

Package ‘gnrprod’

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Title Estimates Production Functions

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Description Implements the nonparametric identification of gross output production functions specified by Gandhi, Navarro, and Rivers (2020).

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colombian	<i>Colombian</i>
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Description

Plant-level production data for the food products industry (International Standard Industrial Classification code 311) in Colombia.

Usage

colombian

Format

A data frame with seven variables:

share level intermediate input's revenue share

id firm id

year the last two digits of a year between 1981 and 1991

RGO level of real gross output with base year 1981

L labor in level employee years

K level of real capital stock with base year 1981

RI level of real intermediate inputs with base year 1981

For a complete listing of data, see <https://www.journals.uchicago.edu/doi/suppl/10.1086/707736>

gnrflex	<i>Estimate flexible input elasticity: Gandhi, Navarro, Rivers (GNR) share regression</i>
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Description

The `gnrflex` function implements the first stage (share regression) of the GNR production function estimation routine, nonparametrically identifying the flexible input elasticity of the production function. This function is called in the main wrapper function `gnrprod`. It currently supports only one flexible input.

For details, see Gandhi, Navarro, and Rivers (2020).

Usage

```
gnrflex(output, fixed, flex, share, id, time, degree, control)
```

Arguments

output	a numeric vector of level gross output
fixed	a numeric matrix of level fixed inputs
flex	a numeric vector of level flexible input
share	a numeric vector of the level intermediate input's revenue share
id	a numeric vector of firm ids
time	a numeric vector of time
degree	degree of share regression polynomial
control	an optional list of convergence settings. See <code>gnrflex.control</code> for listing.

Value

a list of class "gnrflex" containing three elements:

elas: a list containing six elements describing the share regression:

- **flex_in_elas**: a numeric vector of the estimated flexible input elasticity for each observation
- **coef**: a numeric vector of the coefficients of the estimator scaled by a constant (equation (21))
- **residuals**: a numeric vector of the residuals
- **SSR**: sum of squared residuals
- **iterations**: number of iterations performed
- **convergence**: boolean indicating whether convergence was achieved

arg: a list containing seven elements to be passed to the second stage function **gnriv**

- **input**: a numeric matrix (S3 'poly') of the polynomial expansion of all inputs
- **input_degree**: a numeric matrix corresponding to **input** denoting each vector's degree
- **big_Y**: a numeric vector of persistent productivity minus the constant of integration (equation (16) in Gandhi, Navarro, and Rivers (2020))
- **D_coef**: a numeric vector equalling **coef** divided by an estimate of the constant
- **id**: a numeric vector of the firm ids
- **time**: a numeric vector of time
- **degree**: the degree of the share regression

control: the list of convergence control parameters. See **gnrflex.control**

gnrflex.control
Control iterations in first stage of GNR

Description

Allows the user to modify convergence parameters of Gauss Newton algorithm used in the **gnrflex** function

Usage

```
gnrflex.control(
  maxit = 100,
  reltol = 1e-05,
  initial_step = 100,
  min_factor = 1e-05
)
```

Arguments

<code>maxit</code>	Maximum number of iterations. Defaults to 100.
<code>reltol</code>	Relative convergence tolerance. Defaults to 1e-5.
<code>initial_step</code>	A scaling parameter specifying the initial step-size factor used in each iteration of the Gauss-Newton algorithm. <code>initial_step</code> is halved in each convergence step.
<code>min_factor</code>	The minimum value that the step-size factor can take on in the convergence step of any iteration of the Gauss-Newton algorithm.

Value

a list containing four elements: `maxit`, `reltol`, `initial_step`, and `min_factor`

<code>gnriv</code>	<i>Estimate fixed input elasticity and total productivity: Gandhi, Navarro, Rivers (GNR) lag instruments</i>
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Description

The `gnriv` function implements the second stage of the GNR production function estimation routine, nonparametrically identifying the fixed input elasticities of the production function and total productivity. This function is called in the main wrapper function `gnrprod`. It currently supports only one flexible input.

For details, see Gandhi, Navarro, and Rivers (2020).

Usage

```
gnriv(object, degree, control)
```

Arguments

<code>object</code>	object of class <code>gnrflex</code>
<code>degree</code>	degree of Markov process for persistent productivity
<code>control</code>	an optional list of convergence settings. See <code>gnriv.control</code> for listing.

Value

a list of class "gnriv" containing six elements:

`elas`: a numeric matrix of estimated elasticities of fixed inputs for each observation

`productivity`: a numeric vector of estimated total productivity

`degree`: degree of Markov process

`iterations`: number of iterations performed

`convergence`: boolean indicating whether convergence was achieved

`control`: the list of convergence control parameters. See `gnriv.control`.

gnriv.control	<i>Control iterations in second stage of GNR</i>
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Description

Allows the user to modify convergence parameters of Gauss Newton algorithm used in the gnriv function

Usage

```
gnriv.control(maxit = 100, reltol = 1e-08)
```

Arguments

maxit	Maximum number of iterations. Defaults to 100.
reltol	Relative convergence tolerance. Defaults to 1e-8.

Value

a list containing two elements: maxit and reltol

gnrprod	<i>Estimate production functions and productivity: Gandhi, Navarro, and Rivers (2020)</i>
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Description

The gnrprod function is the front end of the gnrprod package. It estimates production functions and productivity in two stages: gnrflex (estimate flexible input elasticity) and gnriv (estimate fixed input elasticities and productivity). It currently supports only one flexible input.

Usage

```
gnrprod(output, fixed, flex, share, in_price = NULL,
        out_price = NULL, id, time, data, degree = 2,
        markov_degree = 2, fs_control = gnrflex.control(),
        ss_control = gnriv.control())
```

Arguments

output	name (character) of variable of level gross output or a numeric vector
fixed	name (character or character vector) of variables of level fixed inputs or a numeric matrix
flex	name (character) of variable of level flexible input or a numeric vector
share	name (character) of variable of level intermediate input's revenue share or a numeric vector
in_price	optional (required if share is not specified) name (character) of variable of common flexible input price or a numeric vector

<code>out_price</code>	optional (required if <code>share</code> is not specified) name (character) of variable of common output price or a numeric vector
<code>id</code>	name (character) of variable of firm id or a numeric vector
<code>time</code>	name (character) of variable of time or a numeric vector
<code>data</code>	dataframe containing all variables with names specified by arguments above (left empty if arguments above are vector/matrix)
<code>degree</code>	degree of share regression polynomial
<code>markov_degree</code>	degree of Markov process for persistent productivity
<code>fs_control</code>	an optional list of convergence settings of the first stage. See <code>gnrflex.control</code> for listing.
<code>ss_control</code>	an optional list of convergence settings of the second stage. See <code>gnriv.control</code> for listing.

Value

a list of class "gnr" with five elements: `avg_elasticity`: a named numeric vector of the average elasticities of all inputs

`data`: a list (dataframe) containing: `output`, `fixed`, `flex`, `id`, `time`, and `share` variables and estimated elasticities for each observation

`first_stage`: a list containing six elements describing the share regression (first stage):

- `coef`: a numeric vector of the coefficients of the estimator scaled by a constant (equation (21))
- `residuals`: a numeric vector of the residuals
- `SSR`: sum of squared residual
- `iterations`: number of iterations performed
- `convergence`: boolean indicating whether convergence was achieved
- `control`: list of convergence control parameters (see `gnrflex.control`)

`second_stage`: a list containing four elements describing the second stage:

- `productivity`: a numeric vector of the estimated total productivity
- `iterations`: number of iterations performed
- `convergence`: boolean indicating whether convergence was achieved
- `control`: list of convergence control parameters (see `gnriv.control`)

Examples

```
require(gnrprod)
data <- colombian
industry_311 <- gnrprod(output = "RGO", fixed = c("L", "K"), flex = "RI",
  share = "share", id = "id", time = "year",
  data = data, degree = 3, markov_degree = 3)
```

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