```
        Baltagi, Song and Koh SLM1 marginal test

data:  Y ~ X
SLM1 = 0.024033, p-value = 0.9808
alternative hypothesis: Random effects

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

        Baltagi, Song and Koh LM2 marginal test

data:  Y ~ X
SLM2 = -0.00040236, p-value = 1
alternative hypothesis: Spatial autocorrelation

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

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

data:  Y ~ X
LM-H = 60841, p-value < 2.2e-16
alternative hypothesis: Random Regional Effects and Spatial
autocorrelation

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

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

data:  Y ~ X
LM*-lambda = 5.8061, p-value = 6.395e-09
alternative hypothesis: Spatial autocorrelation

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

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

Balanced Panel: n=525, T=20, N=10500

Residuals :
   Min. 1st Qu.  Median 3rd Qu.    Max.
-4.6600 -0.2770  0.0162  0.3040  2.9600
```

```
Coefficients :
                        Estimate  Std. Error  t-value Pr(>|t|)
XTemperatura.Media     -0.11817422  0.01259883  -9.3798   <2e-16 ***
XTemperatura.Media.sd. -0.32668384  0.03028303 -10.7877   <2e-16 ***
Xentre0e1              -0.00679895  0.00072613  -9.3633   <2e-16 ***
Xmaisde25mmp           -0.00178148  0.00299572  -0.5947   0.5521
XAno                    0.05812735  0.00102968  56.4517   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    4918.5
Residual Sum of Squares: 3608.1
R-Squared:      0.26643
Adj. R-Squared: 0.25298
F-statistic: 724.214 on 5 and 9970 DF, p-value: < 2.22e-16
>
> re=plm(formula=fm,data=vculttemp,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 = vculttemp, model = "random")

Balanced Panel: n=525, T=20, N=10500

Effects:
                var std.dev share
idiosyncratic 0.3626  0.6021 0.206
individual    1.3935  1.1804 0.794
theta:  0.8867

Residuals :
   Min. 1st Qu.  Median 3rd Qu.    Max.
-4.8800 -0.2830  0.0419  0.3380  2.6600

Coefficients :
                          Estimate  Std. Error  t-value  Pr(>|t|)
(Intercept)              12.21076369  0.34261816  35.6396 < 2.2e-16 ***
XTemperatura.Media       -0.11131473  0.01250352  -8.9027 < 2.2e-16 ***
XTemperatura.Media.sd.   -0.32361697  0.03027912 -10.6878 < 2.2e-16 ***
Xentre0e1                -0.00665282  0.00072279  -9.2044 < 2.2e-16 ***
Xmaisde25mmp             -0.00157871  0.00299705  -0.5268 0.5983754
Xvculttemp.Codigobacia1  -2.39119271  0.70909831  -3.3722 0.0007485 ***
Xvculttemp.Codigobacia10  0.07291595  0.31029095   0.2350 0.8142194
Xvculttemp.Codigobacia11 -2.11545720  0.36530317  -5.7910 7.200e-09 ***
Xvculttemp.Codigobacia12  2.16609908  0.38828590   5.5786 2.485e-08 ***
Xvculttemp.Codigobacia13  1.48673258  0.27623455   5.3821 7.519e-08 ***
Xvculttemp.Codigobacia14  1.01372157  0.27425797   3.6962 0.0002199 ***
Xvculttemp.Codigobacia15  0.59126417  0.23834521   2.4807 0.0131279 *
Xvculttemp.Codigobacia16  0.60150606  0.27757726   2.1670 0.0302584 *
Xvculttemp.Codigobacia17  1.04840718  0.26365435   3.9764 7.042e-05 ***
Xvculttemp.Codigobacia18 -0.44169285  0.30479075  -1.4492 0.1473207
Xvculttemp.Codigobacia19  1.21642211  0.26816203   4.5361 5.793e-06 ***
Xvculttemp.Codigobacia2  -1.95045843  0.33936758  -5.7473 9.319e-09 ***
```

```
Xvculttemp.Codigobacia20  0.19749039  0.28630960   0.6898 0.4903484
Xvculttemp.Codigobacia21  0.40028515  0.30351107   1.3188 0.1872486
Xvculttemp.Codigobacia22  1.00696312  0.32219912   3.1253 0.0017812 **
Xvculttemp.Codigobacia4   1.42019852  0.31044725   4.5747 4.824e-06 ***
Xvculttemp.Codigobacia6  -1.22782729  0.85900876  -1.4294 0.1529324
Xvculttemp.Codigobacia8   1.18603503  0.31110177   3.8124 0.0001384 ***
Xvculttemp.Codigobacia9   1.13198109  0.26511612   4.2698 1.974e-05 ***
XAno                      0.05813841  0.00103057  56.4138 < 2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    5220.4
Residual Sum of Squares: 3798
R-Squared:      0.27246
Adj. R-Squared: 0.27181
F-statistic: 163.451 on 24 and 10475 DF, p-value: < 2.22e-16
>
> phtest(re, fe)

        Hausman Test

data:  fm
chisq = 49.891, df = 5, p-value = 1.459e-09
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=vculttemp,index=NULL,listw=weigthmatrix,
model="within")
> summary(fe)
Spatial panel fixed effects GM model

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

Residuals:
   Min. 1st Qu.  Median 3rd Qu.    Max.
 -6.140  -0.758   0.124   0.895   5.380

Estimated spatial coefficient, variance components and theta:
         Estimate
rho       0.098964
sigma^2_v 1.751925

Coefficients:
                          Estimate Std. Error  t-value  Pr(>|t|)
XTemperatura.Media         0.1186519  0.0188129   6.3069 2.846e-10 ***
XTemperatura.Media.sd.    -0.1158795  0.0632745  -1.8314 0.0670440 .
Xentre0e1                 -0.0010476  0.0011832  -0.8854 0.3759205
Xmaisde25mmp               0.0090277  0.0064906   1.3909 0.1642575
Xvculttemp.Codigobacia1   -2.2998090  0.1780998 -12.9130 < 2.2e-16 ***
Xvculttemp.Codigobacia10  -0.0296776  0.0778928  -0.3810 0.7031990
Xvculttemp.Codigobacia11  -2.1777956  0.0985758 -22.0926 < 2.2e-16 ***
```

```
Xvculttemp.Codigobacia12  1.7039201  0.1081762  15.7513 < 2.2e-16 ***
Xvculttemp.Codigobacia13  1.3541671  0.0710064  19.0711 < 2.2e-16 ***
Xvculttemp.Codigobacia14  0.9732506  0.0746636  13.0351 < 2.2e-16 ***
Xvculttemp.Codigobacia15 -0.0963080  0.0835710  -1.1524 0.2491529
Xvculttemp.Codigobacia16  0.1607839  0.0807699   1.9906 0.0465204 *
Xvculttemp.Codigobacia17  0.7334003  0.0711314  10.3105 < 2.2e-16 ***
Xvculttemp.Codigobacia18 -1.1992850  0.0999890 -11.9942 < 2.2e-16 ***
Xvculttemp.Codigobacia19  0.5558369  0.0896197   6.2022 5.569e-10 ***
Xvculttemp.Codigobacia2  -1.9441076  0.0855578 -22.7227 < 2.2e-16 ***
Xvculttemp.Codigobacia20 -0.4691602  0.0889511  -5.2744 1.332e-07 ***
Xvculttemp.Codigobacia21 -0.2675103  0.0938345  -2.8509 0.0043599 **
Xvculttemp.Codigobacia22  0.3689389  0.0965201   3.8224 0.0001322 ***
Xvculttemp.Codigobacia4   1.3649303  0.0798227  17.0995 < 2.2e-16 ***
Xvculttemp.Codigobacia6  -1.2214832  0.2146447  -5.6907 1.265e-08 ***
Xvculttemp.Codigobacia8   1.1139467  0.0885324  12.5824 < 2.2e-16 ***
Xvculttemp.Codigobacia9   1.1652311  0.0672128  17.3365 < 2.2e-16 ***
XAno                      0.0595276  0.0022688  26.2380 < 2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

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

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

Residuals:
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-6.5400 -0.7670  0.1410 -0.0003  0.9050  5.2600

Estimated spatial coefficient, variance components and theta:
          Estimate
rho        0.099746
sigma^2_v  1.752314
sigma^2_1  1.062224
theta     -0.284393

Coefficients:
                          Estimate  Std. Error  t-value  Pr(>|t|)
(Intercept)               6.7495e+00  4.4325e-01  15.2273 < 2.2e-16 ***
XTemperatura.Media        1.1243e-01  1.7636e-02   6.3752 1.827e-10 ***
XTemperatura.Media.sd.   -1.6266e-01  5.9595e-02  -2.7294 0.0063448 **
Xentre0e1                -1.5909e-05  1.1503e-03  -0.0138 0.9889657
Xmaisde25mmp              5.7314e-03  6.2072e-03   0.9233 0.3558269
Xvculttemp.Codigobacia1  -2.2172e+00  1.7582e-01 -12.6106 < 2.2e-16 ***
Xvculttemp.Codigobacia10 -4.2438e-02  7.7039e-02  -0.5509 0.5817301
Xvculttemp.Codigobacia11 -2.1250e+00  9.6350e-02 -22.0546 < 2.2e-16 ***
Xvculttemp.Codigobacia12  1.6922e+00  1.0608e-01  15.9518 < 2.2e-16 ***
Xvculttemp.Codigobacia13  1.3882e+00  6.9487e-02  19.9782 < 2.2e-16 ***
Xvculttemp.Codigobacia14  9.3992e-01  7.3738e-02  12.7468 < 2.2e-16 ***
Xvculttemp.Codigobacia15 -1.1325e-01  8.1313e-02  -1.3928 0.1636819
Xvculttemp.Codigobacia16  1.0607e-01  7.9733e-02   1.3303 0.1834167
Xvculttemp.Codigobacia17  7.6170e-01  6.9730e-02  10.9234 < 2.2e-16 ***
```

```
Xvculttemp.Codigobacia18 -1.2153e+00  9.7654e-02 -12.4451 < 2.2e-16 ***
Xvculttemp.Codigobacia19  5.4781e-01  8.7180e-02   6.2837 3.307e-10 ***
Xvculttemp.Codigobacia2  -1.9889e+00  8.4268e-02 -23.6016 < 2.2e-16 ***
Xvculttemp.Codigobacia20 -3.8119e-01  8.5730e-02  -4.4463 8.734e-06 ***
Xvculttemp.Codigobacia21 -2.5912e-01  8.9939e-02  -2.8810 0.0039636 **
Xvculttemp.Codigobacia22  3.4772e-01  9.4189e-02   3.6918 0.0002227 ***
Xvculttemp.Codigobacia4   1.3862e+00  7.9548e-02  17.4266 < 2.2e-16 ***
Xvculttemp.Codigobacia6  -1.2041e+00  2.1141e-01  -5.6953 1.232e-08 ***
Xvculttemp.Codigobacia8   1.0680e+00  8.7278e-02  12.2371 < 2.2e-16 ***
Xvculttemp.Codigobacia9   1.1576e+00  6.6472e-02  17.4152 < 2.2e-16 ***
XAno                      5.8596e-02  2.2143e-03  26.4628 < 2.2e-16 ***
---
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 = 95.71, df = 24, p-value = 1.604e-10
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=vculttemp,index=NULL,listw=weigthmatrix,
model="within",spatial.error = T,lag=F)
> summary(fe)
Spatial panel fixed effects GM model

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

Residuals:
   Min. 1st Qu.  Median 3rd Qu.    Max.
 -6.140  -0.758   0.124   0.895   5.380

Estimated spatial coefficient, variance components and theta:
         Estimate
rho       0.098964
sigma^2_v 1.751925

Coefficients:
                          Estimate Std. Error  t-value  Pr(>|t|)
XTemperatura.Media         0.1186519  0.0188129   6.3069 2.846e-10 ***
XTemperatura.Media.sd.    -0.1158795  0.0632745  -1.8314 0.0670440 .
Xentre0e1                 -0.0010476  0.0011832  -0.8854 0.3759205
Xmaisde25mmp               0.0090277  0.0064906   1.3909 0.1642575
Xvculttemp.Codigobacia1   -2.2998090  0.1780998 -12.9130 < 2.2e-16 ***
Xvculttemp.Codigobacia10  -0.0296776  0.0778928  -0.3810 0.7031990
Xvculttemp.Codigobacia11  -2.1777956  0.0985758 -22.0926 < 2.2e-16 ***
Xvculttemp.Codigobacia12   1.7039201  0.1081762  15.7513 < 2.2e-16 ***
```

```
Xvculttemp.Codigobacia13  1.3541671  0.0710064  19.0711 < 2.2e-16 ***
Xvculttemp.Codigobacia14  0.9732506  0.0746636  13.0351 < 2.2e-16 ***
Xvculttemp.Codigobacia15 -0.0963080  0.0835710  -1.1524 0.2491529
Xvculttemp.Codigobacia16  0.1607839  0.0807699   1.9906 0.0465204 *
Xvculttemp.Codigobacia17  0.7334003  0.0711314  10.3105 < 2.2e-16 ***
Xvculttemp.Codigobacia18 -1.1992850  0.0999890 -11.9942 < 2.2e-16 ***
Xvculttemp.Codigobacia19  0.5558369  0.0896197   6.2022 5.569e-10 ***
Xvculttemp.Codigobacia2  -1.9441076  0.0855578 -22.7227 < 2.2e-16 ***
Xvculttemp.Codigobacia20 -0.4691602  0.0889511  -5.2744 1.332e-07 ***
Xvculttemp.Codigobacia21 -0.2675103  0.0938345  -2.8509 0.0043599 **
Xvculttemp.Codigobacia22  0.3689389  0.0965201   3.8224 0.0001322 ***
Xvculttemp.Codigobacia4   1.3649303  0.0798227  17.0995 < 2.2e-16 ***
Xvculttemp.Codigobacia6  -1.2214832  0.2146447  -5.6907 1.265e-08 ***
Xvculttemp.Codigobacia8   1.1139467  0.0885324  12.5824 < 2.2e-16 ***
Xvculttemp.Codigobacia9   1.1652311  0.0672128  17.3365 < 2.2e-16 ***
XAno                      0.0595276  0.0022688  26.2380 < 2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

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

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

Residuals:
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-6.5400 -0.7670  0.1410 -0.0003  0.9050  5.2600

Estimated spatial coefficient, variance components and theta:
          Estimate
rho        0.099746
sigma^2_v  1.752314
sigma^2_1  1.062224
theta     -0.284393

Coefficients:
                          Estimate  Std. Error  t-value  Pr(>|t|)
(Intercept)               6.7495e+00  4.4325e-01  15.2273 < 2.2e-16 ***
XTemperatura.Media        1.1243e-01  1.7636e-02   6.3752 1.827e-10 ***
XTemperatura.Media.sd.   -1.6266e-01  5.9595e-02  -2.7294 0.0063448 **
Xentre0e1                -1.5909e-05  1.1503e-03  -0.0138 0.9889657
Xmaisde25mmp              5.7314e-03  6.2072e-03   0.9233 0.3558269
Xvculttemp.Codigobacia1  -2.2172e+00  1.7582e-01 -12.6106 < 2.2e-16 ***
Xvculttemp.Codigobacia10 -4.2438e-02  7.7039e-02  -0.5509 0.5817301
Xvculttemp.Codigobacia11 -2.1250e+00  9.6350e-02 -22.0546 < 2.2e-16 ***
Xvculttemp.Codigobacia12  1.6922e+00  1.0608e-01  15.9518 < 2.2e-16 ***
Xvculttemp.Codigobacia13  1.3882e+00  6.9487e-02  19.9782 < 2.2e-16 ***
Xvculttemp.Codigobacia14  9.3992e-01  7.3738e-02  12.7468 < 2.2e-16 ***
Xvculttemp.Codigobacia15 -1.1325e-01  8.1313e-02  -1.3928 0.1636819
Xvculttemp.Codigobacia16  1.0607e-01  7.9733e-02   1.3303 0.1834167
Xvculttemp.Codigobacia17  7.6170e-01  6.9730e-02  10.9234 < 2.2e-16 ***
Xvculttemp.Codigobacia18 -1.2153e+00  9.7654e-02 -12.4451 < 2.2e-16 ***
```

```
Xvculttemp.Codigobacia19  5.4781e-01  8.7180e-02   6.2837 3.307e-10 ***
Xvculttemp.Codigobacia2  -1.9889e+00  8.4268e-02 -23.6016 < 2.2e-16 ***
Xvculttemp.Codigobacia20 -3.8119e-01  8.5730e-02  -4.4463 8.734e-06 ***
Xvculttemp.Codigobacia21 -2.5912e-01  8.9939e-02  -2.8810 0.0039636 **
Xvculttemp.Codigobacia22  3.4772e-01  9.4189e-02   3.6918 0.0002227 ***
Xvculttemp.Codigobacia4   1.3862e+00  7.9548e-02  17.4266 < 2.2e-16 ***
Xvculttemp.Codigobacia6  -1.2041e+00  2.1141e-01  -5.6953 1.232e-08 ***
Xvculttemp.Codigobacia8   1.0680e+00  8.7278e-02  12.2371 < 2.2e-16 ***
Xvculttemp.Codigobacia9   1.1576e+00  6.6472e-02  17.4152 < 2.2e-16 ***
XAno                      5.8596e-02  2.2143e-03  26.4628 < 2.2e-16 ***
---
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 = 95.71, df = 24, p-value = 1.604e-10
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=vculttemp,index=NULL,listw=weigthmatrix,
model="within",lag=T,spatial.error = F)
> summary(fe)

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

Residuals:
     Min       1Q   Median       3Q      Max
-6.14668 -0.75538  0.12621  0.89377  5.37764

Coefficients:
                         Estimate Std. Error  t value  Pr(>|t|)
lambda                  0.0462400  0.0270214   1.7112 0.0870373
XTemperatura.Media      0.1221235  0.0193059   6.3257 2.521e-10
XTemperatura.Media.sd. -0.1167576  0.0653049  -1.7879 0.0737947
Xentre0e1              -0.0011434  0.0012163  -0.9401 0.3471906
Xmaisde25mmp            0.0089367  0.0066780   1.3382 0.1808193
Xvculttemp.Codigobacia1  -2.3021422  0.1826062 -12.6071 < 2.2e-16
Xvculttemp.Codigobacia10 -0.0207397  0.0799520  -0.2594 0.7953250
Xvculttemp.Codigobacia11 -2.1754692  0.1012591 -21.4842 < 2.2e-16
Xvculttemp.Codigobacia12  1.6981835  0.1108878  15.3144 < 2.2e-16
Xvculttemp.Codigobacia13  1.3362488  0.0728004  18.3550 < 2.2e-16
Xvculttemp.Codigobacia14  0.9917972  0.0767010  12.9307 < 2.2e-16
Xvculttemp.Codigobacia15 -0.1073134  0.0854915  -1.2553 0.2093875
Xvculttemp.Codigobacia16  0.1548484  0.0829786   1.8661 0.0620240
Xvculttemp.Codigobacia17  0.7232750  0.0729182   9.9190 < 2.2e-16
Xvculttemp.Codigobacia18 -1.2144602  0.1025664 -11.8407 < 2.2e-16
Xvculttemp.Codigobacia19  0.5241527  0.0919130   5.7027 1.179e-08
Xvculttemp.Codigobacia2  -1.9165596  0.0877341 -21.8451 < 2.2e-16
```

```
Xvculttemp.Codigobacia20 -0.4722814  0.0911069  -5.1838 2.174e-07
Xvculttemp.Codigobacia21 -0.2813252  0.0960876  -2.9278 0.0034137
Xvculttemp.Codigobacia22  0.3744435  0.0989354   3.7847 0.0001539
Xvculttemp.Codigobacia4   1.3777982  0.0816425  16.8760 < 2.2e-16
Xvculttemp.Codigobacia6  -1.2373883  0.2200120  -5.6242 1.864e-08
Xvculttemp.Codigobacia8   1.1191685  0.0910808  12.2876 < 2.2e-16
Xvculttemp.Codigobacia9   1.1621669  0.0690758  16.8245 < 2.2e-16
XAno                      0.0593811  0.0023331  25.4515 < 2.2e-16

Residual variance (sigma squared): 1.6681, (sigma: 1.2915)

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

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

Residuals:
     Min       1Q   Median       3Q      Max
-5.07081 -0.58726  0.11075  0.69229  3.97841

Coefficients:
                          Estimate  Std. Error  t value  Pr(>|t|)
lambda                    5.9891e-02  2.6322e-02   2.2753 0.0228853
(Intercept)               6.1265e+00  5.0261e-01  12.1893 < 2.2e-16
XTemperatura.Media        1.1604e-01  1.7506e-02   6.6290 3.381e-11
XTemperatura.Media.sd.   -1.6920e-01  5.9516e-02  -2.8429 0.0044704
Xentre0e1                -2.9155e-05  1.1482e-03  -0.0254 0.9797428
Xmaisde25mmp              5.4037e-03  6.1881e-03   0.8732 0.3825312
Xvculttemp.Codigobacia1  -2.2033e+00  1.7536e-01 -12.5644 < 2.2e-16
Xvculttemp.Codigobacia10 -3.8760e-02  7.6915e-02  -0.5039 0.6143031
Xvculttemp.Codigobacia11 -2.1129e+00  9.6141e-02 -21.9771 < 2.2e-16
Xvculttemp.Codigobacia12  1.6790e+00  1.0567e-01  15.8891 < 2.2e-16
Xvculttemp.Codigobacia13  1.3764e+00  6.9252e-02  19.8757 < 2.2e-16
Xvculttemp.Codigobacia14  9.5342e-01  7.3668e-02  12.9420 < 2.2e-16
Xvculttemp.Codigobacia15 -1.2776e-01  8.0769e-02  -1.5818 0.1137015
Xvculttemp.Codigobacia16  9.2146e-02  7.9666e-02   1.1567 0.2474136
Xvculttemp.Codigobacia17  7.5615e-01  6.9504e-02  10.8792 < 2.2e-16
Xvculttemp.Codigobacia18 -1.2362e+00  9.7330e-02 -12.7016 < 2.2e-16
Xvculttemp.Codigobacia19  5.1551e-01  8.6853e-02   5.9354 2.931e-09
Xvculttemp.Codigobacia2  -1.9711e+00  8.4033e-02 -23.4564 < 2.2e-16
Xvculttemp.Codigobacia20 -3.7759e-01  8.5190e-02  -4.4324 9.320e-06
Xvculttemp.Codigobacia21 -2.7105e-01  8.9322e-02  -3.0345 0.0024091
Xvculttemp.Codigobacia22  3.4690e-01  9.3771e-02   3.6995 0.0002161
Xvculttemp.Codigobacia4   1.3988e+00  7.9222e-02  17.6567 < 2.2e-16
Xvculttemp.Codigobacia6  -1.2264e+00  2.1073e-01  -5.8199 5.890e-09
Xvculttemp.Codigobacia8   1.0669e+00  8.7299e-02  12.2210 < 2.2e-16
Xvculttemp.Codigobacia9   1.1505e+00  6.6441e-02  17.3164 < 2.2e-16
XAno                      5.8272e-02  2.2105e-03  26.3614 < 2.2e-16

Residual variance (sigma squared): 1.0064, (sigma: 1.0032)

>
> 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=vculttemp,index=NULL,listw=weigthmatrix,
model="within",lag=T, spatial.error = T)
> summary(fe)
Spatial panel fixed effects GM model

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

Residuals:
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
 -0.526   5.290   6.200   6.060   6.960  11.400

Estimated spatial coefficient, variance components and theta:
         Estimate
rho       0.054677
sigma^2_v 1.754835

Coefficients:
                          Estimate Std. Error  t-value  Pr(>|t|)
lambda                   0.0421554  0.0275643   1.5294 0.1261775
XTemperatura.Media       0.1198613  0.0193220   6.2034 5.527e-10 ***
XTemperatura.Media.sd.  -0.1159058  0.0651440  -1.7792 0.0752032 .
Xentre0e1               -0.0010832  0.0012160  -0.8908 0.3730540
Xmaisde25mmp             0.0090621  0.0066735   1.3579 0.1744903
Xvculttemp.Codigobacia1 -2.3011033  0.1828218 -12.5866 < 2.2e-16 ***
Xvculttemp.Codigobacia10 -0.0273852  0.0800182  -0.3422 0.7321726
Xvculttemp.Codigobacia11 -2.1787488  0.1012845 -21.5112 < 2.2e-16 ***
Xvculttemp.Codigobacia12  1.7034714  0.1110468  15.3401 < 2.2e-16 ***
Xvculttemp.Codigobacia13  1.3484444  0.0729133  18.4938 < 2.2e-16 ***
Xvculttemp.Codigobacia14  0.9797735  0.0767250  12.7699 < 2.2e-16 ***
Xvculttemp.Codigobacia15 -0.0994004  0.0857189  -1.1596 0.2462078
Xvculttemp.Codigobacia16  0.1595258  0.0829961   1.9221 0.0545949 .
Xvculttemp.Codigobacia17  0.7313279  0.0730483  10.0116 < 2.2e-16 ***
Xvculttemp.Codigobacia18 -1.2037594  0.1026845 -11.7229 < 2.2e-16 ***
Xvculttemp.Codigobacia19  0.5448115  0.0920519   5.9185 3.248e-09 ***
Xvculttemp.Codigobacia2  -1.9337704  0.0878423 -22.0141 < 2.2e-16 ***
Xvculttemp.Codigobacia20 -0.4694268  0.0912770  -5.1429 2.706e-07 ***
Xvculttemp.Codigobacia21 -0.2719307  0.0962848  -2.8242 0.0047394 **
Xvculttemp.Codigobacia22  0.3712599  0.0990700   3.7475 0.0001786 ***
Xvculttemp.Codigobacia4   1.3722551  0.0818610  16.7632 < 2.2e-16 ***
Xvculttemp.Codigobacia6  -1.2333784  0.2203671  -5.5969 2.182e-08 ***
Xvculttemp.Codigobacia8   1.1186323  0.0910419  12.2870 < 2.2e-16 ***
Xvculttemp.Codigobacia9   1.1661206  0.0690949  16.8771 < 2.2e-16 ***
XAno                      0.0595113  0.0023322  25.5173 < 2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

>
```

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

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

Residuals:
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-6.5500 -0.7690  0.1430 -0.0002  0.9010  5.2800

Estimated spatial coefficient, variance components and theta:
          Estimate
rho        0.054677
sigma^2_v  1.754835
sigma^2_1  0.898680
theta     -0.397383

Coefficients:
                          Estimate  Std. Error  t-value  Pr(>|t|)
lambda                    0.05386414  0.02673406   2.0148 0.0439242 *
(Intercept)               6.23524783  0.50253478  12.4076 < 2.2e-16 ***
XTemperatura.Media        0.11323840  0.01740023   6.5079 7.623e-11 ***
XTemperatura.Media.sd.   -0.16912922  0.05898721  -2.8672 0.0041410 **
Xentre0e1                 0.00010202  0.00114175   0.0894 0.9287983
Xmaisde25mmp              0.00534062  0.00614628   0.8689 0.3848911
Xvculttemp.Codigobacia1  -2.20411319  0.17469183 -12.6172 < 2.2e-16 ***
Xvculttemp.Codigobacia10 -0.04495431  0.07661987  -0.5867 0.5573926
Xvculttemp.Codigobacia11 -2.11777883  0.09566570 -22.1373 < 2.2e-16 ***
Xvculttemp.Codigobacia12  1.68689988  0.10529935  16.0200 < 2.2e-16 ***
Xvculttemp.Codigobacia13  1.38834891  0.06898512  20.1253 < 2.2e-16 ***
Xvculttemp.Codigobacia14  0.93948708  0.07334154  12.8098 < 2.2e-16 ***
Xvculttemp.Codigobacia15 -0.12063072  0.08055274  -1.4975 0.1342536
Xvculttemp.Codigobacia16  0.09465362  0.07930490   1.1935 0.2326577
Xvculttemp.Codigobacia17  0.76417426  0.06926738  11.0322 < 2.2e-16 ***
Xvculttemp.Codigobacia18 -1.22488894  0.09692956 -12.6369 < 2.2e-16 ***
Xvculttemp.Codigobacia19  0.53502769  0.08651618   6.1841 6.244e-10 ***
Xvculttemp.Codigobacia2  -1.98843638  0.08371821 -23.7515 < 2.2e-16 ***
Xvculttemp.Codigobacia20 -0.36985083  0.08486704  -4.3580 1.313e-05 ***
Xvculttemp.Codigobacia21 -0.26300829  0.08895495  -2.9566 0.0031101 **
Xvculttemp.Codigobacia22  0.34405772  0.09342486   3.6827 0.0002308 ***
Xvculttemp.Codigobacia4   1.39590103  0.07908112  17.6515 < 2.2e-16 ***
Xvculttemp.Codigobacia6  -1.21731419  0.20997108  -5.7975 6.730e-09 ***
Xvculttemp.Codigobacia8   1.06524740  0.08684485  12.2661 < 2.2e-16 ***
Xvculttemp.Codigobacia9   1.15593860  0.06615907  17.4721 < 2.2e-16 ***
XAno                      0.05842212  0.00219895  26.5682 < 2.2e-16 ***
---
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 = 110.27, df = 25, p-value = 1.106e-12
alternative hypothesis: one model is inconsistent
```