

Package ‘fitCTVARMx’

July 8, 2024

Title Fit the Continuous-Time Vector Autoregressive Model

Version 0.0.0.9000

Description Fit the continuous-time vector autoregressive model using the 'OpenMx' package.

URL <https://github.com/jeksterslab/fitCTVARMx>,
<https://jeksterslab.github.io/fitCTVARMx/>

BugReports <https://github.com/jeksterslab/fitCTVARMx/issues>

License MIT + file LICENSE

Encoding UTF-8

Roxygen list(markdown = TRUE)

VignetteBuilder knitr

Depends R (>= 3.0.0), OpenMx

Imports stats

Suggests knitr, rmarkdown, testthat, simStateSpace

RoxygenNote 7.3.2

NeedsCompilation no

Author Ivan Jacob Agaloos Pesigan [aut, cre, cph]
(<https://orcid.org/0000-0003-4818-8420>)

Maintainer Ivan Jacob Agaloos Pesigan <r.jeksterslab@gmail.com>

Contents

| | |
|--------------------------------|----|
| coef.fitctvaridmx | 2 |
| coef.fitctvarmx | 2 |
| FitCTVARIDMx | 3 |
| FitCTVARMx | 6 |
| print.fitctvaridmx | 9 |
| print.fitctvarmx | 10 |
| summary.fitctvaridmx | 10 |
| summary.fitctvarmx | 11 |
| vcov.fitctvaridmx | 11 |
| vcov.fitctvarmx | 12 |

| | |
|-------------------|----------------------------|
| coef.fitctvaridmx | <i>Parameter Estimates</i> |
|-------------------|----------------------------|

Description

Parameter Estimates

Usage

```
## S3 method for class 'fitctvaridmx'  
coef(object, sigma = FALSE, theta = FALSE, ...)
```

Arguments

| | |
|--------|---|
| object | Object of class fitctvaridmx. |
| sigma | Logical. If sigma = TRUE, include estimates of the sigma matrix, if available. If sigma = FALSE, exclude estimates of the sigma matrix. |
| theta | Logical. If theta = TRUE, include estimates of the theta matrix, if available. If theta = FALSE, exclude estimates of the theta matrix. |
| ... | additional arguments. |

Value

Returns a list of vectors of parameter estimates.

Author(s)

Ivan Jacob Agaloos Pesigan

| | |
|-----------------|----------------------------|
| coef.fitctvarmx | <i>Parameter Estimates</i> |
|-----------------|----------------------------|

Description

Parameter Estimates

Usage

```
## S3 method for class 'fitctvarmx'  
coef(object, sigma = FALSE, theta = FALSE, ...)
```

Arguments

| | |
|--------|---|
| object | Object of class fitctvarmx. |
| sigma | Logical. If sigma = TRUE, include estimates of the sigma matrix, if available. If sigma = FALSE, exclude estimates of the sigma matrix. |
| theta | Logical. If theta = TRUE, include estimates of the theta matrix, if available. If theta = FALSE, exclude estimates of the theta matrix. |
| ... | additional arguments. |

Value

Returns a vector of parameter estimates.

Author(s)

Ivan Jacob Agaloos Pesigan

| | |
|--------------|--|
| FitCTVARIDMx | <i>Fit the First Order Continuous-Time Vector Autoregressive Model by ID</i> |
|--------------|--|

Description

Fit the First Order Continuous-Time Vector Autoregressive Model by ID

Usage

```
FitCTVARIDMx(
  data,
  observed,
  id,
  time,
  phi_start = NULL,
  phi_lbound = NULL,
  phi_ubound = NULL,
  sigma_diag = TRUE,
  sigma_start = NULL,
  sigma_lbound = NULL,
  sigma_ubound = NULL,
  theta_fixed = TRUE,
  theta_start = NULL,
  theta_lbound = NULL,
  theta_ubound = NULL,
  mu0_fixed = TRUE,
  mu0_start = NULL,
  mu0_lbound = NULL,
  mu0_ubound = NULL,
```

```

sigma0_fixed = TRUE,
sigma0_diag = TRUE,
sigma0_start = NULL,
sigma0_lbound = NULL,
sigma0_ubound = NULL,
try = 1000,
ncores = NULL
)

```

Arguments

| | |
|--------------|---|
| data | Data frame. A data frame object of data for potentially multiple subjects that contain a column of subject ID numbers (i.e., an ID variable), and at least one column of observed values. |
| observed | Character vector. A vector of character strings of the names of the observed variables in the data. |
| id | Character string. A character string of the name of the ID variable in the data. |
| time | Character string. A character string of the name of the TIME variable in the data. |
| phi_start | Numeric matrix. Optional starting values for phi. |
| phi_lbound | Numeric matrix. Optional lower bound for phi. |
| phi_ubound | Numeric matrix. Optional upper bound for phi. |
| sigma_diag | Logical. If sigma_diag = TRUE, sigma is a diagonal matrix. |
| sigma_start | Numeric matrix. Optional starting values for sigma. |
| sigma_lbound | Numeric matrix. Optional lower bound for sigma. |
| sigma_ubound | Optional upper bound for sigma. |
| theta_fixed | Logical. If theta_fixed = TRUE, the measurement error matrix theta is fixed to zero. If theta_fixed = FALSE, estimate the diagonal measurement error matrix theta. |
| theta_start | Optional starting values for theta. Ignored if theta_fixed = TRUE. |
| theta_lbound | Optional lower bound for theta. Ignored if theta_fixed = TRUE. |
| theta_ubound | Optional upper bound for theta. Ignored if theta_fixed = TRUE. |
| mu0_fixed | Logical. If mu0_fixed = TRUE, initial mean vector mu0 is fixed. If mu0_fixed = FALSE, initial mean vector mu0 is estimated. |
| mu0_start | Optional starting values for mu0. If mu0_fixed = TRUE, mu0_start will be used as fixed values. If mu0_fixed = FALSE, mu0_start will be used as starting values. |
| mu0_lbound | Optional lower bound for mu0. Ignored if mu0_fixed = TRUE. |
| mu0_ubound | Optional upper bound for mu0. Ignored if mu0_fixed = TRUE. |
| sigma0_fixed | Logical. If sigma0_fixed = TRUE, initial mean vector sigma0 is fixed. If sigma0_fixed = FALSE, initial mean vector sigma0 is estimated. |
| sigma0_diag | Logical. If sigma0_diag = TRUE, sigma0 is a diagonal matrix. |

| | |
|----------------------------|--|
| <code>sigma0_start</code> | Optional starting values for <code>sigma0</code> . If <code>sigma0_fixed = TRUE</code> , <code>sigma0_start</code> will be used as fixed values. If <code>sigma0_fixed = FALSE</code> , <code>sigma0_start</code> will be used as starting values. |
| <code>sigma0_lbound</code> | Optional lower bound for <code>sigma0</code> . Ignored if <code>sigma0_fixed = TRUE</code> . |
| <code>sigma0_ubound</code> | Optional upper bound for <code>sigma0</code> . Ignored if <code>sigma0_fixed = TRUE</code> . |
| <code>try</code> | Positive integer. Number of extra optimization tries. |
| <code>ncores</code> | Positive integer. Number of cores to use. |

Author(s)

Ivan Jacob Agaloos Pesigan

References

- Hunter, M. D. (2017). State space modeling in an open source, modular, structural equation modeling environment. *Structural Equation Modeling: A Multidisciplinary Journal*, 25(2), 307–324. doi:[10.1080/10705511.2017.1369354](https://doi.org/10.1080/10705511.2017.1369354)
- Neale, M. C., Hunter, M. D., Pritikin, J. N., Zahery, M., Brick, T. R., Kirkpatrick, R. M., Estabrook, R., Bates, T. C., Maes, H. H., & Boker, S. M. (2015). OpenMx 2.0: Extended structural equation and statistical modeling. *Psychometrika*, 81(2), 535–549. doi:[10.1007/s1133601494358](https://doi.org/10.1007/s1133601494358)

See Also

Other CTVAR Functions: [FitCTVARmX\(\)](#)

Examples

```
## Not run:
# Generate data using the simStateSpace package-----
set.seed(42)
phi_mu <- matrix(
  data = c(
    -0.357, 0.771, -0.450,
    0.0, -0.511, 0.729,
    0, 0, -0.693
  ),
  nrow = 3
)
phi_sigma <- diag(3 * 3)
phi <- simStateSpace::SimPhiN(
  n = 5,
  phi = phi_mu,
  vcov_phi_vec_l = t(chol(phi_sigma))
)
sim <- simStateSpace::SimSSMOUIVary(
  n = 5,
  time = 100,
  delta_t = 0.10,
  mu0 = list(rep(x = 0, times = 3)),
  sigma0_l = list(t(chol(diag(3)))),
```

```

mu = list(rep(x = 0, times = 3)),
phi = phi,
sigma_l = list(t(chol(diag(3)))),
nu = list(rep(x = 0, times = 3)),
lambda = list(diag(3)),
theta_l = list(matrix(data = 0, nrow = 3, ncol = 3))
)
data <- as.data.frame(sim)

# Fit the model-----
library(fitCTVARMx)
fit <- FitCTVARIDMx(
  data = data,
  observed = c("y1", "y2", "y3"),
  id = "id"
)
print(fit)
summary(fit)
coef(fit)
vcov(fit)

## End(Not run)

```

FitCTVARMx

Fit the First-Order Continuous-Time Vector Autoregressive Model

Description

Fit the First-Order Continuous-Time Vector Autoregressive Model

Usage

```

FitCTVARMx(
  data,
  observed,
  id,
  time,
  phi_start = NULL,
  phi_lbound = NULL,
  phi_ubound = NULL,
  sigma_diag = TRUE,
  sigma_start = NULL,
  sigma_lbound = NULL,
  sigma_ubound = NULL,
  theta_fixed = TRUE,
  theta_start = NULL,
  theta_lbound = NULL,
  theta_ubound = NULL,

```

```

    mu0_fixed = TRUE,
    mu0_start = NULL,
    mu0_lbound = NULL,
    mu0_ubound = NULL,
    sigma0_fixed = TRUE,
    sigma0_diag = TRUE,
    sigma0_start = NULL,
    sigma0_lbound = NULL,
    sigma0_ubound = NULL,
    try = 1000,
    ncores = NULL
)

```

Arguments

| | |
|--------------|---|
| data | Data frame. A data frame object of data for potentially multiple subjects that contain a column of subject ID numbers (i.e., an ID variable), and at least one column of observed values. |
| observed | Character vector. A vector of character strings of the names of the observed variables in the data. |
| id | Character string. A character string of the name of the ID variable in the data. |
| time | Character string. A character string of the name of the TIME variable in the data. |
| phi_start | Numeric matrix. Optional starting values for phi. |
| phi_lbound | Numeric matrix. Optional lower bound for phi. |
| phi_ubound | Numeric matrix. Optional upper bound for phi. |
| sigma_diag | Logical. If sigma_diag = TRUE, sigma is a diagonal matrix. |
| sigma_start | Numeric matrix. Optional starting values for sigma. |
| sigma_lbound | Numeric matrix. Optional lower bound for sigma. |
| sigma_ubound | Optional upper bound for sigma. |
| theta_fixed | Logical. If theta_fixed = TRUE, the measurement error matrix theta is fixed to zero. If theta_fixed = FALSE, estimate the diagonal measurement error matrix theta. |
| theta_start | Optional starting values for theta. Ignored if theta_fixed = TRUE. |
| theta_lbound | Optional lower bound for theta. Ignored if theta_fixed = TRUE. |
| theta_ubound | Optional upper bound for theta. Ignored if theta_fixed = TRUE. |
| mu0_fixed | Logical. If mu0_fixed = TRUE, initial mean vector mu0 is fixed. If mu0_fixed = FALSE, initial mean vector mu0 is estimated. |
| mu0_start | Optional starting values for mu0. If mu0_fixed = TRUE, mu0_start will be used as fixed values. If mu0_fixed = FALSE, mu0_start will be used as starting values. |
| mu0_lbound | Optional lower bound for mu0. Ignored if mu0_fixed = TRUE. |
| mu0_ubound | Optional upper bound for mu0. Ignored if mu0_fixed = TRUE. |

| | |
|----------------------------|--|
| <code>sigma0_fixed</code> | Logical. If <code>sigma0_fixed = TRUE</code> , initial mean vector <code>sigma0</code> is fixed. If <code>sigma0_fixed = FALSE</code> , initial mean vector <code>sigma0</code> is estimated. |
| <code>sigma0_diag</code> | Logical. If <code>sigma0_diag = TRUE</code> , <code>sigma0</code> is a diagonal matrix. |
| <code>sigma0_start</code> | Optional starting values for <code>sigma0</code> . If <code>sigma0_fixed = TRUE</code> , <code>sigma0_start</code> will be used as fixed values. If <code>sigma0_fixed = FALSE</code> , <code>sigma0_start</code> will be used as starting values. |
| <code>sigma0_lbound</code> | Optional lower bound for <code>sigma0</code> . Ignored if <code>sigma0_fixed = TRUE</code> . |
| <code>sigma0_ubound</code> | Optional upper bound for <code>sigma0</code> . Ignored if <code>sigma0_fixed = TRUE</code> . |
| <code>try</code> | Positive integer. Number of extra optimization tries. |
| <code>ncores</code> | Positive integer. Number of cores to use. |

Value

Returns an object of class `fitctvarmx` which is a list with the following elements:

call Function call.

args List of function arguments.

fun Function used ("FitCTVARMx").

output A fitted OpenMx model.

Author(s)

Ivan Jacob Agaloos Pesigan

References

Hunter, M. D. (2017). State space modeling in an open source, modular, structural equation modeling environment. *Structural Equation Modeling: A Multidisciplinary Journal*, 25(2), 307–324. doi:10.1080/10705511.2017.1369354

Neale, M. C., Hunter, M. D., Pritikin, J. N., Zahery, M., Brick, T. R., Kirkpatrick, R. M., Estabrook, R., Bates, T. C., Maes, H. H., & Boker, S. M. (2015). OpenMx 2.0: Extended structural equation and statistical modeling. *Psychometrika*, 81(2), 535–549. doi:10.1007/s1133601494358

See Also

Other CTVAR Functions: [FitCTVARIDMx\(\)](#)

Examples

```
## Not run:
# Generate data using the simStateSpace package-----
set.seed(42)
sim <- simStateSpace::SimSSMOUFixed(
  n = 5,
  time = 100,
  delta_t = 0.10,
  mu0 = rep(x = 0, times = 3),
  sigma0_l = t(chol(diag(3))),
```



```

mu = rep(x = 0, times = 3),
phi = matrix(
  data = c(
    -0.357, 0.771, -0.450,
    0.0, -0.511, 0.729,
    0, 0, -0.693
  ),
  nrow = 3
),
sigma_l = t(chol(diag(3))),
nu = rep(x = 0, times = 3),
lambda = diag(3),
theta_l = matrix(data = 0, nrow = 3, ncol = 3)
)
data <- as.data.frame(sim)

# Fit the model-----
library(fitCTVARMx)
fit <- FitCTVARMx(
  data = data,
  observed = c("y1", "y2", "y3"),
  id = "id"
)
print(fit)
summary(fit)
coef(fit)
vcov(fit)

## End(Not run)

```

| | |
|--------------------|--|
| print.fitctvaridmx | <i>Print Method for Object of Class fitctvaridmx</i> |
|--------------------|--|

Description

Print Method for Object of Class fitctvaridmx

Usage

```

## S3 method for class 'fitctvaridmx'
print(x, means = TRUE, ...)

```

Arguments

| | |
|-------|--|
| x | an object of class fitctvaridmx. |
| means | Logical. If means = TRUE, return means. Otherwise, the function returns raw estimates. |
| ... | further arguments. |

Author(s)

Ivan Jacob Agaloos Pesigan

| | |
|------------------|--|
| print.fitctvarmx | <i>Print Method for Object of Class fitctvarmx</i> |
|------------------|--|

Description

Print Method for Object of Class fitctvarmx

Usage

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

Arguments

| | |
|-----|--------------------------------|
| x | an object of class fitctvarmx. |
| ... | further arguments. |

Author(s)

Ivan Jacob Agaloos Pesigan

| | |
|----------------------|--|
| summary.fitctvaridmx | <i>Summary Method for Object of Class fitctvaridmx</i> |
|----------------------|--|

Description

Summary Method for Object of Class fitctvaridmx

Usage

```
## S3 method for class 'fitctvaridmx'  
summary(object, means = TRUE, ...)
```

Arguments

| | |
|--------|--|
| object | an object of class fitctvaridmx. |
| means | Logical. If means = TRUE, return means. Otherwise, the function returns raw estimates. |
| ... | further arguments. |

Author(s)

Ivan Jacob Agaloos Pesigan

| | |
|--------------------|--|
| summary.fitctvarmx | <i>Summary Method for Object of Class fitctvarmx</i> |
|--------------------|--|

Description

Summary Method for Object of Class fitctvarmx

Usage

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

Arguments

| | |
|--------|--------------------------------|
| object | an object of class fitctvarmx. |
| ... | further arguments. |

Author(s)

Ivan Jacob Agaloos Pesigan

| | |
|-------------------|--|
| vcov.fitctvaridmx | <i>Sampling Covariance Matrix of the Parameter Estimates</i> |
|-------------------|--|

Description

Sampling Covariance Matrix of the Parameter Estimates

Usage

```
## S3 method for class 'fitctvaridmx'
vcov(object, sigma = FALSE, theta = FALSE, ...)
```

Arguments

| | |
|--------|---|
| object | Object of class fitctvaridmx. |
| sigma | Logical. If sigma = TRUE, include estimates of the sigma matrix, if available. If sigma = FALSE, exclude estimates of the sigma matrix. |
| theta | Logical. If theta = TRUE, include estimates of the theta matrix, if available. If theta = FALSE, exclude estimates of the theta matrix. |
| ... | additional arguments. |

Value

Returns a list of sampling variance-covariance matrices.

Author(s)

Ivan Jacob Agaloos Pesigan

vcov.fitctvarmx

Sampling Covariance Matrix of the Parameter Estimates

Description

Sampling Covariance Matrix of the Parameter Estimates

Usage

```
## S3 method for class 'fitctvarmx'  
vcov(object, sigma = FALSE, theta = FALSE, ...)
```

Arguments

| | |
|--------|---|
| object | Object of class fitctvarmx. |
| sigma | Logical. If sigma = TRUE, include estimates of the sigma matrix, if available. If sigma = FALSE, exclude estimates of the sigma matrix. |
| theta | Logical. If theta = TRUE, include estimates of the theta matrix, if available. If theta = FALSE, exclude estimates of the theta matrix. |
| ... | additional arguments. |

Value

Returns a list of sampling variance-covariance matrices.

Author(s)

Ivan Jacob Agaloos Pesigan

Index

- * **CTVAR Functions**
 - FitCTVARIDMx, [3](#)
 - FitCTVARMx, [6](#)
- * **fitCTVARMx**
 - FitCTVARIDMx, [3](#)
 - FitCTVARMx, [6](#)
- * **fit**
 - FitCTVARIDMx, [3](#)
 - FitCTVARMx, [6](#)
- * **methods**
 - coef.fitctvaridmx, [2](#)
 - coef.fitctvarmx, [2](#)
 - print.fitctvaridmx, [9](#)
 - print.fitctvarmx, [10](#)
 - summary.fitctvaridmx, [10](#)
 - summary.fitctvarmx, [11](#)
 - vcov.fitctvaridmx, [11](#)
 - vcov.fitctvarmx, [12](#)

coef.fitctvaridmx, [2](#)
coef.fitctvarmx, [2](#)

FitCTVARIDMx, [3](#), [8](#)
FitCTVARMx, [5](#), [6](#)

print.fitctvaridmx, [9](#)
print.fitctvarmx, [10](#)

summary.fitctvaridmx, [10](#)
summary.fitctvarmx, [11](#)

vcov.fitctvaridmx, [11](#)
vcov.fitctvarmx, [12](#)