Usage

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

Arguments

`x`	An object of class "EconEVPI".
`...`	Additional arguments (unused).

Value

The input object, invisibly.

print.EconEVPPI *Print an Expected Value of Partial Perfect Information Object*

Description

Print an Expected Value of Partial Perfect Information Object

Usage

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

Arguments

x	An object of class "EconEVPPI".
...	Additional arguments (unused).

Value

The input object, invisibly.

print.EconPSA *Print a Probabilistic Sensitivity Analysis Object*

Description

Print a Probabilistic Sensitivity Analysis Object

Usage

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

Arguments

x	An object of class "EconPSA".
...	Additional arguments (unused).

Value

The input object, invisibly.

print.EconTornado *Print a Tornado Diagram Object*

Description

Print a Tornado Diagram Object

Usage

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

Arguments

`x`	An object of class "EconTornado".
`...`	Additional arguments (unused).

Value

The input object, invisibly.

print.EconTree *Print a Decision Tree Analysis Object*

Description

Print a Decision Tree Analysis Object

Usage

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

Arguments

`x`	An object of class "EconTree".
`...`	Additional arguments (unused).

Value

The input object, invisibly.

`probabilistic_sensitivity_analysis` *Probabilistic Sensitivity Analysis*

Description

Performs Monte Carlo simulation for economic evaluation.

Usage

```
probabilistic_sensitivity_analysis(n = 1000, sampler, model, seed = NULL)
```

Arguments

`n`	Integer. Number of Monte Carlo simulations.
`sampler`	A function generating one random parameter set. The function should return a list.
`model`	A function accepting the sampled parameter list and returning a single numeric outcome.
`seed`	Optional integer random seed.

Details

This function performs probabilistic sensitivity analysis (PSA) using Monte Carlo simulation. During each iteration, random parameters are generated by `sampler()` and passed to `model()`. The model must return one finite numeric outcome.

Value

An object of class `"EconPSA"`.

Examples

```
sampler <- function() {

  list(
    cost = rnorm(1, 1000, 100),
    effectiveness = rbeta(1, 20, 5)
  )

}

model <- function(par) {

  par$effectiveness * 5000 -
    par$cost

}
```

```
psa <- probabilistic_sensitivity_analysis(
  n = 1000,
  sampler = sampler,
  model = model,
  seed = 123
)
```

`profitability_index` *Profitability Index*

Description

Calculates the Profitability Index (PI).

Usage

```
profitability_index(cashflow, rate)
```

Arguments

`cashflow`	Numeric vector of cash flows.
`rate`	Discount rate.

Value

Object of class "`EconPI`".

`summary.EconBCR` *Summarize an EconBCR object*

Description

Summarize an EconBCR object

Usage

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

Arguments

`object`	An object of class "`EconBCR`".
`...`	Additional arguments (unused).

Value

A data frame summarizing the benefit-cost analysis.

summary.EconBIA *Summarize a Budget Impact Analysis Object*

Description

Returns a summary of the annual and cumulative budget impact over the specified time horizon.

Usage

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

Arguments

object	An object of class "EconBIA".
...	Additional arguments (unused).

Value

A data frame containing annual budget impact results.

Examples

```
bia <- budget_impact_analysis(
  population = 10000,
  uptake = c(0.10, 0.20, 0.35, 0.45, 0.60),
  current_cost = 1200,
  new_cost = 1500,
  years = 5,
  discount = 0.03
)

summary(bia)
```

summary.EconCEA *Summarize a Cost-Effectiveness Analysis*

Description

Summarize a Cost-Effectiveness Analysis

Usage

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

Arguments

`object`	An object of class "EconCEA".
`...`	Additional arguments (unused).

Value

A data frame summarizing the cost-effectiveness analysis.

---

summary.EconCEAC *Summarize a Cost-Effectiveness Acceptability Curve Object*

Description

Summarize a Cost-Effectiveness Acceptability Curve Object

Usage

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

Arguments

`object`	An object of class "EconCEAC".
`...`	Additional arguments (unused).

Value

A data frame summarizing the Cost-Effectiveness Acceptability Curve.

---

summary.EconCEAF *Summarize a Cost-Effectiveness Acceptability Frontier Object*

Description

Returns a summary of the Cost-Effectiveness Acceptability Frontier (CEAF) results across all willingness-to-pay (WTP) thresholds.

Usage

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

Arguments

`object`	An object of class "EconCEAF".
`...`	Additional arguments (unused).

Value

A data frame containing:

WTP Willingness-to-pay threshold.

OptimalStrategy Optimal strategy at each WTP.

Probability Probability that the optimal strategy is truly cost-effective.

ExpectedNMB Expected Net Monetary Benefit.

Examples

```
set.seed(123)

cost <- cbind(
  rnorm(100, 1000, 100),
  rnorm(100, 1200, 120),
  rnorm(100, 1400, 150)
)

effect <- cbind(
  rnorm(100, 0.70, 0.05),
  rnorm(100, 0.80, 0.05),
  rnorm(100, 0.90, 0.05)
)

ceaf <- cost_effectiveness_acceptability_frontier(
  cost = cost,
  effect = effect,
  wtp = c(0, 50000, 100000)
)

summary(ceaf)
```

`summary.EconEVPI` *Summarize an Expected Value of Perfect Information Object*

Description

Returns a summary of the Expected Value of Perfect Information (EVPI) across willingness-to-pay (WTP) thresholds.

Usage

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

Arguments

`object`	An object of class "EconEVPI".
`...`	Additional arguments (unused).

Value

A data frame containing:

WTP Willingness-to-pay threshold.

EVPI Expected Value of Perfect Information.

ExpectedPerfectInformation Expected value under perfect information, $E[\max(NMB)]$.

ExpectedCurrentInformation Expected value under current information, $\max(E[NMB])$.

Examples

```
set.seed(123)

cost <- cbind(
  rnorm(100, 1000, 100),
  rnorm(100, 1200, 120),
  rnorm(100, 1500, 140)
)

effect <- cbind(
  rnorm(100, 0.70, 0.05),
  rnorm(100, 0.82, 0.05),
  rnorm(100, 0.92, 0.05)
)

evpi <- expected_value_perfect_information(
  cost = cost,
  effect = effect,
  wtp = c(0, 50000, 100000)
)

summary(evpi)
```

`summary.EconEVPPI` *Summarize an Expected Value of Partial Perfect Information Object*

Description

Returns a summary of the Expected Value of Partial Perfect Information (EVPPI) across willingness-to-pay (WTP) thresholds.

Usage

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

Arguments

`object`	An object of class "EconEVPPI".
`...`	Additional arguments (unused).

Value

A data frame containing:

WTP Willingness-to-pay threshold.

EVPPI Expected Value of Partial Perfect Information.

Examples

```
evppi <- list(
  wtp = c(0, 50000, 100000),
  evppi = c(0, 125, 250)
)
class(evppi) <- "EconEVPPI"

summary(evppi)
```

---

summary.EconPSA *Summarize a Probabilistic Sensitivity Analysis Object*

Description

Summarize a Probabilistic Sensitivity Analysis Object

Usage

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

Arguments

`object`	An object of class "EconPSA".
`...`	Additional arguments (unused).

Value

A data frame containing summary statistics.

summary.EconTornado *Summarize a Tornado Diagram Object*

Description

Summarize a Tornado Diagram Object

Usage

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

Arguments

`object`	An object of class "`EconTornado`".
`...`	Additional arguments (unused).

Value

A data frame summarizing the tornado analysis.

summary.EconTree *Summarize a Decision Tree Analysis Object*

Description

Returns a summary of the expected costs and expected effectiveness for each terminal node.

Usage

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

Arguments

`object`	An object of class "`EconTree`".
`...`	Additional arguments (unused).

Value

A data frame containing:

Strategy Terminal strategy.
Probability Terminal node probability.
Cost Observed cost.
Effectiveness Observed effectiveness.
ExpectedCost Expected cost.
ExpectedEffectiveness Expected effectiveness.

Examples

```
strategy <- c(
  "Treatment A",
  "Treatment B",
  "Treatment C"
)

probability <- c(0.30, 0.45, 0.25)
cost <- c(1200, 1800, 2400)
effectiveness <- c(0.70, 0.82, 0.91)

tree <- decision_tree_analysis(
  strategy,
  probability,
  cost,
  effectiveness
)

summary(tree)
```

`threshold_analysis` *Threshold Analysis*

Description

Identifies the threshold value of a parameter at which a model outcome reaches a specified target.

Usage

```
threshold_analysis(lower, upper, target = 0, model, tol = 1e-08)
```

Arguments

`lower`	Lower search bound.
`upper`	Upper search bound.
`target`	Target outcome.
`model`	Function returning the model outcome.
`tol`	Numerical tolerance.

Value

Object of class "EconThreshold".

tornado_diagram *Tornado Diagram*

Description

Creates data for a tornado diagram.

Usage

```
tornado_diagram(parameter, low, high, base_case)
```

Arguments

`parameter`	Character vector of parameter names.
`low`	Numeric vector of outcomes at the low value.
`high`	Numeric vector of outcomes at the high value.
`base_case`	Numeric scalar.

Value

Object of class `"EconTornado"`.

two_way_sensitivity_analysis *Two-Way Sensitivity Analysis*

Description

Performs deterministic two-way sensitivity analysis by varying two model parameters simultaneously.

Usage

```
two_way_sensitivity_analysis(parameter1, parameter2, model)
```

Arguments

`parameter1`	Numeric vector of values for parameter 1.
`parameter2`	Numeric vector of values for parameter 2.
`model`	Function accepting two arguments and returning a numeric outcome.

Value

An object of class `"EconTWSA"`.

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