Package ‘dmacs’

Type          Package
Title    Measurement Nonequivalence Effect Size Calculator
Version    0.1.0
Maintainer  David Dueber <david.dueber@uky.edu>
Description Computes measurement nonequivalence effect size indices described in Nye and Dras-
URL          https://github.com/ddueber/dmacs
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R topics documented:

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delta_mean_item

Expected bias to item mean

Description

delta_mean_item computes the expected bias in item mean due to measurement nonequivalence.

Usage

delta_mean_item(LambdaR, ThreshR, LambdaF, ThreshF, MeanF, VarF, categorical = FALSE, stepsize = 0.001)

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LambdaR</td>
<td>is the factor loading of the item onto the factor of interest for the reference group.</td>
</tr>
<tr>
<td>ThreshR</td>
<td>is the indicator intercept (for continuous indicators) or a vector of thresholds (for categorical indicators) for the reference group.</td>
</tr>
<tr>
<td>LambdaF</td>
<td>is the factor loading of the item onto the factor of interest for the focal group.</td>
</tr>
<tr>
<td>ThreshF</td>
<td>is the indicator intercept (for continuous indicators) or a vector of thresholds (for categorical indicators) for the focal group.</td>
</tr>
<tr>
<td>MeanF</td>
<td>is the factor mean in the focal group</td>
</tr>
<tr>
<td>VarF</td>
<td>is the factor variances in the focal group</td>
</tr>
<tr>
<td>categorical</td>
<td>is a Boolean variable declaring whether the variables in the model are ordered categorical. Models in which some variables are categorical and others are continuous are not supported. If no value is provided, categorical defaults to FALSE, although if a vector of thresholds are provided, categorical will be forced to TRUE. A graded response model with probit link (e.g., DWLS in lavaan or WLSMV in Mplus) is used for categorical variables. If you desire for other categorical models (e.g., IRT parameterization) to be supported, e-mail the maintainer.</td>
</tr>
<tr>
<td>stepsize</td>
<td>is the interval width for the Riemann sum used to estimate the integral in equation 6 of Nye &amp; Drasgow (2011). Default value is .001. A larger value can be used for faster performance; accuracy is excellent at stepsize = .01 in my simulations.</td>
</tr>
</tbody>
</table>

Details

delta_mean_item is called by dmacs_summary_single, which in turn is called by lavaan_dmacs and mplus_dmacs, which are the only functions in this package intended for casual users

Value

The expected bias in item mean due to measurement nonequivalence in equation 4 of Nye & Drasgow (2011).
delta_var

References


Examples

```r
LambdaF <- 0.74
LambdaR <- 0.76
ThreshF <- 1.28
ThreshR <- 0.65
MeanF <- 0.21
VarF <- 1.76
delta_mean_item(LambdaR, ThreshR, LambdaF, ThreshF, MeanF, VarF)
```

---

**delta_var**

*Expected bias to total score variance*

**Description**

delta_var computes the expected bias in total score variance due to measurement nonequivalence. delta_var will only work for unidimensional linear models (not categorical).

**Usage**

delta_var(LambdaR, LambdaF, VarF, categorical = FALSE)

**Arguments**

- **LambdaR** is the vector of factor loadings for the reference group.
- **LambdaF** is the vector of factor loadings for the focal group.
- **VarF** is the factor variance of the focal group.
- **categorical** is a Boolean variable declaring whether the variables in the model are ordered categorical. Categorical indicators are not supported for this function.

**Details**

delta_var is called by dmacs_summary_single, which in turn is called by lavaan_dmacs and mplus_dmacs, which are the only functions in this package intended for casual users.

**Value**

The expected bias in total score variance due to measurement nonequivalence in equation 7, 8, and 9 of Nye & Drasgow (2011).
dmacs_summary

References

Examples

LambdaF <- c(1.00, 0.74, 1.14, 0.92)
LambdaR <- c(1.00, 0.76, 1.31, 0.98)
VarF <- 1.76
delta_var(LambdaR, LambdaF, VarF)

dmacs

*dmacs: A package for computing measurement nonequivalence effects.*

Description
The *dmacs* package provides functions used to compute indices related to the effects of measurement nonequivalence on observed scores, as described in Nye and Drasgow (2011).

dmacs functions
The *dmacs* package includes helper functions that can compute the various indices from Nye and Drasgow (2011) for fitted lavaan objects (*lavaan_dmacs*) and Mplus output files (*mplus_dmacs*). For users of other software and those interested, specific functions for computing these indices for individual items in individual focal groups are also available.

References

dmacs_summary

*Summary of measurement nonequivalence effects*

Description
dmacs_summary returns a summary of measurement non-equivalence effects given lists of parameters.

Usage
dmacs_summary(LambdaList, ThreshList, MeanList, VarList, SDList, Groups = NULL, RefGroup = 1, categorical = FALSE, ...)

Arguments

LambdaList is a list, indexed by groups, of factor loading matrices (dataframes are allowed).

ThreshList is a list, indexed by groups, of vectors of indicator intercepts (for continuous indicators) or lists, indexed by items, of vectors of thresholds (for categorical indicators). For categorical indicators, do not provide a matrix of thresholds for each group.

MeanList is a list, indexed by groups, of vectors of factor means. For unidimensional models, this is simply a list of factor means.

VarList is a list, indexed by groups, of vectors of factor variances. For unidimensional models, this is simply a list of factor variances.

SDLList is a list, indexed by groups, of vectors of indicator observed standard deviations used as the denominator of the dmacs effect size. This will usually either be pooled standard deviations or the standard deviation of the reference group. Each group, including the reference group, must be included in SDLList (although the standard deviations for the reference group are ignored).

Groups is a vector of group names. If no value is provided, dmacs_summary will try to use names(LambdaList); if LambdaList has no names, then the groups will be numbered.

RefGroup can be the name of the reference group (as a string), or the index of the reference group (as a number). RefGroup defaults to the first group if no value is provided. It is strongly recommended to provide the reference group as a string, since group names in data are often ordered by their appearance in the data, not alphabetically.

categorical is a Boolean variable declaring whether the variables in the model are ordered categorical. Models in which some variables are categorical and others are continuous are not supported. If no value is provided, categorical defaults to FALSE, although if multiple thresholds are provided for an item, categorical will be forced to TRUE. A graded response model with probit link (e.g., DWLS in lavaan or WLSMV in Mplus) is used for categorical variables. If you desire for other categorical models (e.g., IRT parameterization) to be supported, e-mail the maintainer.

... other parameters to be used in functions that dmacs_summary calls, most likely stepsize for the item_dmacs and delta_mean_item functions.

Details

dmacs_summary is called by lavaan_dmacs and mplus_dmacs, which are the only functions in this package intended for casual users.

Value

A list, indexed by groups, of lists of measurement nonequivalence effects from Nye and Drasgow (2011), including dmacs, expected bias in the mean score by item, expected bias in the mean total score, and expected bias in the variance of the total score. Expected bias in the variance of the total score is only supplied for unidimensional models with linear indicators (i.e., not categorical) in the current version of this package.
References


Examples

```r
LambdaList <- list(Group1 <- matrix(c(1.00, 0.74, 1.14, 0.92), ncol = 1),
                     Group2 <- matrix(c(1.00, 0.76, 1.31, 0.98), ncol = 1))
ThreshList <- list(Group1 <- c(0.00, 1.28, -0.82, 0.44),
                    Group2 <- c(0.00, 0.65, -0.77, 0.47))
MeanList  <- list(Group1 <- 0.21,
                   Group2 <- 0.19)
VarList   <- list(Group1 <- 1.76,
                   Group2 <- 1.34)
SDList    <- list(Group1 <- c(2.12, 1.85, 1.12, 3.61),
                   Group2 <- c(NA, NA, NA, NA))
Groups <- c("Group1", "Group2")
RefGroup <- "Group2"
dmacs_summary(LambdaList, ThreshList, MeanList, VarList, SDList, Groups, RefGroup)
```

---

dmacs_summary_single  Summary of measurement nonequivalence effects for a single group

Description

dmacs_summary_single returns a summary of measurement non-equivalence effects given parameters for a focal and reference group.

Usage

```r
dmacs_summary_single(LambdaR, ThreshR, LambdaF, ThreshF, MeanF, VarF, SD,
categorical = FALSE, ...)
```

Arguments

- **LambdaR** is the factor loading matrix (or dataframe) for the reference group.
- **ThreshR** is a vector of indicator intercepts (for continuous indicators) or a list, indexed by items, of vectors of thresholds (for categorical indicators) for the reference group. For categorical indicators, do **not** provide a matrix of thresholds.
- **LambdaF** is the factor loading matrix (or dataframe) for the focal group.
- **ThreshF** is a vector of indicator intercepts (for continuous indicators) or a list, indexed by items, of vectors of thresholds (for categorical indicators) for the focal group. For categorical indicators, do **not** provide a matrix of thresholds.
- **MeanF** is a vector of factor means for the focal group.
VarF is a vector of factor variances for the focal group.

SD is a vector of indicator observed standard deviations used as the denominator of the dmacs effect size. This will usually either be pooled standard deviations or the standard deviation of the reference group.

categorical is a Boolean variable declaring whether the variables in the model are ordered categorical. Models in which some variables are categorical and others are continuous are not supported. If no value is provided, categorical defaults to FALSE, although if multiple thresholds are provided for an item, categorical will be forced to TRUE. A graded response model with probit link (e.g., DWLS in lavaan or WLSMV in Mplus) is used for categorical variables. If you desire for other categorical models (e.g., IRT parameterization) to be supported, e-mail the maintainer.

... other parameters to be used in functions that dmacs_summary_single calls, most likely stepsize for the item_dmacs and delta_mean_item functions.

Details

dmacs_summary_single is called by dmacs_summary, which in turn is called by lavaan_dmacs and mplus_dmacs, which are the only functions in this package intended for casual users.

Value

A list of measurement nonequivalence effects from Nye and Drasgow (2011), including dmacs, expected bias in the mean score by item, expected bias in the mean total score, and expected bias in the variance of the total score. Expected bias in the variance of the total score is only supplied for unidimensional models in the current version of this package.

References


Examples

```r
LambdaF <- matrix(c(1.00, 0.74, 1.14, 0.92), ncol = 1)
LambdaR <- matrix(c(1.00, 0.76, 1.31, 0.98), ncol = 1)
ThreshF <- c(0.00, 1.28, -0.82, 0.44)
ThreshR <- c(0.00, 0.65, -0.77, 0.47)
MeanF <- 0.21
VarF <- 1.76
SD <- c(2.12, 1.85, 1.12, 3.61)
dmacs_summary_single(LambdaR, ThreshR, LambdaF, ThreshF, MeanF, VarF, SD)
```
**item_dmacs**

*dmacs measurement nonequivalence effect size*

---

**Description**

`item_dmacs` computes the dmacs effect size for a single indicator relative to a single factor in a single focal group.

**Usage**

```r
item_dmacs(LambdaR, ThreshR, LambdaF, ThreshF, MeanF, VarF, SD, 
categorical = FALSE, stepsize = 0.001)
```

**Arguments**

- `LambdaR` is the factor loading of the item onto the factor of interest for the reference group.
- `ThreshR` is the indicator intercept (for continuous indicators) or a vector of thresholds (for categorical indicators) for the reference group.
- `LambdaF` is the factor loading of the item onto the factor of interest for the focal group.
- `ThreshF` is the indicator intercept (for continuous indicators) or a vector of thresholds (for categorical indicators) for the focal group.
- `MeanF` is the factor mean in the focal group.
- `VarF` is the factor variances in the focal group.
- `SD` is the indicator standard deviations to be used as the denominator of the dmacs effect size. This will usually either be pooled standard deviation for the indicator or the standard deviation for the indicator in the reference group.
- `categorical` is a Boolean variable declaring whether the variables in the model are ordered categorical. Models in which some variables are categorical and others are continuous are not supported. If no value is provided, categorical defaults to FALSE, although if a vector of thresholds are provided, categorical will be forced to TRUE. A graded response model with probit link (e.g., DWLS in lavaan or WLSMV in Mplus) is used for categorical variables. If you desire for other categorical models (e.g., IRT parameterization) to be supported, e-mail the maintainer.
- `stepsize` is the interval width for the Riemann sum used to estimate the integral in equation 3 of Nye & Drasgow (2011). Default value is .001. A larger value can be used for faster performance; accuracy is excellent at stepsize = .01 in my simulations.

**Details**

`item_dmacs` is called by `dmacs_summary_single`, which in turn is called by `lavaan_dmacs` and `mplus_dmacs`, which are the only functions in this package intended for casual users.
Value

The dmacs effect size of equation 3 of Nye & Drasgow (2011).

References


Examples

```r
LambdaF <- 0.74
LambdaR <- 0.76
ThreshF <- 1.28
ThreshR <- 0.65
MeanF <- 0.21
VarF <- 1.76
SD <- 1.85
item_dmacs(LambdaR, ThreshR, LambdaF, ThreshF, MeanF, VarF, SD)
```

```
lavaan_dmacs      Summary of measurement nonequivalence effects
```

Description

lavaan_dmacs returns a summary of measurement non-equivalence effects given a fitted multi-group lavaan object.

Usage

```r
lavaan_dmacs(fit, RefGroup = 1, dtype = "pooled", ...)
```

Arguments

- **fit** is a fitted lavaan multi-group object. Only CFA models are supported, and be sure to have an anchor item.
- **RefGroup** can be the name of the reference group (as a string), or the index of the reference group (as a number). RefGroup defaults to the first group if no value is provided. It is strongly recommended to provide the reference group as a string, since group names in data are often ordered by their appearance in the data, not alphabetically.
- **dtype** describes the pooling of standard deviations for use in the denominator of the dmacs effect size. Possibilities are "pooled" for pooled standard deviations, or "glass" for always using the standard deviation of the reference group.
- **...** other parameters to be used in functions that lavaan_dmacs calls, most likely stepsize for the item_dmacs and delta_mean_item functions.
mplus_dmacs

Value

A list, indexed by group, of lists of measurement nonequivalence effects from Nye and Drasgow (2011), including dmacs, expected bias in the mean score by item, expected bias in the mean total score, and expected bias in the variance of the total score. Expected bias in the variance of the total score is only supplied for unidimensional models in the current version of this package.

References


Examples

```r
HS.model <- ' visual =~ x1 + x2 + x3
textual =~ x4 + x5 + x6
speed =~ x7 + x8 + x9 '
fit <- lavaan::cfa(HS.model,
data = lavaan::HolzingerSwineford1939,
group = "school")
lavaan_dmacs(fit, RefGroup = "Pasteur")
```

mplus_dmacs

Summary of measurement nonequivalence effects

Description

*mplus_dmacs* returns a summary of measurement non-equivalence effects given an Mplus .out file.

Usage

```r
mplus_dmacs(fit = file.choose(), RefGroup = 1, dtype = "pooled", ...)
```

Arguments

- **fit** is an Mplus .out file of a multigroup CFA analysis. The default is to launch a window for choosing the file.
- **RefGroup** can be the name of the reference group (as a string), or the index of the reference group (as a number). RefGroup defaults to the first group if no value is provided. It is strongly recommended to provide the reference group as a string, since group names in data are often ordered by their appearance in the data, not alphabetically.
- **dtype** described the pooling of standard deviations for use in the denominator of the dmacs effect size. Possibilities are "pooled" for pooled standard deviations, or "glass" for always using the standard deviation of the reference group.
- **...** other parameters to be used in functions that *mplus_dmacs* calls, most likely stepsize for the *item_dmacs* and *delta_mean_item* functions.
**Value**

A list, indexed by group, of lists of measurement nonequivalence effects from Nye and Drasgow (2011), including dmacs, expected bias in the mean score by item, expected bias in the mean total score, and expected bias in the variance of the total score. Expected bias in the variance of the total score is only supplied for unidimensional models in the current version of this package.

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