Package 'rmedsem'

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Title Statistical Mediation Analysis for SEMs

Version 1.0.0

Description Conducts mediation analysis for structural equation models (SEM) estimated with 'lavaan', 'blavaan', 'cSEM', or 'modsem'. Implements the Baron and Kenny (1986) <doi:10.1037/0022-3514.51.6.1173> and Zhao, Lynch & Chen (2010) <doi:10.1086/651257> approaches to determine the presence and type of mediation. Supports covariance-based SEM, partial least squares SEM, Bayesian SEM, and moderated mediation models. Reports indirect effects with standard errors from Sobel, Delta, Monte-Carlo, and bootstrap methods, along with effect size measures (RIT, RID).

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Encoding UTF-8

RoxygenNote 7.3.2

Imports lavaan, mvtnorm, ggplot2, dplyr, purrr, stats

URL https://github.com/ihrke/rmedsem, https://ihrke.github.io/rmedsem/

BugReports https://github.com/ihrke/rmedsem/issues

Depends R (>= 4.1.0)

LazyData true

Suggests blavaan, boot, cSEM, HDInterval, modsem, semPlot, rmarkdown, testthat (>= 3.0.0)

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Contents

`as.data.frame.rmedsem` *Convert an rmedsem Object to a Data Frame*

Description

Convert an rmedsem Object to a Data Frame

Usage

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

Arguments

`x`	the `rmedsem` object
`...`	additional arguments (currently unused)

Value

a data.frame

Examples

```
mod.txt <- "
read ~ math
science ~ read + math
"
mod <- lavaan::sem(mod.txt, data=rmedsem::hsbdemo)
out <- rmedsem(mod, indep="math", med="read", dep="science")
as.data.frame(out)
```

---

hsbdemo *High School and Beyond Demo Dataset*

Description

High School and Beyond Demo Dataset

Usage

```
hsbdemo
```

Format

hsbdemo**:**

A data frame with 20 rows and 13 columns:

id Student ID

female

---

mchoice *Mate-Choice Survey Data from Trondheim*

Description

Data from a survey on mate-choice in Trondheim.

Usage

```
mchoice
```

Format

`mchoice`:

A data frame with 1090 rows and 9 columns:

smv_attr_face How well does this describe you as a partner?, [1] very bad - [5] very well

smv_attr_body How well does this describe you as a partner?, [1] very bad - [5] very well

smv_sexy How well does this describe you as a partner?, [1] very bad - [5] very well

ses_satis On the whole, I am satisfied with myself, [1] totally disgree - [5] totally agree

ses_qualities I feel that I have a number of good qualities, [1] totally disgree - [5] totally agree

ses_able_todo I am able to do things as well as most other people, [1] totally disgree - [5] totally agree

mwb_optimistic I have been feeling optimistic about the future, [1] never - [5] always

mwb_useful I have been feeling useful, [1] never - [5] always

mwb_energy I have had energy to spare, [1] never - [5] always

smv_kind ?, [1] ? - [5] ?

smv_caring ?, [1] ? - [5] ?

smv_understanding ?, [1] ? - [5] ?

smv_make_laughh ?, [1] ? - [5] ?

smv_funny ?, [1] ? - [5] ?

smv_sociable ?, [1] ? - [5] ?

`plot.rmedsem` *Plot an rmedsem Object*

Description

Creates a visualization of the mediation analysis results. By default, produces a coefficient plot. Use `type = "effect"` for an effect size pie chart.

Usage

```
## S3 method for class 'rmedsem'
plot(x, type = c("coef", "effect"), ...)
```

Arguments

`x`	the `rmedsem` object
`type`	character; either `"coef"` (default) for a coefficient plot or `"effect"` for an effect size plot
`...`	additional arguments passed to `plot_coef()` or `plot_effect()`

Value

a `ggplot` object

Examples

```
mod.txt <- "
read ~ math
science ~ read + math
"
mod <- lavaan::sem(mod.txt, data=rmedsem::hsbdemo)
out <- rmedsem(mod, indep="math", med="read", dep="science")
plot(out)
plot(out, type="effect")
```

`plot_coef` *Plot Coefficients for an rmedsem Object*

Description

Plot Coefficients for an rmedsem Object

Usage

```
plot_coef(res)
```

Arguments

`res`	the `rmedsem` object

Value

a `ggplot` object

Examples

```
mod.txt <- "
read ~ math
science ~ read + math
"
mod <- lavaan::sem(mod.txt, data=rmedsem::hsbdemo)
out <- rmedsem(mod, indep="math", med="read", dep="science")
plot_coef(out)
```

plot_effect *Plot Effect Sizes for an rmedsem Object*

Description

Plot Effect Sizes for an rmedsem Object

Usage

```
plot_effect(res, description = TRUE)
```

Arguments

res	the rmedsem object
description	logical, whether to add a description subtitle

Value

a ggplot object

Examples

```
mod.txt <- "
read ~ math
science ~ read + math
"
mod <- lavaan::sem(mod.txt, data=rmedsem::hsbdemo)
out <- rmedsem(mod, indep="math", med="read", dep="science")
plot_effect(out)
```

print.rmedsem *Print an rmedsem Object*

Description

Print an rmedsem Object

Usage

```
## S3 method for class 'rmedsem'
print(x, digits = 3, indent = 3, ...)
```

Arguments

x	the rmedsem object to print
digits	an integer, number of digits to print in table
indent	an integer, number of spaces to indent
...	additional arguments (currently unused)

Value

the rmedsem object x (invisibly)

Examples

```
mod.txt <- "
read ~ math
science ~ read + math
"
mod <- lavaan::sem(mod.txt, data=rmedsem::hsbdemo)
out <- rmedsem(mod, indep="math", med="read", dep="science")
print(out)
```

RID *Ratio of Indirect to Direct Effect (RID)*

Description

Ratio of Indirect to Direct Effect (RID)

Usage

```
RID(res, ...)

## S3 method for class 'rmedsem'
RID(res, ...)
```

Arguments

res	fitted rmedsem object
...	additional arguments (currently unused)

Value

A numeric scalar giving the ratio of the indirect effect to the direct effect (indirect / direct).

Examples

```
mod.txt <- "
read ~ math
science ~ read + math
"
mod <- lavaan::sem(mod.txt, data=rmedsem::hsbdemo)
out <- rmedsem(mod, indep="math", med="read", dep="science")
RID(out)
```

RIT *Ratio of Indirect to Total Effect (RIT)*

Description

Ratio of Indirect to Total Effect (RIT)

Usage

```
RIT(res, ...)

## S3 method for class 'rmedsem'
RIT(res, ...)
```

Arguments

`res`	fitted `rmedsem` object
`...`	additional arguments (currently unused)

Value

A numeric scalar giving the ratio of the indirect effect to the total effect (indirect / total).

Examples

```
mod.txt <- "
read ~ math
science ~ read + math
"
mod <- lavaan::sem(mod.txt, data=rmedsem::hsbdemo)
out <- rmedsem(mod, indep="math", med="read", dep="science")
RIT(out)
```

rmedsem *Mediation Analysis for Structural Equation Models*

Description

Conducts mediation analysis on a fitted SEM model using the Baron and Kenny (1986) and/or Zhao, Lynch & Chen (2010) approaches.

Usage

```
rmedsem(
  mod,
  indep,
  med,
  dep,
  approach = c("bk", "zlc"),
  p.threshold = 0.05,
  effect.size = c("RIT", "RID", "upsilon"),
  ...
)
```

Arguments

mod	a fitted SEM model object (from lavaan, blavaan, cSEM, or modsem)
indep	a string indicating the name of the independent variable
med	a string indicating the name of the mediator variable
dep	a string indicating the name of the dependent variable
approach	either "bk" or "zlc" or both c("bk", "zlc") (default)
p.threshold	a numeric giving the p-value threshold for significance
effect.size	character vector; one or more of "RIT", "RID", "upsilon"
...	additional arguments passed to methods

Value

an object of class rmedsem

Examples

```
mod.txt <- "
read ~ math
science ~ read + math
"
mod <- lavaan::sem(mod.txt, data=rmedsem::hsbdemo)
out <- rmedsem(mod, indep="math", med="read", dep="science")
out
```

`rmedsem.blavaan` *Mediation Analysis for Blavaan Models*

Description

Mediation Analysis for Blavaan Models

Usage

```
## S3 method for class 'blavaan'
rmedsem(
  mod,
  indep,
  med,
  dep,
  approach = c("bk", "zlc"),
  p.threshold = 0.05,
  effect.size = c("RIT", "RID", "upsilon"),
  ...
)
```

Arguments

`mod`	A fitted SEM model (blavaan). Note that the model has to be fit using `save.lvs=TRUE` if the mediation model contains latent variables.
`indep`	A string indicating the name of the independent variable in the model.
`med`	A string indicating the name of the mediator variable in the model.
`dep`	A string indicating the name of the dependent variable in the model.
`approach`	either 'bk' or 'zlc' or both c("bk", "zlc") (default)
`p.threshold`	A double giving the p-value for determining whether a path is significant or not
`effect.size`	calculate different effect-sizes; one or more of "RIT", "RID"
`...`	additional arguments (currently unused)

Value

A `rmedsem` structure containing the results from the analysis

Examples

```
## Not run:
# Requires blavaan and a MCMC backend (Stan/JAGS)
model02 <- "
  # measurement model
    ind60 =~ x1 + x2 + x3
    dem60 =~ y1 + y2 + y3 + y4
    dem65 =~ y5 + y6 + y7 + y8
```

```
  # regressions
    dem60 ~ ind60
    dem65 ~ ind60 + dem60
"
mod <- blavaan::bsem(model02, data=lavaan::PoliticalDemocracy, std.lv=TRUE,
            meanstructure=TRUE, n.chains=1,
            save.lvs=TRUE, burnin=500, sample=500)
out <- rmedsem(mod,  indep="ind60", med="dem60", dep="dem65")
print(out)

## End(Not run)
```

`rmedsem.cSEMResults` *Mediation Analysis for cSEM Models*

Description

Mediation Analysis for cSEM Models

Usage

```
## S3 method for class 'cSEMResults'
rmedsem(
  mod,
  indep,
  med,
  dep,
  approach = c("bk", "zlc"),
  p.threshold = 0.05,
  effect.size = c("RIT", "RID", "upsilon"),
  nbootstrap = 1000,
  ci.two.tailed = 0.95,
  ...
)
```

Arguments

`mod`	A fitted SEM model (cSEM).
`indep`	A string indicating the name of the independent variable in the model.
`med`	A string indicating the name of the mediator variable in the model.
`dep`	A string indicating the name of the dependent variable in the model.
`approach`	either 'bk' or 'zlc' or both c("bk", "zlc") (default)
`p.threshold`	A double giving the p-value for determining whether a path is significant or not
`effect.size`	calculate different effect-sizes; one or more of "RIT", "RID"
`nbootstrap`	number of bootstrap samples, default=1000
`ci.two.tailed`	A double giving the confidence level for two-tailed confidence intervals (default 0.95)
`...`	additional arguments (currently unused)

Value

A rmedsem structure containing the results from the analysis

---

rmedsem.lavaan *Mediation Analysis for Lavaan Models*

Description

Mediation Analysis for Lavaan Models

Usage

```
## S3 method for class 'lavaan'
rmedsem(
  mod,
  indep,
  med,
  dep,
  approach = c("bk", "zlc"),
  p.threshold = 0.05,
  effect.size = c("RIT", "RID", "upsilon"),
  standardized = TRUE,
  mcreps = NULL,
  ci.two.tailed = 0.95,
  ...
)
```

Arguments

mod	A fitted SEM model (lavaan).
indep	A string indicating the name of the independent variable in the model.
med	A string indicating the name of the mediator variable in the model.
dep	A string indicating the name of the dependent variable in the model.
approach	either 'bk' or 'zlc' or both c("bk", "zlc") (default)
p.threshold	A double giving the p-value for determining whether a path is significant or not
effect.size	calculate different effect-sizes; one or more of "RIT", "RID"
standardized	A boolean indicating whether the coefficients should be standardized. The default value is FALSE.
mcreps	An integer determining the number of monte-carlo samples.
ci.two.tailed	A double giving the confidence level for two-tailed confidence intervals (default 0.95)
...	additional arguments (currently unused)

Value

A rmedsem structure containing the results from the analysis

Examples

```
mod.txt <- "
read ~ math
science ~ read + math
"
mod <- lavaan::sem(mod.txt, data=rmedsem::hsbdemo)
out <- rmedsem(mod, indep="math", med="read", dep="science",
               standardized=TRUE, mcreps=5000,
               approach = c("bk","zlc"))
print(out)
```

---

rmedsem.modsem *Mediation Analysis for Modsem Models*

Description

Mediation Analysis for Modsem Models

Usage

```
## S3 method for class 'modsem'
rmedsem(
  mod,
  indep,
  med,
  dep,
  approach = c("bk", "zlc"),
  p.threshold = 0.05,
  effect.size = c("RIT", "RID", "upsilon"),
  moderator = NULL,
  standardized = TRUE,
  mcreps = NULL,
  ci.two.tailed = 0.95,
  ...
)
```

Arguments

mod	A fitted SEM model (modsem).
indep	A string indicating the name of the independent variable in the model.
med	A string indicating the name of the mediator variable in the model.
dep	A string indicating the name of the dependent variable in the model.

approach	either 'bk' or 'zlc' or both c("bk", "zlc") (default)
p.threshold	A double giving the p-value for determining whether a path is significant or not
effect.size	calculate different effect-sizes; one or more of "RIT", "RID"
moderator	A string indicating the name of the moderator variable in the model.
standardized	A boolean indicating whether the coefficients should be standardized. The default value is FALSE.
mcreps	An integer determining the number of monte-carlo samples.
ci.two.tailed	A double giving the confidence level for two-tailed confidence intervals (default 0.95)
...	additional arguments (currently unused)

Value

A rmedsem structure containing the results from the analysis

Examples

```
if (requireNamespace("modsem", quietly = TRUE)) {
  m <- "
    OwnLook =~ smv_attr_face + smv_attr_body + smv_sexy
    SelfEst =~ ses_satis + ses_qualities + ses_able_todo
    MentWell =~ mwb_optimistic + mwb_useful + mwb_energy
    smv =~ smv_kind + smv_caring + smv_understanding +
      smv_make_laughh + smv_funny + smv_sociable
    SelfEst ~ OwnLook + smv + smv:OwnLook
    MentWell ~ OwnLook + SelfEst + smv + smv:OwnLook
  "

  est <- modsem::modsem(m, data = mchoice, method="lms")

  # mediated moderation
  rmedsem(indep="smv:OwnLook", dep="MentWell", med="SelfEst", mod=est)

  # moderated mediation
  rmedsem(indep="OwnLook", dep="MentWell", med="SelfEst", mod=est, moderator="smv")
}
```

---

summary.rmedsem *Summarize an rmedsem Object*

Description

Prints the mediation analysis results to the console.

Usage

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

Arguments

object	the rmedsem object
...	additional arguments passed to print.rmedsem()

Value

the rmedsem object (invisibly)

Examples

```
mod.txt <- "
read ~ math
science ~ read + math
"
mod <- lavaan::sem(mod.txt, data=rmedsem::hsbdemo)
out <- rmedsem(mod, indep="math", med="read", dep="science")
summary(out)
```

Upsilon *Upsilon Effect Size*

Description

Returns the Upsilon effect size (Lachowicz, Preacher & Kelley, 2018), an R-squared-type measure representing the variance in Y explained indirectly by X through M.

Usage

```
Upsilon(res, ...)

## S3 method for class 'rmedsem'
Upsilon(res, adjusted = TRUE, ...)
```

Arguments

res	fitted rmedsem object
...	additional arguments (currently unused)
adjusted	logical; if TRUE (default), return the bias-adjusted estimator; if FALSE, return the unadjusted estimator

Value

A numeric scalar giving the Upsilon effect size, an R-squared-type measure of the variance in the dependent variable explained indirectly through the mediator.

Examples

```
mod.txt <- "
read ~ math
science ~ read + math
"
mod <- lavaan::sem(mod.txt, data=rmedsem::hsbdemo)
out <- rmedsem(mod, indep="math", med="read", dep="science",
               effect.size=c("RIT","RID","upsilon"))
Upsilon(out)
Upsilon(out, adjusted=FALSE)
```

---

workout *Fitness Center Survey Data from Trondheim*

Description

Data from a survey in a fitness center in Trondheim.

Usage

```
workout
```

Format

workout**:**
A data frame with 246 rows and 12 columns:

age Age in years
lweight How important is following to workout- to loose weight
calories How important is following to workout- to burn calories
cweight How important is following to workout- to control my weight
body How important is following to workout- to have a good body
appear How important is following to workout- to improve my appearance
attract How important is following to workout- to look more attractive
muscle How important is following to workout- to develop my muscles
strength How important is following to workout- to get stronger
endur How important is following to workout- to increase my endurance
face How well does the following describe you as a person - attractive face
sexy How well does the following describe you as a person - sexy

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