

Package ‘splm’

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Author Giovanni Millo <giovanni_millo@generali.com>, Gianfranco Piras <gpiras@mac.com>

Maintainer Giovanni Millo <giovanni_millo@generali.com>

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bsjkttest	<i>Baltagi, Song, Jung and Koh LM test for spatial panels</i>
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Description

Baltagi, Song, Jung and Koh joint or conditional LM test for spatial error correlation or serial correlation sub spatial, serial correlation and random effects in panel models

Usage

```
bsjkttest(x,...)
## S3 method for class 'formula'
bsjkttest(x, data, index=NULL, listw,
test=c("C.1","C.2","C.3","J"), ...)
```

Arguments

x	an object of class formula
data	a data.frame or pdata.frame containing the variables in the model
index	either NULL (default) or a character vector to identify the indexes among the columns of the data.frame
listw	either a matrix or a listw representing the spatial structure
test	one of c("C.1","C.2","C.3","J"), the test to be performed. "C.3" is not implemented yet.
...	additional arguments to be passed

Value

an object of class htest

Author(s)

Giovanni Millo

References

Baltagi, B.H., Song, S.H., Jung B. and Koh, W. (2007) Testing panel data regression models with spatial and serial error correlation. *Journal of Econometrics*, **140**, 5-51.

See Also

bsktest

Examples

```
data(Produc, package="Ecdat")
data(usaww)
fm <- log(gsp)~log(pcap)+log(pc)+log(emp)+unemp
bsjktest(fm, data=Produc, listw = usaww, test="C.1")
```

bsktest

Baltagi, Song and Koh LM test for spatial panels

Description

Baltagi, Song and Koh marginal or conditional LM test for spatial error correlation or random effects in panel models

Usage

```
bsktest(x,...)
## S3 method for class 'formula'
bsktest(x, data, index=NULL, listw,
test=c("LMH", "LM1", "LM2", "CLMlambda", "CLMmu"),
standardize=TRUE, ...)
```

Arguments

x	a formula
data	a data.frame or pdata.frame containing the variables in the model
index	either NULL (default) or a character vector to identify the indexes among the columns of the data.frame
listw	a listw representing the spatial structure
test	one of c("LMH", "LM1", "LM2", "CLMlambda", "CLMmu"), the test to be performed
standardize	whether to standardize the test statistic or not (applies only to LM1 and LM2)
...	additional arguments to be passed

Value

an object of class htest

Author(s)

Gianfranco Piras

References

Baltagi, B.H., Song, S.H. and Koh, W. (2003) Testing panel data regression models with spatial error correlation. *Journal of Econometrics*, **117**, 123–150.

Millo, G., Piras, G. (2012) splm: Spatial Panel Data Models in R. *Journal of Statistical Software*, **47(1)**, 1–38. URL <http://www.jstatsoft.org/v47/i01/>.

See Also

sphtest

Examples

```
data(Produc, package="Ecdat")
data(usaww)
fm <- log(gsp)~log(pcap)+log(pc)+log(emp)+unemp
bsktest(fm,data=Produc, listw = mat2listw(usaww),
        test="LM1", standardize=TRUE)
```

effects.splm

method for extracting fixed effects

Description

Methods used for extracting fixed effects from objects of class `splm` where `type` is one of "fixed effects lag" or "fixed effects error"

Usage

```
## S3 method for class 'splm'
effects(object,...)
```

Arguments

`object` an object of class 'splm'
`...` additional arguments to be passed over

Details

If the argument `object` is not of class `splm` the function will terminate with an error.

If the argument `object` is of class `splm` but `type` is not one of "fixed effects lag" or "fixed effects error", the function will terminate with an error.

Value

An object of class `effects.splm`

`res` a list whose elements are various type of fixed effects and the intercept (when present)

Author(s)

Gianfranco Piras

References

Elhorst, J.P. (2003) Specification and estimation of spatial panel data models, *International Regional Science Review*, **26**, pages 244–268.

Elhorst, J.P. (2009) Spatial panel data models, In Fischer, M.M. and Getis, A. (eds), *Handbook of Applied Spatial Analysis* Springer, Berlin.

See Also

`splm` `summary.effects.splm`

Examples

```
data(Produc, package = "Ecdat")
data(usaww)
fm <- log(gsp) ~ log(pcap) + log(pc) + log(emp) + unemp
err <- splm(fm, data = Produc, listw = mat2listw(usaww), model="within")
summary(err)
eff <- effects(err)
print(eff)
```

Insurance

Insurance consumption across Italian provinces, 1998-2002

Description

A panel of 103 observations
number of observations : 515
observation : provinces
country : Italy

Usage

```
data(Insurance)
```

Format

A dataframe containing :

code the province code according to Istat

year the year of observation

ppcd real per capita premiums in 2000 euros, non-life insurance excluding mandatory motor third-party liability

rgdp real per-capita GDP

bank real per-capita bank deposits

den population density per square Km

rirs real interest rate on lending to families and small enterprises

agen density of insurance agencies per 1000 inhabitants

school share of people with second grade schooling or more

vaagr share of value added, agriculture

fam average number of family members

inef judicial inefficiency index: average years to settle first degree of civil case

trust survey result to the question "do you trust others?"

dXX year dummies

NorthWest macroregional dummy

NorthEast macroregional dummy

Centre macroregional dummy

South macroregional dummy

Islands macroregional dummy (Sicily and Sardinia)

Author(s)

Giovanni Millo

Source

Giovanni Millo and Gaetano Carmeci, (2011) "Non-life insurance consumption in Italy: a sub-regional panel data analysis", *Journal of Geographical Systems*, **13:273–298**.

itaww	<i>Spatial weights matrix - Italian provinces</i>
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Description

Spatial weights matrix of the 103 Italian provinces as in 1992-2005.

Usage

```
data(itaww)
```

Format

A matrix with elements different from zero if province *i* and *j* are neighbors. Weights are row-standardized. Messina and Reggio Calabria, divided by the Messina Strait, are considered neighbours.

Author(s)

Giovanni Millo

listw2dgCMatrix	<i>Interface between Matrix class objects and weights list</i>
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Description

Interface between Matrix class objects and weights list

Usage

```
listw2dgCMatrix(listw, zero.policy = NULL)
```

Arguments

<code>listw</code>	a <code>listw</code> object created for example by <code>nb2listw</code>
<code>zero.policy</code>	See <code>lagsarlm</code> for details

Value

Matrix class object: a sparse Matrix

Author(s)

Gianfranco Piras

Examples

```
library(spdep)
data(columbus)
listw<-nb2listw(col.gal.nb)
spW<-listw2dgCMatrix(listw)
```

```
print.splm          print method for class splm
```

Description

Method to print objects of class `summary.splm` and `splm`

Usage

```
## S3 method for class 'splm'
print(x, digits = max(3,getOption("digits") -3), ...)
```

Arguments

<code>x</code>	an object of class <code>splm</code>
<code>digits</code>	minimal number of significant digits, see <code>print.default</code>
<code>...</code>	additional arguments to be passed

Details

The summary function `summary.splm` returns an objects of class 'splm' organized in a coefficient matrix.

Also a matrix for the error components, or the spatial coefficients will be generated depending on the estimated model.

Author(s)

Giovanni Millo, Gianfranco Piras

See Also

`spml`, `spgm`

Examples

```
data(Produc, package = "Ecdat")
data(usaww)
spremod<-spml(log(gsp)~log(pcap)+log(pc)+log(emp)+unemp, data=Produc,
listw = mat2listw(usaww), model="random", lag=TRUE, spatial.error="none")
summary(spremod)
```

RiceFarms

Production of Rice in Indonesia

Description

A panel of 171 observations

number of observations : 1026

observation : farms

country : Indonesia

Usage

`data(RiceFarms)`

Format

A dataframe containing :

id the farm identifier

size the total area cultivated with rice, measured in hectares

status land status, on of 'owner' (non sharecroppers, owner operators or leasholders or both), 'share' (sharecroppers), 'mixed' (mixed of the two previous status)

varieties one of 'trad' (traditional varieties), 'high' (high yielding varieties) and 'mixed' (mixed varieties)

bimas BIMAS is an intensification program ; one of 'no' (non-bimas famer), 'yes' (bimas farmer) or 'mixed' (part but not all of farmer's land was registered to be in the bimas program)

seed seed in kilogram

urea urea in kilogram

phosphate phosphate in kilogram

pesticide pesticide cost in Rupiah

pseed price of seed in Rupiah per kg

purea price of urea in Rupiah per kg

pphosph price of phosphate in Rupiah per kg

hiredlabor hired labor in hours

famlabor family labor in hours

totlabor total labor (excluding harvest labor)

wage labor wage in Rupiah per hour

goutput gross output of rice in kg

noutput net output, gross output minus harvesting cost (paid in terms of rice)

price price of rough rice in Rupiah per kg

region one of six regions

Author(s)

Yves Croissant

Source

Qu Feng and William C. Horrace, (2012) “Alternative Measures of Technical Efficiency: Skew, Bias and Scale”, *Journal of Applied Econometrics*, **forthcoming**.

 riceww

Spatial weights matrix of Indonesian rice farms

Description

Spatial weights matrix of the 171 farms in the Indonesian Rice Farming example. Farms in the same village (out of six) are considered contiguous.

Usage

data(riceww)

Format

A matrix with elements different from zero if farms i and j are neighbors. Farms are considered neighbors if in the same village. Weights are row-standardized.

Author(s)

Giovanni Millo, data provided by Yves Croissant

 spgm

GM estimation of spatial panel data models

Description

GM estimation of panel data models with spatially correlated errors components of the form:

$$y_N(t) = \lambda W y + X_N(t)\beta + u_N(t)$$

$$u_N(t) = \rho W_N u_N(t) + \epsilon(t)$$

$$\epsilon_N = (e_T \otimes I_N)\mu_N + \nu_N$$

where ρ , and the variance components σ_μ^2 and σ_ν^2 are estimated by GM, and the model coefficients by a feasible GLS estimator. The model can also include additional (other than the spatial lag) endogenous variables.

Usage

```
spgm(formula, data=list(), index=NULL, listw,
      model=c("within","random"), lag=FALSE, spatial.error=FALSE,
      moments = c("initial", "weights", "fullweights"), endog = NULL,
      instruments= NULL, verbose = FALSE,
      method = c("w2s1s", "b2s1s", "g2s1s", "ec2s1s"),
      control = list())
```

Arguments

formula	a description of the model to be fit. The details of model specification are given for <code>lm</code>
data	an object of class <code>data.frame</code> or <code>pdata.frame</code> . An optional data frame containing the variables in the model. When the object is a <code>data.frame</code> , the first two columns may contain the indexes. See <code>index</code>
index	if not <code>NULL</code> (default), a character vector to identify the indexes among the columns of the <code>data.frame</code>
listw	an object of class <code>listw</code> created for example by <code>nb2listw</code> . If a matrix is given as input the function will transform it using <code>mat2listw</code>
model	One of "within" or "random". The assumption made on the individual effects
lag	if <code>TRUE</code> a spatial lag of the dependent variable is added to the regression equation
spatial.error	a logic vector. If <code>TRUE</code> the spatial autoregressive error term is added to the model and an estimate for ρ is produced
moments	"initial" (default) defines the set of GM estimator to be used. Alternatives are "weights" and "fullweights" (See Details)
endog	default <code>NULL</code> . A string with the name of additional (other than the spatial lag) endogenous variables
instruments	default <code>NULL</code> . Either a matrix or a string with the name of the specific instruments for the additional endogenous variables
verbose	default <code>FALSE</code> , If <code>TRUE</code> reports function values during optimization
method	One of "w2s1s", "b2s1s", "g2s1s", "ec2s1s". (See Details)
control	a list of control parameters for the optimization

Details

The function is a very general interface to estimate various nested specifications of the general model including additional endogenous variables described above. When both `spatial.error` and `lag` are `FALSE` the model reduces to a panel data model with an additional endogeneous variable. The function then uses `ivsplm` to perform the Instrumental Variables and two-stage least squares for panel data model. `method = "w2s1s"` corresponds to the fixed effects estimator, `method = "b2s1s"` to the between effects model, `method = "g2s1s"` to the GLS random effects model, and `method = "ec2s1s"` to teh Baltagi's EC2SLS.

When `spatial.error` is `TRUE` and `lag` is `FALSE` the model is one with spatially autocorrelated error components. If effects is "random", the Kapoor et al. (2007) GM estimator is performed

and the residuals in the first step come from an OLS regression. When `moments` is "initial", the initial estimator is calculated. This first set of GM estimators is based only on a subset of the moments conditions and assigns equal weights to each of them. When `moments` is "fullweights", the second set of GM estimators is calculated. This estimator is based on the full set of moments conditions. It also involves the expression for the variance covariance matrix of the sample moments calculated under the assumption of normally distributed innovations. The calculation of the trace terms in the expression of the variance covariance matrix of the sample moments uses codes from the Matrix package. When `moments` is "weights", the third set of GM estimator is used. This is motivated by computational issues. The procedure is analogous to the second one but uses a simplified expression for the variance covariance matrix of the sample moments. If `effects` is "fixed", the initial estimator is a within estimator and the moments conditions of Kapoor et al. (2007) are modified accordingly.

Finally, when both `spatial.error` and `lag` are TRUE the complete model is estimated (with or without additional endogenous variables). OLS residuals are no longer consistent because of the spatially lagged dependent variable. If `effects` is "random", two initial estimators are computed: a within two-stage least squares and a between two stage least squares. The two sets of corresponding residuals are used in the spatial generalized moments estimator (GM) where the moments conditions of Kapoor et al. (2007) are again modified accordingly. If `effects` is "fixed", the initial estimator is a within two stage least squares estimator and the moments conditions of Kapoor et al. (2007) are modified accordingly.

Note that for the random effects models, σ_{μ}^2 is not reported. σ_1^2 is reported instead. However, a value for σ_{μ}^2 can easily be obtained from:

$$\sigma_1^2 = \sigma_{\nu}^2 + T\sigma_{\mu}^2$$

The function also produces an estimate for θ which is a function of the variance components.

Value

An object of class "splm".

<code>coefficients</code>	GLS coefficients estimate of the model parameters
<code>vcov</code>	the variance covariance matrix of the estimated coefficients
<code>residuals</code>	the GLS residuals
<code>fitted.values</code>	difference between response variable and residuals
<code>sigma2</code>	GLS residuals variance
<code>type</code>	'random effect GM'
<code>rho</code>	a vector including the spatial parameter and the variance components (see Details)
<code>model</code>	the matrix of the data used
<code>call</code>	the call used to create the object

Author(s)

Gianfranco Piras

References

- Kapoor, M., Kelejian, H.H. and Prucha, I.R. (2007) Panel data model with spatially correlated error components, *Journal of Econometrics*, **140**, pages 97–130.
- Mutl, J., and Pfaffermayr, M. (2011) The Hausman test in a Cliff and Ord panel model, *Econometrics Journal*, **14**, pages 48–76.
- Kelejian, H.H. and Prucha, I.R. (1999) A Generalized Moments Estimator for the Autoregressive Parameter in a Spatial Model, *International Economic Review*, **40**, pages 509–533.
- Kelejian, H.H. and Prucha, I.R. (1999) A Generalized Spatial Two Stage Least Square Procedure for Estimating a Spatial Autoregressive Model with Autoregressive Disturbances, *Journal of Real Estate Finance and Economics*, **17**, pages 99–121.
- Millo, G., Piras, G. (2012) splm: Spatial Panel Data Models in R. *Journal of Statistical Software*, **47(1)**, 1–38. URL <http://www.jstatsoft.org/v47/i01/>.

Examples

```
data(Produc, package = "Ecdat")
data(usaww)
GM <- spgm(log(gsp)~log(pcap)+log(pc)+log(emp)+unemp, data=Produc,
           listw = usaww, moments="fullweights", spatial.error = TRUE)
summary(GM)
```

sphtest

Hausman test for spatial panel data models

Description

Hausman specification test for spatial panel data models

Usage

```
sphtest(x, ...)
## S3 method for class 'formula'
sphtest(x, data, index = NULL, listw,
        spatial.model = c("lag", "error", "sasar"),
        method = c("ML", "GM"), errors = c("KKP", "BSK"),...)
## S3 method for class 'splm'
sphtest(x, x2, ...)
```

Arguments

- | | |
|------|---|
| x | an object of class formula or splm |
| x2 | an object of class splm |
| data | an object of class data.frame or pdata.frame. An optional data frame containing the variables in the model. When the object is a data.frame, the first two columns may contain the indexes. See index |

index	if not NULL (default), a character vector to identify the indexes among the columns of the data.frame
listw	an object of class listw created for example by nb2listw
spatial.model	one of c("lag", "error", "sarar"), the model to be estimated (only lag, only error, both lag and error dependence)
method	one of c("ML", "GM")
errors	one of c("BSK", "KPP"). When method is "ML" defines the specification of the innovations
...	additional arguments to be passed

Value

an object of class htest

Author(s)

Gianfranco Piras

References

Millo, G., Piras, G. (2012) splm: Spatial Panel Data Models in R. *Journal of Statistical Software*, **47(1)**, 1–38. URL <http://www.jstatsoft.org/v47/i01/>.

See Also

spgm

Examples

```
data(Produc, package="Ecdat")
data(usaww)
fm <- log(gsp)~log(pcap)+log(pc)+log(emp)+unemp
test1<-sphtest(fm,data=Produc, listw = mat2listw(usaww),
              spatial.model = "error", method="GM")
test1
mod1<- spgm(fm, data=Produc, listw = usaww, model = "random",
            spatial.error = TRUE, moments="fullweights")
mod2<- spgm(fm, data=Produc, listw = usaww, model = "within",
            spatial.error = TRUE)
test2<-sphtest(mod1, mod2)
test2
```

spml

*Spatial Panel Model by Maximum Likelihood***Description**

Maximum likelihood (ML) estimation of spatial panel models, possibly with fixed or random effects.

Usage

```
spml(formula, data, index=NULL, listw, listw2=listw, na.action,
      model=c("within", "random", "pooling"),
      effect=c("individual", "time", "twoways"),
      lag=FALSE, spatial.error=c("b", "kkp", "none"),
      ...)
```

Arguments

formula	a symbolic description of the model to be estimated
data	an object of class <code>data.frame</code> or <code>pdata.frame</code> . A data frame containing the variables in the model. When the object is a <code>data.frame</code> , the first two columns shall contain the indexes, unless otherwise specified. See <code>index</code>
index	if not <code>NULL</code> (default), a character vector to identify the indexes among the columns of the <code>data.frame</code>
listw	an object of class <code>listw</code> or a matrix. It represents the spatial weights to be used in estimation.
listw2	an object of class <code>listw</code> or a matrix. Second of set spatial weights for estimation, if different from the first (e.g., in a 'sarar' model).
na.action	see spdep for more details.
model	one of <code>c("within", "random", "pooling")</code> .
effect	one of <code>c("individual", "time", "twoways")</code> ; the effects introduced in the model.
lag	default= <code>FALSE</code> . If <code>TRUE</code> , a spatial lag of the dependent variable is added.
spatial.error	one of <code>c("b", "kkp", "none")</code> . The type of spatial error in the specification, if any. See details.
...	additional argument to pass over to other functions

Details

The models are estimated by two-step Maximum Likelihood. Further optional parameters to be passed on to the estimator may be: `pvar`: if `TRUE` the `pvar` function is called `hess`: if `TRUE` use numerical Hessian instead of GLS for the standard errors of the estimates `quiet`: if `FALSE` report function and parameters values during optimization `initval`: one of `c("zeros", "estimate")`, the initial values for the parameters. If `"zeros"` a vector of zeros is used. if `"estimate"` the initial

values are retrieved from the estimation of the nested specifications. Alternatively, a numeric vector can be specified. `x.tol`: Tolerance. See `nlminb` for details. `rel.tol`: Relative tolerance. See `nlminb` for details.

Value

An object of class "sp1m".

<code>coefficients</code>	coefficients estimate of the model parameters
<code>arcoef</code>	the coefficient for the spatial lag on y
<code>errcomp</code>	the estimates of the error variance components
<code>vcov</code>	the asymptotic variance covariance matrix of the estimated coefficients
<code>vcov.arcoef</code>	the asymptotic variance of the estimated spatial lag parameter
<code>vcov.errcomp</code>	the asymptotic variance covariance matrix of the estimated error covariance parameters
<code>type</code>	'random effects ML'
<code>residuals</code>	the model residuals
<code>fitted.values</code>	the fitted values, calculated as $\hat{y} = X\hat{\beta}$
<code>sigma2</code>	GLS residuals variance
<code>model</code>	the matrix of the data used
<code>call</code>	the call used to create the object
<code>logLik</code>	the value of the log likelihood function at the optimum
<code>errors</code>	the value of the errors argument

Author(s)

Giovanni Millo

References

Baltagi, B.H., Song, S.H., Jung B. and Koh, W. (2007) Testing panel data regression models with spatial and serial error correlation. *Journal of Econometrics*, **140**, 5-51.

Millo, G., Piras, G. (2012) sp1m: Spatial Panel Data Models in R. *Journal of Statistical Software*, **47(1)**, 1-38. URL <http://www.jstatsoft.org/v47/i01/>.

See Also

`spgm`

Examples

```

data(Produc, package = "Ecdat")
data(usaww)
fm <- log(gsp) ~ log(pcap) + log(pc) + log(emp) + unemp
## the two standard specifications (SEM and SAR) one with FE
## and the other with RE:
## fixed effects panel with spatial errors
fespaterr <- spml(fm, data = Produc, listw = mat2listw(usaww),
                 model="within", spatial.error="b", Hess = FALSE)
summary(fespaterr)
## random effects panel with spatial lag
respatlag <- spml(fm, data = Produc, listw = mat2listw(usaww),
                 model="random", spatial.error="none", lag=TRUE)
summary(respatlag)

```

spreml

*Spatial Panel Model with Random Effects by Maximum Likelihood***Description**

Maximum likelihood (ML) estimation of spatial panel models with random effects and serial error correlation.

Usage

```

spreml(formula, data, index = NULL, w, w2=w, lag = FALSE,
       errors = c("semsrre", "semsr", "srre", "semre",
                 "re", "sr", "sem", "ols", "sem2srre", "sem2re"),
       pvar = FALSE, hess = FALSE, quiet = TRUE,
       initval = c("zeros", "estimate"),
       x.tol = 1.5e-18, rel.tol = 1e-15, ...)

```

Arguments

formula	a symbolic description of the model to be estimated
data	an object of class <code>data.frame</code> or <code>pdata.frame</code> . A data frame containing the variables in the model. When the object is a <code>data.frame</code> , the first two columns shall contain the indexes, unless otherwise specified. See <code>index</code>
index	if not <code>NULL</code> (default), a character vector to identify the indexes among the columns of the <code>data.frame</code>
w	an object of class <code>listw</code> or a <code>matrix</code> . It represents the spatial weights to be used in estimation.
w2	an object of class <code>listw</code> or a <code>matrix</code> . Second set of spatial weights for estimation, if different from the first (e.g., in a 'sarar' model).
lag	default= <code>FALSE</code> . If <code>TRUE</code> , a spatial lag of the dependent variable is added.
errors	Specifies the error covariance structure. See details.

pvar	legacy parameter here only for compatibility.
hess	default=FALSE. If TRUE estimate the covariance for beta_hat by numerical Hessian instead of GLS at optimal values.
quiet	default=TRUE. If FALSE, report function and parameters values during optimization.
initval	one of c("zeros", "estimate"), the initial values for the parameters. If "zeros" a vector of zeros is used. if "estimate" the initial values are retrieved from the estimation of the nested specifications. Alternatively, a numeric vector can be specified.
x.tol	control parameter for tolerance. See nlmminb for details.
rel.tol	control parameter for relative tolerance. See nlmminb for details.
...	additional arguments to pass over to other functions, e.g. method.

Details

Second-level wrapper for estimation of random effects models with serial and spatial correlation. The specifications without serial correlation (no "sr" in errors) can be called through spml, the extended ones only through spreml. The models are estimated by two-step Maximum Likelihood. Abbreviations in errors correspond to: "sem" Anselin-Baltagi type spatial autoregressive error: if present, random effects are not spatially correlated; "sem2" Kapoor, Kelejian and Prucha-type spatial autoregressive error model with spatially correlated random effects; "sr" serially correlated remainder errors; "re" random effects; "ols" spherical errors (usually combined with lag=T). The optimization method can be passed on as optional parameter. Default is "nlminb"; all constrained optimization methods from maxLik are allowed ("BFGS", "NM", "SANN") but the latter two are still experimental.

Value

An object of class "sp1m".

coefficients	coefficients estimate of the model parameters
arcoef	the coefficient for the spatial lag on y
errcomp	the estimates of the error variance components
vcov	the asymptotic variance covariance matrix of the estimated coefficients
vcov.arcoef	the asymptotic variance of the estimated spatial lag parameter
vcov.errcomp	the asymptotic variance covariance matrix of the estimated error covariance parameters
type	'random effects ML'
residuals	the model residuals
fitted.values	the fitted values, calculated as $\hat{y} = X\hat{\beta}$
sigma2	GLS residuals variance
model	the matrix of the data used
call	the call used to create the object
logLik	the value of the log likelihood function at the optimum
errors	the value of the errors argument

Author(s)

Giovanni Millo

References

Millo, G. (2013) Maximum likelihood estimation of spatially and serially correlated panels with random effects. *Computational Statistics and Data Analysis*, **forthcoming**.

See Also

splm

Examples

```
data(Produc, package = "Ecdat")
data(usaww)
fm <- log(gsp) ~ log(pcap) + log(pc) + log(emp) + unemp
## random effects panel with spatial lag and serial error correlation
## optimization method set to "BFGS"
sarsrmod <- sprem1(fm, data = Produc, w = usaww, errors="sr", lag=TRUE,
                  method="BFGS")
summary(sarsrmod)
```

summary.splm

*summary method for class splm***Description**

Method for summarizing the results of objects of class 'splm'

Usage

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

Arguments

```
object      an object of class 'splm'
...         additional arguments to be passed
```

Details

The summary function `summary.splm` returns an objects of class 'splm' organized in a coefficient matrix.

Also a matrix for the error components, or the spatial coefficients will be generated depending on the estimated model.

When the 'splm' is produced by the function 'spsegm', the summary will be generated looping over the number of equations in the system.

Value

An object of class 'summary.splm'

Author(s)

Giovanni Millo, Gianfranco Piras

See Also

spl, spgm

Examples

```
data(Produc, package = "Ecdat")
data(usaww)
GM <- spgm(log(gsp)~log(pcap)+log(pc)+log(emp)+unemp, data=Produc,
           listw=usaww, moments = "fullweights", spatial.error = TRUE)
summary(GM)
```

usaww

Spatial weights matrix - US states

Description

Spatial weights matrix of the 48 continental US States based on the queen contiguity criterium.

Usage

```
data(usaww)
```

Format

A matrix with elements different from zero if state *i* and *j* are neighbors. Weights are row standardized. According to the queen contiguity criterium, Arizona and Colorado are considered neighbours.

Author(s)

Giovanni Millo

`vcov.splm`*Covariance extractor method for splm objects*

Description

Covariance extractor method for `splm` objects. Seldom used as such but needed, e.g., for interoperability with testing functions in `lmtest` and `car`.

Usage

```
## S3 method for class 'splm'  
vcov(object, ...)
```

Arguments

<code>object</code>	an object of class <code>splm</code>
<code>...</code>	additional arguments to be passed; currently not used

Value

a covariance matrix of beta coefficients

Author(s)

Giovanni Millo

References

Zeileis, A. (2006) Object-Oriented Computation of Sandwich Estimators. *Journal of Statistical Software*, **16(9)**, 1-16.

Examples

```
data(Produc, package="Ecdat")  
data(usaww)  
fm <- log(gsp)~log(pcap)+log(pc)+log(emp)+unemp  
sarremod <- spml(fm, data=Produc, listw = mat2listw(usaww),  
  model="random", lag=TRUE, spatial.error="none")  
## compact representation of betas  
library(lmtest)  
coefest(sarremod)  
## linear hypothesis test  
library(car)  
lht(sarremod, "log(pcap)=log(pc)")
```

write.effects.splm *method for writing a table with fixed effects*

Description

Methods used for writing fixed effects to filename

Usage

```
## S3 method for class 'effects.splm'  
write(x, file = "effects",  
      ncolumns = if (is.character(x)) 1 else 5,  
      append = FALSE, sep = ",")
```

Arguments

x	an object of class 'effects.splm'
file	name of the file, default set to "effects"
ncolumns	the number of columns to write the data in
append	if TRUE the data are appended to the connection
sep	string to separate columns; default is = ","

Details

If the argument object is not of class effects.splm the function will terminate with an error message.

Author(s)

Gianfranco Piras

References

Elhorst, J.P. (2003) Specification and estimation of spatial panel data models, *International Regional Science Review*, **26**, pages 244–268.

Elhorst, J.P. (2009) Spatial panel data models, *In* Fischer, M.M. and Getis, A. (eds), *Handbook of Applied Spatial Analysis* Springer, Berlin.

See Also

splm

Examples

```
## not run
## data(Produc, package = "Ecdat")
## data(usaww)
## fm <- log(gsp) ~ log(pcap) + log(pc) + log(emp) + unemp
## err <- spml(fm, data = Produc, listw = mat2listw(usaww),
## model="within", effect="time", spatial.error="b",
## method="eigen", Hess= FALSE)
## summary(err)
## eff <- effects(err)
## write.effects.splm(eff)
```

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