Package 'sdpdth'

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Type Package

Title M-Estimator for Threshold Spatial Dynamic Panel Data Model

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sdpdth-package *sdpdth*

Description

M-estimator for threshold and non-threshold spatial dynamic panel data model.

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data_n *A simulated data set for testing*

Description

A simulated data set for testing

Usage

data_n

Format

An object of class list of length 4.

---

data_nw *A simulated data set for testing*

Description

A simulated data set for testing

Usage

data_nw

Format

An object of class matrix with 12 rows and 12 columns.

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data_th	*A simulated data set for testing*

Description

A simulated data set for testing

Usage

```
data_th
```

Format

An object of class `list` of length 8.

---

data_w	*A simulated data set for testing*

Description

A simulated data set for testing

Usage

```
data_w
```

Format

An object of class `matrix` with 16 rows and 16 columns.

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msdpd	*M-estimator for spatial dynamic panel data model*

Description

Estimating the spatial dynamic panel data model with M-estimator

Usage

```
msdpd(
  y,
  x,
  w1,
  correction = TRUE,
  hessian_er = FALSE,
  true_range = FALSE,
  max_try = 5,
  w2 = w1,
  w3 = w1,
  no_tf = FALSE,
  model = "full",
  rcpp = TRUE,
  cma_pop_multi = 1
)
```

Arguments

y	matrix, containing regional index (first column), time index (second column, numeric) and dependent variable (third column, numeric).
x	matrix, containing regional index (first column), time index (second column, numeric) and regressors (numeric).
w1	matrix, the spatial weight matrix. If w2 and w3 are supplied, the spatial weight matrix for spatial lag.
correction	logical, whether to use adjusted score function. Default value is TRUE.
hessian_er	logical, whether to output hessian based se. Ignored if correction is set to False. Default value is FALSE.
true_range	logical, whether to used the accurate stationary check. Default value is FALSE due to performance reasons.
max_try	integer, maximum attempt for the solver. Default value is 5.
w2	matrix, the spatial weight matrix for spatio-temporal lag. Default value is the same as w1.
w3	matrix, the spatial weight matrix for spatial error. Default value is the same as w1.
no_tf	logical, whether to account for time effect. Default value is TRUE.
model	character, indicates the model used for estimation, can be "full", "slm", "sem", "sltl". See Details.
rcpp	logical, whether to use the rcpp implementation to calculate the score function. Default value is TRUE.
cma_pop_multi	integer, multiplier for the population size used in CMA-ES. Default value is 1.

Details

Estimating the spatial dynamic panel data model with Yang(2018)'s M-estimator

$$y_{ti} = \mu_i + \alpha_t + x_{ti}\beta + \rho y_{t-1,i} + \lambda_1 \sum_{j=1}^{n} w_{1,ij} y_{tj} + \lambda_2 \sum_{j=1}^{n} w_{2,ij} y_{t-1,j} + u_{ti}, u_{ti} = \lambda_3 \sum_{j=1}^{n} w_{3,ij} u_{tj} + v_{ti}, i = 1, \ldots, n, t = 1, \ldots,$$

The minimum number of time-periods is 4. Make sure the rows and columns of w1, w2, and w3 are lined up with the regional index. Sub-models can be specified by argument "model"

- "full" Full model
- "slm" $\lambda_2 = \lambda_3 = 0$
- "sem" $\lambda_1 = \lambda_2 = 0$
- "sltl" $\lambda_3 = 0$

Some suggestions when the optimizer fails:

- Increase max_try
- Increase cma_pop_multi
- try a different submodel

Value

A list of estimation results of S3 class "msdpd"

- "coefficient" list, coefficients and standard errors
- "model" character, model used for estimation
- "vc_mat" matrix, variance-covariance matrix
- "hessian" matrix, optional, hessian matrix

References

Yang, Z. (2018). Unified M-estimation of fixed-effects spatial dynamic models with short panels. Journal of Econometrics, 205(2), 423-447.

Examples

```
data(data_n, data_nw)
result <- msdpd(y = data_n$y, x = data_n$x, w1 = data_nw)
```

---

msdpdth	*M-estimator for threshold spatial dynamic panel data model*

Description

Estimating threshold spatial dynamic panel data model with M-estimator

Usage

```
msdpdth(
  y,
  x,
  w1,
  th,
  correction = TRUE,
  max_try = 5,
  all_er = FALSE,
  true_range = FALSE,
  residual = FALSE,
  w3 = w1,
  w2 = w1,
  no_tf = FALSE,
  model = "full",
  th_type = "row",
  ini_val = NULL,
  rcpp = TRUE,
  cma_pop_multi = 1
)
```

Arguments

y	matrix, containing regional index (first column), time index (second column) and dependent variable (third column).
x	matrix, containing regional index (first column), time index (second column) and regressors.
w1	matrix, the spatial weight matrix. If w2 and w3 are supplied, the spatial weight matrix for spatial lag.
th	data.frame, containing regional index (first column, numeric) and grouping indicator(second column, logical). The number of rows should be the same as the number of regions.
correction	logical, whether to use adjusted score function. Default value is TRUE.
max_try	integer, maximum attempt for the solver. Default value is 5.
all_er	logical, whether to output Hessian and Gamma matrix based se. Ignored if correction is set to FALSE. Default value is FALSE.

`true_range`	logical, whether to used the accurate stationary check. Default value is FALSE due to performance reasons.
`residual`	logical, whether to output the residual. Default value is FALSE.
`w3`	matrix, the spatial weight matrix for spatial error. Default value is the same as w1.
`w2`	matrix, the spatial weight matrix for spatio-temporal lag. Default value is the same as w1.
`no_tf`	logical, whether to account for time effect. Default value is TRUE.
`model`	character, indicates the model used for estimation, can be "full", "slm", "sem", "sltl". See Details.
`th_type`	character, "row" or "col". Indicates whether the threshold is applied to the columns or the rows of the weight matrix. Default value is "row".
`ini_val`	vector msdpd object. A length 4 vector of the initial values of lambda1, lambda2, lambda3, rho or an msdpd object that contain the non-threshold estimation result. If unsupplied msdpd() will be called.
`rcpp`	logical, whether to use the rcpp implementation to calculate the score function. Default value is TRUE.
`cma_pop_multi`	integer, multiplier for the population size used in CMA-ES. Default value is 1.

Details

Estimating threshold spatial dynamic panel data model with extended Yang(2018)'s M-estimator

$$y_{ti} = \mu_i + \alpha_t + x_{ti}\beta_q + \rho_q y_{t-1,i} + \lambda_{1q}\sum_{j=1}^{n} w_{1,ij}y_{tj} \qquad + \lambda_{2q}\sum_{j=1}^{n} w_{2,ij}y_{t-1,i} + u_{ti}, u_{ti} = \lambda_{3q}\sum_{j=1}^{n} w_{3,ij}u_{tj} + v_{ti}, i = 1, \ldots, n, t$$

The minimum number of time-periods is 4. Make sure the rows and columns of w1, w2, and w3 are lined up with the regional index. Sub-models can be specified by argument "model"

- "full" Full model
- "slm" $\lambda_{2q} = \lambda_{3q} = 0$
- "sem" $\lambda_{1q} = \lambda_{2q} = 0$
- "sltl" $\lambda_{3q} = 0$

Some suggestions when the optimizer fails:

- Increase max_try
- Increase cma_pop_multi
- try a different submodel

Value

A list of estimation results of S3 class "msdpdth"

- "coefficient" list, coefficients and standard errors
- "model" character, model used for estimation

- "vc_mat" matrix, variance-covariance matrix
- "hes_mat" matrix, optional, Hessian matrix
- "gamma_mat" matrix, optional, Gamma matrix
- "residual" numeric, optional, residuals

References

Wu, J and Matsuda, Y. (2021). A threshold extension of spatial dynamic panel model with fixed effects. Journal of Spatial Econometrics 2,3

Examples

```
data(data_th, data_w)
result <- msdpdth(y = data_th$y, x = data_th$x, w1 = data_w, th = data_th$th)
```

---

print.msdpd	*Print method for msdpd class*

Description

Print method for msdpd class

Usage

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

Arguments

x	msdpd class
...	other parameters

Details

Print method for msdpd class

Value

A data.frame containing the coefficients and the corresponding standard error.

Examples

```
data(data_n, data_nw)
result <- msdpd(y = data_n$y, x = data_n$x, w1 = data_nw)
result
```

---

print.msdpdth   *Print method for msdpdth class*

Description

Print method for msdpdth class

Usage

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

Arguments

x   msdpdth class

...   other parameters

Details

Print method for msdpdth class

Value

A data.frame containing the coefficients and the corresponding standard error.

Examples

```
data(data_th, data_w)
result <- msdpdth(y = data_th$y, x = data_th$x, w1 = data_w, th = data_th$th)
result
```

---

wald_test   *Wald test for threshold spatial dynamic panel data model*

Description

Wald test for threshold spatial dynamic panel data model

Usage

```
wald_test(th_res)
```

Arguments

th_res   msdpdth class, generated by function msdpdth()

Details

Two sided Wald test for testing whether two estimated parameters for each group are equal

- "h_0" $\theta_1 = \theta_2$
- "h_1" $\theta_1 \neq \theta_2$

Value

A list of p-values for each parameter.

Examples

```
data(data_th, data_w)
result <- msdpdth(y = data_th$y, x = data_th$x, w1 = data_w, th = data_th$th)
wald_test(result)
```

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