```
 #Testes Lagrange multiplier
>
> LM1=bsktest(x=fm,data=vcultperm,listw=weigthmatrix,test="LM1")
> LM1

        Baltagi, Song and Koh SLM1 marginal test

data:  Y ~ X
SLM1 = 0.024931, p-value = 0.9801
alternative hypothesis: Random effects


>
> LM2=bsktest(x=fm,data=vcultperm,listw=weigthmatrix,test="LM2")
> LM2

        Baltagi, Song and Koh LM2 marginal test

data:  Y ~ X
SLM2 = -1.7687e-05, p-value = 1
alternative hypothesis: Spatial autocorrelation


>
> LMH=bsktest(x=fm,data=vcultperm,listw=weigthmatrix,test="LMH")
> LMH

        Baltagi, Song and Koh LM-H one-sided joint test

data:  Y ~ X
LM-H = 55756, p-value < 2.2e-16
alternative hypothesis: Random Regional Effects and Spatial
autocorrelation


>
>
CLMlambda=bsktest(x=fm,data=vcultperm,listw=weigthmatrix,test="CLMlambda
")
> CLMlambda

        Baltagi, Song and Koh LM*-lambda conditional LM test (assuming
sigma^2_mu >= 0)

data:  Y ~ X
LM*-lambda = 5.5212, p-value = 3.368e-08
alternative hypothesis: Spatial autocorrelation


>
> ##################
> #Efeitos fixos e aleatórios não espacial + teste de hausmann
> fe=plm(formula=fm,data=vcultperm,model="within")
series TesteNA is constant and has been removed
> summary(fe)
Oneway (individual) effect Within Model

Call:
plm(formula = fm, data = vcultperm, model = "within")

Balanced Panel: n=486, T=20, N=9720
```

```
Residuals :
   Min. 1st Qu.  Median 3rd Qu.    Max.
-5.0600 -0.3200  0.0381  0.3720  4.7700

Coefficients :
                        Estimate  Std. Error t-value  Pr(>|t|)
XTemperatura.Media      0.11478836  0.01544097  7.4340 1.147e-13 ***
XTemperatura.Media.sd. -0.27793367  0.03596237 -7.7285 1.202e-14 ***
Xentre0e1              -0.00357392  0.00087957 -4.0633 4.879e-05 ***
Xmaisde25mm            -0.01208559  0.00188702 -6.4046 1.581e-10 ***
XAno                    0.01769349  0.00122955 14.3903 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares:    4650.5
Residual Sum of Squares: 4426.9
R-Squared:        0.048076
Adj. R-Squared: 0.045647
F-statistic: 93.2199 on 5 and 9229 DF, p-value: < 2.22e-16
>
> re=plm(formula=fm,data=vcultperm,model="random")
series TesteNA is constant and has been removed
> summary(re)
Oneway (individual) effect Random Effect Model
   (Swamy-Arora's transformation)

Call:
plm(formula = fm, data = vcultperm, model = "random")

Balanced Panel: n=486, T=20, N=9720

Effects:
               var std.dev share
idiosyncratic 0.4807  0.6933 0.215
individual    1.7518  1.3236 0.785
theta:  0.8837

Residuals :
   Min. 1st Qu.  Median 3rd Qu.    Max.
-5.0600 -0.3290  0.0593  0.4010  4.6000

Coefficients :
                          Estimate  Std. Error t-value   Pr(>|t|)
(Intercept)               7.49389277  0.41824124 17.9176 < 2.2e-16 ***
XTemperatura.Media        0.10886260  0.01531991  7.1060 1.279e-12 ***
XTemperatura.Media.sd.   -0.28561136  0.03596935 -7.9404 2.239e-15 ***
Xentre0e1                -0.00360822  0.00087474 -4.1249 3.740e-05 ***
Xmaisde25mm              -0.01217724  0.00188575 -6.4575 1.116e-10 ***
Xvcultperm.Codigobacia1  -1.45741810  0.79616927 -1.8305 0.0672002 .
Xvcultperm.Codigobacia10 -0.36529162  0.38195079 -0.9564 0.3389021
Xvcultperm.Codigobacia11  0.73530882  0.39083294  1.8814 0.0599490 .
Xvcultperm.Codigobacia12  0.54273813  0.45218938  1.2002 0.2300735
Xvcultperm.Codigobacia13  0.22206005  0.31735707  0.6997 0.4841210
Xvcultperm.Codigobacia14  0.42178803  0.31197485  1.3520 0.1764089
Xvcultperm.Codigobacia15  0.13287853  0.27160201  0.4892 0.6246830
Xvcultperm.Codigobacia16  0.48816093  0.33293189  1.4662 0.1426130
Xvcultperm.Codigobacia17 -0.94059505  0.30403120 -3.0937 0.0019821 **
```

```
Xvcultperm.Codigobacia18 -0.46302122  0.34394630 -1.3462 0.1782688
Xvcultperm.Codigobacia19 -1.30901445  0.30289392 -4.3217 1.564e-05 ***
Xvcultperm.Codigobacia2  -2.49425993  0.38194508 -6.5304 6.888e-11 ***
Xvcultperm.Codigobacia20 -1.11243436  0.32990470 -3.3720 0.0007492 ***
Xvcultperm.Codigobacia21 -1.42940439  0.35743286 -3.9991 6.406e-05 ***
Xvcultperm.Codigobacia22 -2.81102013  0.42411523 -6.6280 3.585e-11 ***
Xvcultperm.Codigobacia4   0.27974516  0.34966947  0.8000 0.4237145
Xvcultperm.Codigobacia6   0.39753285  0.79598819  0.4994 0.6174945
Xvcultperm.Codigobacia7   1.05206051  0.96422797  1.0911 0.2752599
Xvcultperm.Codigobacia8  -0.12524089  0.38279732 -0.3272 0.7435442
Xvcultperm.Codigobacia9   0.56379343  0.31418233  1.7945 0.0727680 .
XAno                      0.01770183  0.00123104 14.3796 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares:    4988
Residual Sum of Squares: 4662.5
R-Squared:       0.065261
Adj. R-Squared: 0.065087
F-statistic: 27.0724 on 25 and 9694 DF, p-value: < 2.22e-16
>
> phtest(re, fe)

        Hausman Test

data:  fm
chisq = 52.629, df = 5, p-value = 4.008e-10
alternative hypothesis: one model is inconsistent

>
>
> #Modelos espaciais de efeitos fixo e efeitos aleatórios sem erro
espacial e
> #sem lag +  teste de hausman
> fe=spgm(formula=fm,data=vcultperm,index=NULL,listw=weigthmatrix,
model="within")
> summary(fe)
Spatial panel fixed effects GM model

Call:
spgm(formula = fm, data = vcultperm, index = NULL, listw = weigthmatrix,
    model = "within")

Residuals:
   Min. 1st Qu.  Median 3rd Qu.     Max.
 -6.450  -0.894   0.153   1.020    3.890

Estimated spatial coefficient, variance components and theta:
          Estimate
rho        0.14279
sigma^2_v  2.23902

Coefficients:
                         Estimate Std. Error  t-value  Pr(>|t|)
XTemperatura.Media      -0.0723069  0.0217504  -3.3244 0.0008861 ***
XTemperatura.Media.sd.  -0.7508498  0.0718936 -10.4439 < 2.2e-16 ***
Xentre0e1               -0.0049320  0.0013559  -3.6376 0.0002752 ***
```

```
Xmaisde25mm               -0.0118290  0.0036935  -3.2027 0.0013617 **
Xvcultperm.Codigobacia1   -1.5216544  0.2036243  -7.4729 7.847e-14 ***
Xvcultperm.Codigobacia10  -0.2945296  0.0964047  -3.0551 0.0022496 **
Xvcultperm.Codigobacia11   0.7548545  0.1031099   7.3209 2.464e-13 ***
Xvcultperm.Codigobacia12   0.6931431  0.1282620   5.4041 6.513e-08 ***
Xvcultperm.Codigobacia13   0.2771584  0.0829050   3.3431 0.0008285 ***
Xvcultperm.Codigobacia14   0.4592513  0.0850067   5.4025 6.571e-08 ***
Xvcultperm.Codigobacia15   0.5794795  0.0963785   6.0125 1.826e-09 ***
Xvcultperm.Codigobacia16   0.7647413  0.0969434   7.8885 3.058e-15 ***
Xvcultperm.Codigobacia17  -0.7530463  0.0821596  -9.1657 < 2.2e-16 ***
Xvcultperm.Codigobacia18  -0.0036167  0.1160199  -0.0312 0.9751316
Xvcultperm.Codigobacia19  -0.8436531  0.1031037  -8.1826 2.779e-16 ***
Xvcultperm.Codigobacia2   -2.5659185  0.0976646 -26.2728 < 2.2e-16 ***
Xvcultperm.Codigobacia20  -0.6259470  0.1021967  -6.1249 9.073e-10 ***
Xvcultperm.Codigobacia21  -0.9707000  0.1105735  -8.7788 < 2.2e-16 ***
Xvcultperm.Codigobacia22  -2.1706113  0.1250347 -17.3601 < 2.2e-16 ***
Xvcultperm.Codigobacia4    0.1906753  0.0925958   2.0592 0.0394731 *
Xvcultperm.Codigobacia6    0.7036946  0.2000002   3.5185 0.0004340 ***
Xvcultperm.Codigobacia7    1.1514421  0.2425212   4.7478 2.056e-06 ***
Xvcultperm.Codigobacia8   -0.3422949  0.1078447  -3.1740 0.0015037 **
Xvcultperm.Codigobacia9    0.4684814  0.0807729   5.8000 6.632e-09 ***
XAno                       0.0175852  0.0025829   6.8083 9.874e-12 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

>
> re=spgm(formula=fm,data=vcultperm,index=NULL,listw=weigthmatrix,
model="random")
> summary(re)
Spatial panel random effects GM model

Call:
spgm(formula = fm, data = vcultperm, index = NULL, listw = weigthmatrix,
    model = "random")

Residuals:
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-6.6300 -0.9040  0.1750 -0.0007  1.0600  3.9600

Estimated spatial coefficient, variance components and theta:
         Estimate
rho       0.14354
sigma^2_v 2.24083
sigma^2_1 1.67102
theta    -0.15801

Coefficients:
                          Estimate Std. Error  t-value  Pr(>|t|)
(Intercept)              12.6832748  0.5529148  22.9389 < 2.2e-16 ***
XTemperatura.Media       -0.0718921  0.0216408  -3.3221 0.0008935 ***
XTemperatura.Media.sd.   -0.7460967  0.0714988 -10.4351 < 2.2e-16 ***
Xentre0e1                -0.0039136  0.0013504  -2.8981 0.0037538 **
Xmaisde25mm              -0.0113074  0.0036955  -3.0597 0.0022153 **
Xvcultperm.Codigobacia1  -1.5033788  0.2020926  -7.4391 1.014e-13 ***
Xvcultperm.Codigobacia10 -0.2871518  0.0965246  -2.9749 0.0029308 **
Xvcultperm.Codigobacia11  0.7879617  0.1020855   7.7186 1.176e-14 ***
Xvcultperm.Codigobacia12  0.9270362  0.1270814   7.2948 2.991e-13 ***
```

```
Xvcultperm.Codigobacia13  0.3101363  0.0815666   3.8022 0.0001434 ***
Xvcultperm.Codigobacia14  0.4383659  0.0854674   5.1290 2.912e-07 ***
Xvcultperm.Codigobacia15  0.5756389  0.0963487   5.9745 2.307e-09 ***
Xvcultperm.Codigobacia16  0.8440542  0.0967834   8.7211 < 2.2e-16 ***
Xvcultperm.Codigobacia17 -0.6578638  0.0811376  -8.1080 5.146e-16 ***
Xvcultperm.Codigobacia18  0.1322243  0.1145823   1.1540 0.2485133
Xvcultperm.Codigobacia19 -0.7780280  0.1021321  -7.6179 2.579e-14 ***
Xvcultperm.Codigobacia2  -2.4844695  0.0961852 -25.8301 < 2.2e-16 ***
Xvcultperm.Codigobacia20 -0.5582003  0.1015336  -5.4977 3.848e-08 ***
Xvcultperm.Codigobacia21 -0.8209858  0.1084455  -7.5705 3.718e-14 ***
Xvcultperm.Codigobacia22 -2.1973925  0.1236297 -17.7740 < 2.2e-16 ***
Xvcultperm.Codigobacia4   0.2239786  0.0907810   2.4672 0.0136158 *
Xvcultperm.Codigobacia6   0.5032772  0.1995929   2.5215 0.0116850 *
Xvcultperm.Codigobacia7   1.0479358  0.2417850   4.3342 1.463e-05 ***
Xvcultperm.Codigobacia8  -0.1952497  0.1069124  -1.8263 0.0678113 .
Xvcultperm.Codigobacia9   0.4946624  0.0799519   6.1870 6.132e-10 ***
XAno                      0.0180411  0.0026336   6.8502 7.373e-12 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

>
> sphtest(x = re, x2 = fe)

        Hausman test for spatial models

data:  fm
chisq = 907.88, df = 25, p-value < 2.2e-16
alternative hypothesis: one model is inconsistent

>
>
> #Modelos espaciais de efeitos fixo e efeitos aleatórios com erro
espacial e
> #sem lag +  teste de hausman
>
> fe=spgm(formula=fm,data=vcultperm,index=NULL,listw=weigthmatrix,
model="within",spatial.error = T,lag=F)
> summary(fe)
Spatial panel fixed effects GM model

Call:
spgm(formula = fm, data = vcultperm, index = NULL, listw = weigthmatrix,
    model = "within", lag = F, spatial.error = T)

Residuals:
   Min. 1st Qu.  Median 3rd Qu.    Max.
 -6.450  -0.894   0.153   1.020   3.890

Estimated spatial coefficient, variance components and theta:
         Estimate
rho       0.14279
sigma^2_v 2.23902

Coefficients:
                     Estimate Std. Error  t-value  Pr(>|t|)
XTemperatura.Media    -0.0723069  0.0217504  -3.3244 0.0008861 ***
XTemperatura.Media.sd. -0.7508498  0.0718936 -10.4439 < 2.2e-16 ***
```

```
Xentre0e1                 -0.0049320  0.0013559   -3.6376 0.0002752 ***
Xmaisde25mm               -0.0118290  0.0036935   -3.2027 0.0013617 **
Xvcultperm.Codigobacia1   -1.5216544  0.2036243   -7.4729 7.847e-14 ***
Xvcultperm.Codigobacia10  -0.2945296  0.0964047   -3.0551 0.0022496 **
Xvcultperm.Codigobacia11   0.7548545  0.1031099    7.3209 2.464e-13 ***
Xvcultperm.Codigobacia12   0.6931431  0.1282620    5.4041 6.513e-08 ***
Xvcultperm.Codigobacia13   0.2771584  0.0829050    3.3431 0.0008285 ***
Xvcultperm.Codigobacia14   0.4592513  0.0850067    5.4025 6.571e-08 ***
Xvcultperm.Codigobacia15   0.5794795  0.0963785    6.0125 1.826e-09 ***
Xvcultperm.Codigobacia16   0.7647413  0.0969434    7.8885 3.058e-15 ***
Xvcultperm.Codigobacia17  -0.7530463  0.0821596   -9.1657 < 2.2e-16 ***
Xvcultperm.Codigobacia18  -0.0036167  0.1160199   -0.0312 0.9751316
Xvcultperm.Codigobacia19  -0.8436531  0.1031037   -8.1826 2.779e-16 ***
Xvcultperm.Codigobacia2   -2.5659185  0.0976646  -26.2728 < 2.2e-16 ***
Xvcultperm.Codigobacia20  -0.6259470  0.1021967   -6.1249 9.073e-10 ***
Xvcultperm.Codigobacia21  -0.9707000  0.1105735   -8.7788 < 2.2e-16 ***
Xvcultperm.Codigobacia22  -2.1706113  0.1250347  -17.3601 < 2.2e-16 ***
Xvcultperm.Codigobacia4    0.1906753  0.0925958    2.0592 0.0394731 *
Xvcultperm.Codigobacia6    0.7036946  0.2000002    3.5185 0.0004340 ***
Xvcultperm.Codigobacia7    1.1514421  0.2425212    4.7478 2.056e-06 ***
Xvcultperm.Codigobacia8   -0.3422949  0.1078447   -3.1740 0.0015037 **
Xvcultperm.Codigobacia9    0.4684814  0.0807729    5.8000 6.632e-09 ***
XAno                       0.0175852  0.0025829    6.8083 9.874e-12 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

>
> re=spgm(formula=fm,data=vcultperm,index=NULL,listw=weigthmatrix,
model="random",spatial.error = T,lag=F)
> summary(re)
Spatial panel random effects GM model

Call:
spgm(formula = fm, data = vcultperm, index = NULL, listw = weigthmatrix,
    model = "random", lag = F, spatial.error = T)

Residuals:
   Min. 1st Qu.  Median    Mean 3rd Qu.     Max.
-6.6300 -0.9040  0.1750 -0.0007  1.0600   3.9600

Estimated spatial coefficient, variance components and theta:
         Estimate
rho       0.14354
sigma^2_v 2.24083
sigma^2_1 1.67102
theta    -0.15801

Coefficients:
                          Estimate Std. Error  t-value  Pr(>|t|)
(Intercept)             12.6832748  0.5529148  22.9389 < 2.2e-16 ***
XTemperatura.Media      -0.0718921  0.0216408   -3.3221 0.0008935 ***
XTemperatura.Media.sd.  -0.7460967  0.0714988  -10.4351 < 2.2e-16 ***
Xentre0e1               -0.0039136  0.0013504   -2.8981 0.0037538 **
Xmaisde25mm             -0.0113074  0.0036955   -3.0597 0.0022153 **
Xvcultperm.Codigobacia1 -1.5033788  0.2020926   -7.4391 1.014e-13 ***
Xvcultperm.Codigobacia10 -0.2871518 0.0965246   -2.9749 0.0029308 **
Xvcultperm.Codigobacia11  0.7879617 0.1020855    7.7186 1.176e-14 ***
```

```
Xvcultperm.Codigobacia12  0.9270362  0.1270814   7.2948 2.991e-13 ***
Xvcultperm.Codigobacia13  0.3101363  0.0815666   3.8022 0.0001434 ***
Xvcultperm.Codigobacia14  0.4383659  0.0854674   5.1290 2.912e-07 ***
Xvcultperm.Codigobacia15  0.5756389  0.0963487   5.9745 2.307e-09 ***
Xvcultperm.Codigobacia16  0.8440542  0.0967834   8.7211 < 2.2e-16 ***
Xvcultperm.Codigobacia17 -0.6578638  0.0811376  -8.1080 5.146e-16 ***
Xvcultperm.Codigobacia18  0.1322243  0.1145823   1.1540 0.2485133
Xvcultperm.Codigobacia19 -0.7780280  0.1021321  -7.6179 2.579e-14 ***
Xvcultperm.Codigobacia2  -2.4844695  0.0961852 -25.8301 < 2.2e-16 ***
Xvcultperm.Codigobacia20 -0.5582003  0.1015336  -5.4977 3.848e-08 ***
Xvcultperm.Codigobacia21 -0.8209858  0.1084455  -7.5705 3.718e-14 ***
Xvcultperm.Codigobacia22 -2.1973925  0.1236297 -17.7740 < 2.2e-16 ***
Xvcultperm.Codigobacia4   0.2239786  0.0907810   2.4672 0.0136158 *
Xvcultperm.Codigobacia6   0.5032772  0.1995929   2.5215 0.0116850 *
Xvcultperm.Codigobacia7   1.0479358  0.2417850   4.3342 1.463e-05 ***
Xvcultperm.Codigobacia8  -0.1952497  0.1069124  -1.8263 0.0678113 .
Xvcultperm.Codigobacia9   0.4946624  0.0799519   6.1870 6.132e-10 ***
XAno                      0.0180411  0.0026336   6.8502 7.373e-12 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

>
> sphtest(x = re, x2 = fe)

        Hausman test for spatial models

data:  fm
chisq = 907.88, df = 25, p-value < 2.2e-16
alternative hypothesis: one model is inconsistent

>
> #Modelos espaciais de efeitos fixo e efeitos aleatórios sem erro
espacial e
> #com lag +  teste de hausman
> fe=spgm(formula=fm,data=vcultperm,index=NULL,listw=weigthmatrix,
model="within",lag=T,spatial.error = F)
> summary(fe)

Call:spgm(formula = fm, data = vcultperm, index = NULL, listw =
weigthmatrix,
    model = "within", lag = T, spatial.error = F)

Residuals:
    Min      1Q  Median      3Q     Max
-6.43695 -0.90492  0.15249  1.01420  3.88632

Coefficients:
                        Estimate Std. Error  t value  Pr(>|t|)
lambda                  0.2543823  0.0416731   6.1042 1.033e-09
XTemperatura.Media     -0.0698781  0.0223851  -3.1216 0.0017985
XTemperatura.Media.sd. -0.7464031  0.0739673 -10.0910 < 2.2e-16
Xentre0e1              -0.0049458  0.0013911  -3.5553 0.0003776
Xmaisde25mm            -0.0114244  0.0038021  -3.0048 0.0026575
Xvcultperm.Codigobacia1 -1.4460361  0.2077626  -6.9600 3.402e-12
Xvcultperm.Codigobacia10 -0.2890058  0.0985226  -2.9334 0.0033528
Xvcultperm.Codigobacia11  0.7638714  0.1055196   7.2391 4.516e-13
Xvcultperm.Codigobacia12  0.6786479  0.1310967   5.1767 2.258e-07
```

```
Xvcultperm.Codigobacia13   0.2724706  0.0847416    3.2153 0.0013030
Xvcultperm.Codigobacia14   0.4535138  0.0867392    5.2285 1.709e-07
Xvcultperm.Codigobacia15   0.5904500  0.0986279    5.9866 2.142e-09
Xvcultperm.Codigobacia16   0.7748627  0.0991462    7.8154 5.551e-15
Xvcultperm.Codigobacia17  -0.7086320  0.0837968   -8.4565 < 2.2e-16
Xvcultperm.Codigobacia18  -0.0022893  0.1186035   -0.0193 0.9845999
Xvcultperm.Codigobacia19  -0.8272031  0.1056682   -7.8283 4.885e-15
Xvcultperm.Codigobacia2   -2.5384061  0.0999706  -25.3915 < 2.2e-16
Xvcultperm.Codigobacia20  -0.5904529  0.1045175   -5.6493 1.611e-08
Xvcultperm.Codigobacia21  -0.9488751  0.1128492   -8.4083 < 2.2e-16
Xvcultperm.Codigobacia22  -2.1277872  0.1277465  -16.6563 < 2.2e-16
Xvcultperm.Codigobacia4    0.1812400  0.0942881    1.9222 0.0545813
Xvcultperm.Codigobacia6    0.6998600  0.2052596    3.4096 0.0006505
Xvcultperm.Codigobacia7    1.1248898  0.2481560    4.5330 5.815e-06
Xvcultperm.Codigobacia8   -0.3389757  0.1106298   -3.0641 0.0021836
Xvcultperm.Codigobacia9    0.4944881  0.0827476    5.9759 2.289e-09
XAno                       0.0176354  0.0026613    6.6266 3.435e-11

Residual variance (sigma squared): 2.1362, (sigma: 1.4616)


>
> re=spgm(formula=fm,data=vcultperm,index=NULL,listw=weigthmatrix,
model="random",lag=T,spatial.error = F)
> summary(re)

Call:spgm(formula = fm, data = vcultperm, index = NULL, listw =
weigthmatrix,
    model = "random", lag = T, spatial.error = F)

Residuals:
     Min        1Q    Median        3Q       Max
-4.491640 -0.619278  0.098086  0.714589  2.786544

Coefficients:
                        Estimate Std. Error  t value   Pr(>|t|)
lambda                  0.2466487  0.0396479    6.2210 4.941e-10
(Intercept)            10.4449292  0.6739260   15.4986 < 2.2e-16
XTemperatura.Media     -0.0689408  0.0216929   -3.1780 0.0014828
XTemperatura.Media.sd. -0.7382299  0.0715725  -10.3144 < 2.2e-16
Xentre0e1              -0.0035825  0.0013501   -2.6535 0.0079652
Xmaisde25mm            -0.0106571  0.0037112   -2.8716 0.0040839
Xvcultperm.Codigobacia1  -1.4347182  0.2005936   -7.1524 8.529e-13
Xvcultperm.Codigobacia10 -0.2835878  0.0963358   -2.9437 0.0032427
Xvcultperm.Codigobacia11  0.7995266  0.1016187    7.8679 3.553e-15
Xvcultperm.Codigobacia12  0.9905247  0.1263943    7.8368 4.663e-15
Xvcultperm.Codigobacia13  0.3138248  0.0808991    3.8792 0.0001048
Xvcultperm.Codigobacia14  0.4213549  0.0852596    4.9420 7.732e-07
Xvcultperm.Codigobacia15  0.5816207  0.0962110    6.0453 1.492e-09
Xvcultperm.Codigobacia16  0.8812591  0.0965260    9.1298 < 2.2e-16
Xvcultperm.Codigobacia17 -0.5917066  0.0804441   -7.3555 1.903e-13
Xvcultperm.Codigobacia18  0.1766255  0.1138027    1.5520 0.1206544
Xvcultperm.Codigobacia19 -0.7453199  0.1018155   -7.3203 2.474e-13
Xvcultperm.Codigobacia2  -2.4375893  0.0955824  -25.5025 < 2.2e-16
Xvcultperm.Codigobacia20 -0.5102302  0.1010878   -5.0474 4.479e-07
Xvcultperm.Codigobacia21 -0.7596010  0.1073649   -7.0749 1.495e-12
Xvcultperm.Codigobacia22 -2.1786573  0.1227887  -17.7431 < 2.2e-16
Xvcultperm.Codigobacia4   0.2210687  0.0897045    2.4644 0.0137239
```

```
Xvcultperm.Codigobacia6   0.4326336  0.1997794   2.1656 0.0303451
Xvcultperm.Codigobacia7   1.0011804  0.2412195   4.1505 3.318e-05
Xvcultperm.Codigobacia8  -0.1483276  0.1066809  -1.3904 0.1644118
Xvcultperm.Codigobacia9   0.5195755  0.0796474   6.5234 6.871e-11
XAno                      0.0182586  0.0026677   6.8442 7.689e-12

Residual variance (sigma squared): 1.0212, (sigma: 1.0105)

>
> sphtest(x = re, x2 = fe)
Error in UseMethod("sphtest") :
  método não aplicável para 'sphtest' aplicado a um objeto de classe
"stsls"
>
>
> #Modelos espaciais de efeitos fixo e efeitos aleatórios com erro
espacial e
> #com lag +  teste de hausman
> fe=spgm(formula=fm,data=vcultperm,index=NULL,listw=weigthmatrix,
model="within",lag=T, spatial.error = T)
> summary(fe)
Spatial panel fixed effects GM model

Call:
spgm(formula = fm, data = vcultperm, index = NULL, listw = weigthmatrix,
    model = "within", lag = T, spatial.error = T)

Residuals:
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
   3.93    9.59   10.60   10.50   11.60   14.60

Estimated spatial coefficient, variance components and theta:
         Estimate
rho      -0.11704
sigma^2_v  2.23352

Coefficients:
                        Estimate Std. Error  t-value  Pr(>|t|)
lambda                 0.2728208  0.0388529   7.0219 2.189e-12 ***
XTemperatura.Media    -0.0751126  0.0222500  -3.3759 0.0007359 ***
XTemperatura.Media.sd. -0.7445826  0.0736929 -10.1039 < 2.2e-16 ***
Xentre0e1             -0.0049334  0.0013824  -3.5687 0.0003587 ***
Xmaisde25mm           -0.0112026  0.0037893  -2.9563 0.0031130 **
Xvcultperm.Codigobacia1  -1.4405923  0.2051100  -7.0235 2.164e-12 ***
Xvcultperm.Codigobacia10 -0.2803062  0.0975630  -2.8731 0.0040649 **
Xvcultperm.Codigobacia11  0.7650651  0.1046244   7.3125 2.622e-13 ***
Xvcultperm.Codigobacia12  0.6728594  0.1298346   5.1824 2.190e-07 ***
Xvcultperm.Codigobacia13  0.2682578  0.0839296   3.1962 0.0013924 **
Xvcultperm.Codigobacia14  0.4426797  0.0857766   5.1608 2.458e-07 ***
Xvcultperm.Codigobacia15  0.6191836  0.0977042   6.3373 2.338e-10 ***
Xvcultperm.Codigobacia16  0.7760216  0.0982503   7.8984 2.825e-15 ***
Xvcultperm.Codigobacia17 -0.6760651  0.0828325  -8.1618 3.300e-16 ***
Xvcultperm.Codigobacia18  0.0124756  0.1174414   0.1062 0.9154010
Xvcultperm.Codigobacia19 -0.7924623  0.1048110  -7.5609 4.004e-14 ***
Xvcultperm.Codigobacia2  -2.5170109  0.0991951 -25.3743 < 2.2e-16 ***
Xvcultperm.Codigobacia20 -0.5666895  0.1035624  -5.4720 4.451e-08 ***
Xvcultperm.Codigobacia21 -0.9165332  0.1115891  -8.2135 < 2.2e-16 ***
```

```
Xvcultperm.Codigobacia22 -2.0969842  0.1264868 -16.5787 < 2.2e-16 ***
Xvcultperm.Codigobacia4   0.1847084  0.0930424   1.9852 0.0471213 *
Xvcultperm.Codigobacia6   0.6283674  0.2035542   3.0870 0.0020220 **
Xvcultperm.Codigobacia7   1.1338391  0.2459213   4.6106 4.016e-06 ***
Xvcultperm.Codigobacia8  -0.3508475  0.1098768  -3.1931 0.0014075 **
Xvcultperm.Codigobacia9   0.4961965  0.0820033   6.0509 1.440e-09 ***
XAno                      0.0175847  0.0026547   6.6240 3.497e-11 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

>
> re=spgm(formula=fm,data=vcultperm,index=NULL,listw=weigthmatrix,
model="random",lag=T,spatial.error = T)
> summary(re)
Spatial panel random effects GM model

Call:
spgm(formula = fm, data = vcultperm, index = NULL, listw = weigthmatrix,
    model = "random", lag = T, spatial.error = T)

Residuals:
   Min. 1st Qu.  Median   Mean 3rd Qu.    Max.
-6.5300 -0.9100  0.1490  0.0004  1.0500  4.1200

Estimated spatial coefficient, variance components and theta:
         Estimate
rho       -0.11704
sigma^2_v  2.23352
sigma^2_1  1.10700
theta     -0.42044

Coefficients:
                          Estimate Std. Error  t-value  Pr(>|t|)
lambda                    0.2771571  0.0365103   7.5912 3.170e-14 ***
(Intercept)              10.2439275  0.6548772  15.6425 < 2.2e-16 ***
XTemperatura.Media       -0.0733239  0.0212966  -3.4430 0.0005753 ***
XTemperatura.Media.sd.   -0.7322093  0.0703812 -10.4035 < 2.2e-16 ***
Xentre0e1                -0.0035281  0.0013254  -2.6618 0.0077721 **
Xmaisde25mm              -0.0103428  0.0036538  -2.8307 0.0046447 **
Xvcultperm.Codigobacia1  -1.4235614  0.1956577  -7.2758 3.444e-13 ***
Xvcultperm.Codigobacia10 -0.2773467  0.0942946  -2.9413 0.0032686 **
Xvcultperm.Codigobacia11  0.7974817  0.0995254   8.0128 1.121e-15 ***
Xvcultperm.Codigobacia12  0.9904326  0.1236870   8.0076 1.170e-15 ***
Xvcultperm.Codigobacia13  0.3099592  0.0791170   3.9177 8.939e-05 ***
Xvcultperm.Codigobacia14  0.4085933  0.0833336   4.9031 9.433e-07 ***
Xvcultperm.Codigobacia15  0.6061104  0.0941704   6.4363 1.224e-10 ***
Xvcultperm.Codigobacia16  0.8866845  0.0944973   9.3832 < 2.2e-16 ***
Xvcultperm.Codigobacia17 -0.5605961  0.0785636  -7.1356 9.638e-13 ***
Xvcultperm.Codigobacia18  0.1945787  0.1112828   1.7485 0.0803763 .
Xvcultperm.Codigobacia19 -0.7119321  0.0997404  -7.1378 9.480e-13 ***
Xvcultperm.Codigobacia2  -2.4146625  0.0936430 -25.7858 < 2.2e-16 ***
Xvcultperm.Codigobacia20 -0.4878941  0.0989448  -4.9310 8.182e-07 ***
Xvcultperm.Codigobacia21 -0.7302280  0.1048613  -6.9638 3.313e-12 ***
Xvcultperm.Codigobacia22 -2.1534352  0.1200759 -17.9339 < 2.2e-16 ***
Xvcultperm.Codigobacia4   0.2217130  0.0874594   2.5350 0.0112435 *
Xvcultperm.Codigobacia6   0.3602363  0.1957585   1.8402 0.0657377 .
Xvcultperm.Codigobacia7   1.0161594  0.2361942   4.3022 1.691e-05 ***
```

```
Xvcultperm.Codigobacia8   -0.1544917  0.1046328  -1.4765 0.1398062
Xvcultperm.Codigobacia9    0.5202700  0.0779712   6.6726 2.513e-11 ***
XAno                       0.0182749  0.0026325   6.9422 3.861e-12 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

>
> sphtest(x = re, x2 = fe)

        Hausman test for spatial models

data:  fm
chisq = 240.22, df = 26, p-value < 2.2e-16
alternative hypothesis: one model is inconsistent
```