

Package: spefa (via r-universe)

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Type Package

Title Spatial Stochastic Frontier with Fixed Effects and Endogeneity

Version 0.1.0

Description Maximum-likelihood estimation of the spatial autoregressive stochastic frontier model with individual fixed effects (removed by first differencing) and endogenous regressors handled through a Gaussian control function, as in Giannini (2025) <doi:10.1080/17421772.2024.2414962>. Returns coefficient estimates and standard errors, spatially-corrected technical (in)efficiency scores, and direct, indirect and total marginal impacts. Depends only on base R.

License GPL-3

Encoding UTF-8

Depends R (>= 3.5.0)

Imports stats

LazyData true

Suggests knitr, rmarkdown

VignetteBuilder knitr

RoxygenNote 7.2.3

NeedsCompilation no

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efficiency	<i>Technical (in)efficiency scores</i>
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Description

Conditional-mean (JLMS) inefficiency estimates with optional spatial rescaling by $(I - \lambda W)^{-1}$.

Usage

```
efficiency(object, spatial = TRUE)
```

Arguments

object	a fitted spefa object.
spatial	logical; apply the spatial multiplier.

Value

A list with the inefficiency matrix u ($N \times T$), efficiency $\text{eff} = \exp(-u)$, and per-unit $E u_i$.

Examples

```
data(spefademo)
fit <- spefa(y ~ x1 + q1, data = spefademo, index = c("id", "time"),
            W = spefaW, endogenous = list(q1 = ~ z1, q2 = ~ z2),
            scaling = ~ x2 + q2)
ef <- efficiency(fit)
summary(as.vector(ef$eff))
```

impacts	<i>Direct, indirect and total marginal impacts (with inference)</i>
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Description

LeSage-Pace decomposition of frontier marginal effects through the spatial multiplier $(I - \lambda W)^{-1}$. Standard errors, z-statistics and p-values are obtained by simulation from the asymptotic distribution of (β, λ) .

Usage

```
impacts(object, ...)

## S3 method for class 'spefa'
impacts(object, R = 1000, seed = NULL, ...)
```

Arguments

object	a fitted spefa object.
R	number of simulation draws for the standard errors.
seed	optional integer seed for reproducibility.
...	unused.

Value

An object of class `impacts.spefa`: a list with matrices `Direct`, `Indirect` and `Total`, each with columns `Estimate`, `Std.Error`, `z value` and `Pr(>|z|)`.

Examples

```
data(spefademo)
fit <- spefa(y ~ x1 + q1, data = spefademo, index = c("id", "time"),
            W = spefaW, endogenous = list(q1 = ~ z1, q2 = ~ z2),
            scaling = ~ x2 + q2)
impacts(fit, R = 500, seed = 1)
```

spefa	<i>Spatial Stochastic Frontier with Fixed Effects and Endogeneity</i>
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Description

Maximum-likelihood estimation of a spatial autoregressive stochastic frontier model with individual fixed effects (removed by first differencing) and endogenous regressors handled by a Gaussian control function.

Usage

```
spefa(formula, data, index, W, endogenous = NULL, scaling = NULL,
      mu = FALSE, control = list(maxit = 500, reltol = 1e-9))
```

Arguments

formula	frontier equation, e.g. $y \sim x1 + q1$. The intercept is removed by first differencing.
data	a balanced panel data.frame.
index	length-2 character vector $c(\text{unit}, \text{time})$.
W	an $N \times N$ spatial weight matrix, rows/cols ordered by sorted unit id.
endogenous	named list mapping endogenous regressors to instruments, e.g. $\text{list}(q1 = \sim z1, q2 = \sim z2)$, or NULL.
scaling	one-sided formula of variables entering the inefficiency scaling $h_{it} = \exp(z'_{it}\phi)$, e.g. $\sim x2 + q2$.
mu	logical; if TRUE estimate the truncation point (truncated-normal inefficiency), else half-normal.
control	list passed to <code>optim</code> .

Value

An object of class `spefa` with methods `summary`, `coef`, `vcov`, `logLik`, `efficiency` and `impacts`.

Examples

```
data(spefademo)
fit <- spefa(y ~ x1 + q1, data = spefademo, index = c("id", "time"),
            W = spefaW, endogenous = list(q1 = ~ z1, q2 = ~ z2),
            scaling = ~ x2 + q2)
summary(fit)
```

spefademo

Simulated demo panel for spefa

Description

A small simulated balanced panel and its spatial weight matrix, used in the examples and vignette. Generated from the model in Giannini (2025) with $\beta = (0.5, 0.5)$, $\delta = (1, 1)$, $\phi = (0.3, 0.3)$, $\sigma_\varepsilon^2 = 0.09$, $\sigma_v^2 = 0.04$, $\rho = (0.5, 0.5)$, $\sigma_u^2 = 0.09$ and $\lambda = 0.5$; $q1$ and $q2$ are endogenous, $q1$ enters the frontier and $q2$ the scaling.

Usage

```
data(spefademo)
```

Format

`spefademo`: a `data.frame` with 480 rows ($N = 40$ units, $T = 12$ periods) and columns `id`, `time`, `y`, `x1`, `x2`, `q1`, `q2`, `z1`, `z2`.

`spefaW`: a 40 x 40 row-normalised spatial weight matrix, ordered by `id`.

Examples

```
data(spefademo)
str(spefademo)
dim(spefaW)
```

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