

# Package ‘longMI’

December 11, 2023

**Title** Longitudinal Measurement Invariance

**Version** 1.0.0

**Description** Fits longitudinal measurement invariance models using the 'lavaan' package.  
For a thorough exposition of testing measurement invariance,  
see Millsap (2011) <[doi:10.4324/9780203821961](https://doi.org/10.4324/9780203821961)>.

**URL** <https://github.com/ijapesigan/longMI>,  
<https://ijapesigan.github.io/longMI/>

**BugReports** <https://github.com/ijapesigan/longMI/issues>

**License** MIT + file LICENSE

**Encoding** UTF-8

**LazyData** true

**Roxygen** list(markdown = TRUE)

**Depends** R (>= 3.5.0)

**Imports** lavaan

**Suggests** knitr, rmarkdown, testthat

**RoxygenNote** 7.2.3

**NeedsCompilation** no

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Comparison	<i>Comparison Measurement Invariance Models</i>
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**Description**

Comparison Measurement Invariance Models

**Usage**

```
Comparison(configural = NULL, weak = NULL, strong = NULL, strict = NULL, ...)
```

**Arguments**

configural	Fitted configural invariance model.
weak	Fitted weak invariance model.
strong	Fitted strong invariance model.
strict	Fitted strict invariance model.
...	Additional arguments to pass to <a href="#">lavaan::lavTestLRT()</a> .

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Longitudinal Measurement Invariance Functions: [Configural\(\)](#), [Invariance\(\)](#), [Strict\(\)](#), [Strong\(\)](#), [Weak\(\)](#)

**Examples**

```
data("osbornesudick1972", package = "longMI")
configural_fit <- Configural(
  data = osbornesudick1972,
  time_points = c(1, 6),
  factor_loadings = list(
    c(1, 2, 3, 4)
  )
)
weak_fit <- Weak(
  data = osbornesudick1972,
  time_points = c(1, 6),
  factor_loadings = list(
    c(1, 2, 3, 4)
  )
)
strong_fit <- Strong(
  data = osbornesudick1972,
```

```

    time_points = c(1, 6),
    factor_loadings = list(
      c(1, 2, 3, 4)
    )
  )
  strict_fit <- Strict(
    data = osbornesudick1972,
    time_points = c(1, 6),
    factor_loadings = list(
      c(1, 2, 3, 4)
    )
  )
  mi <- Comparison(
    configural = configural_fit,
    weak = weak_fit,
    strong = strong_fit,
    strict = strict_fit
  )
  print(mi)
  summary(mi)

```

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Configural

---

*Configural Invariance Model*


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## Description

Configural Invariance Model

## Usage

```

Configural(
  data,
  time_points,
  factor_loadings,
  covariances = FALSE,
  model_add = NULL,
  ...
)

```

## Arguments

data	Dataframe. The function assumes that the data is in the wide format and the variables are named as follows: <code>paste0("y", time_point, "_", item_number)</code> . For example, for the item 1 from the first time point, the variable name should be <code>y1_1</code> .
time_points	Numeric vector of discrete time points.
factor_loadings	List with length equal to the number of factors. Each element of the list is the item number of items for the specific factor.

covariances	Logical. If covariance = TRUE, model the covariances of the measurement error.
model_add	Additional specification added to the lavaan model syntax.
...	Additional arguments to pass to <code>lavaan::cfa()</code> .

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Longitudinal Measurement Invariance Functions: [Comparison\(\)](#), [Invariance\(\)](#), [Strict\(\)](#), [Strong\(\)](#), [Weak\(\)](#)

**Examples**

```
data("osbornesudick1972", package = "longMI")
configural_fit <- Configural(
  data = osbornesudick1972,
  time_points = c(1, 6),
  factor_loadings = list(
    c(1, 2, 3, 4)
  )
)
library(lavaan)
summary(configural_fit)
```

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Invariance

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*Test Longitudinal Measurement Invariance*


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**Description**

Test Longitudinal Measurement Invariance

**Usage**

```
Invariance(
  data,
  time_points,
  factor_loadings,
  covariances = FALSE,
  model_add_configural = NULL,
  model_add_weak = NULL,
  model_add_strong = NULL,
  model_add_strict = NULL,
  ...
)
```

**Arguments**

<code>data</code>	Dataframe. The function assumes that the data is in the wide format and the variables are named as follows: <code>paste0("y", time_point, "_", item_number)</code> . For example, for the item 1 from the first time point, the variable name should be <code>y1_1</code> .
<code>time_points</code>	Numeric vector of discrete time points.
<code>factor_loadings</code>	List with length equal to the number of factors. Each element of the list is the item number of items for the specific factor.
<code>covariances</code>	Logical. If <code>covariance = TRUE</code> , model the covariances of the measurement error.
<code>model_add_configural</code>	Additional specification added to the lavaan model syntax for the configural invariance model.
<code>model_add_weak</code>	Additional specification added to the lavaan model syntax for the weak invariance model.
<code>model_add_strong</code>	Additional specification added to the lavaan model syntax for the strong invariance model.
<code>model_add_strict</code>	Additional specification added to the lavaan model syntax for the strict invariance model.
<code>...</code>	Additional arguments to pass to <code>lavaan::cfa()</code> .

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Longitudinal Measurement Invariance Functions: [Comparison\(\)](#), [Configural\(\)](#), [Strict\(\)](#), [Strong\(\)](#), [Weak\(\)](#)

**Examples**

```
data("osbornesudick1972", package = "longMI")
mi <- Invariance(
  data = osbornesudick1972,
  time_points = c(1, 6),
  factor_loadings = list(
    c(1, 2, 3, 4)
  )
)
print(mi)
summary(mi)
```

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osbornesudick1972	<i>Wechsler Intelligence Scale for Children Data from Osborne and Sudick (1972)</i>
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**Description**

Wechsler Intelligence Scale for Children Data from Osborne and Sudick (1972)

**Usage**

osbornesudick1972

**Format**

The data set has the following variables:

- id** ID
- y1\_1** Time 1 Information
- y1\_2** Time 1 Comprehension
- y1\_3** Time 1 Similarities
- y1\_4** Time 1 Vocabulary
- y6\_1** Time 6 Information
- y6\_2** Time 6 Comprehension
- y6\_3** Time 6 Similarities
- y6\_4** Time 6 Vocabulary

**References**

Osborne, R. T., & Suddick, D. E. (1972). A longitudinal investigation of the intellectual differentiation hypothesis. *The Journal of Genetic Psychology: Research and Theory on Human Development*, 121(1), 83–89. doi:10.1080/00221325.1972.10533131.

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print.longmi	<i>Print Method for an Object of Class longmi</i>
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**Description**

Print Method for an Object of Class longmi

**Usage**

```
## S3 method for class 'longmi'  
print(x, digits = 4, ...)
```

**Arguments**

<code>x</code>	Object of class <code>longmi</code> .
<code>digits</code>	Digits to print.
<code>...</code>	additional arguments.

**Value**

Returns a matrix of selected fit measures.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**Examples**

```
data("osbornesudick1972", package = "longMI")
mi <- Invariance(
  data = osbornesudick1972,
  time_points = c(1, 6),
  factor_loadings = list(
    c(1, 2, 3, 4)
  )
)
print(mi)
```

---

 Strict

---

*Strict Invariance Model*


---

**Description**

Strict Invariance Model

**Usage**

```
Strict(
  data,
  time_points,
  factor_loadings,
  covariances = FALSE,
  model_add = NULL,
  ...
)
```

**Arguments**

<code>data</code>	Dataframe. The function assumes that the data is in the wide format and the variables are named as follows: <code>paste0("y", time_point, "_", item_number)</code> . For example, for the item 1 from the first time point, the variable name should be <code>y1_1</code> .
<code>time_points</code>	Numeric vector of discrete time points.
<code>factor_loadings</code>	List with length equal to the number of factors. Each element of the list is the item number of items for the specific factor.
<code>covariances</code>	Logical. If <code>covariance = TRUE</code> , model the covariances of the measurement error.
<code>model_add</code>	Additional specification added to the lavaan model syntax.
<code>...</code>	Additional arguments to pass to <a href="#">lavaan::cfa()</a> .

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Longitudinal Measurement Invariance Functions: [Comparison\(\)](#), [Configural\(\)](#), [Invariance\(\)](#), [Strong\(\)](#), [Weak\(\)](#)

**Examples**

```
data("osbornesudick1972", package = "longMI")
strict_fit <- Strict(
  data = osbornesudick1972,
  time_points = c(1, 6),
  factor_loadings = list(
    c(1, 2, 3, 4)
  )
)
library(lavaan)
summary(strict_fit)
```

---

Strong

*Strong Invariance Model*

---

**Description**

Strong Invariance Model



**Usage**

```
Strong(
  data,
  time_points,
  factor_loadings,
  covariances = FALSE,
  model_add = NULL,
  ...
)
```

**Arguments**

<code>data</code>	Dataframe. The function assumes that the data is in the wide format and the variables are named as follows: <code>paste0("y", time_point, "_", item_number)</code> . For example, for the item 1 from the first time point, the variable name should be <code>y1_1</code> .
<code>time_points</code>	Numeric vector of discrete time points.
<code>factor_loadings</code>	List with length equal to the number of factors. Each element of the list is the item number of items for the specific factor.
<code>covariances</code>	Logical. If <code>covariance = TRUE</code> , model the covariances of the measurement error.
<code>model_add</code>	Additional specification added to the lavaan model syntax.
<code>...</code>	Additional arguments to pass to <a href="#">lavaan::cfa()</a> .

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Longitudinal Measurement Invariance Functions: [Comparison\(\)](#), [Configural\(\)](#), [Invariance\(\)](#), [Strict\(\)](#), [Weak\(\)](#)

**Examples**

```
data("osbornesudick1972", package = "longMI")
strong_fit <- Strong(
  data = osbornesudick1972,
  time_points = c(1, 6),
  factor_loadings = list(
    c(1, 2, 3, 4)
  )
)
library(lavaan)
summary(strong_fit)
```

---

summary.longmi	<i>Summary Method for an Object of Class longmi</i>
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---

## Description

Summary Method for an Object of Class longmi

## Usage

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

## Arguments

object	Object of class longmi.
...	additional arguments.

## Value

Returns a list of likelihood ratio tests.

## Author(s)

Ivan Jacob Agaloos Pesigan

## Examples

```
data("osbornesudick1972", package = "longMI")  
mi <- Invariance(  
  data = osbornesudick1972,  
  time_points = c(1, 6),  
  factor_loadings = list(  
    c(1, 2, 3, 4)  
  )  
)  
summary(mi)
```

Weak

*Weak Invariance Model***Description**

Weak Invariance Model

**Usage**

```
Weak(
  data,
  time_points,
  factor_loadings,
  covariances = FALSE,
  model_add = NULL,
  ...
)
```

**Arguments**

<code>data</code>	Dataframe. The function assumes that the data is in the wide format and the variables are named as follows: <code>paste0("y", time_point, "_", item_number)</code> . For example, for the item 1 from the first time point, the variable name should be <code>y1_1</code> .
<code>time_points</code>	Numeric vector of discrete time points.
<code>factor_loadings</code>	List with length equal to the number of factors. Each element of the list is the item number of items for the specific factor.
<code>covariances</code>	Logical. If <code>covariance = TRUE</code> , model the covariances of the measurement error.
<code>model_add</code>	Additional specification added to the lavaan model syntax.
<code>...</code>	Additional arguments to pass to <a href="#">lavaan::cfa()</a> .

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Longitudinal Measurement Invariance Functions: [Comparison\(\)](#), [Configural\(\)](#), [Invariance\(\)](#), [Strict\(\)](#), [Strong\(\)](#)

**Examples**

```
data("osbornesudick1972", package = "longMI")
weak_fit <- Weak(
  data = osbornesudick1972,
  time_points = c(1, 6),
  factor_loadings = list(
    c(1, 2, 3, 4)
  )
)
library(lavaan)
summary(weak_fit)
```

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