Package ‘sgmodel’

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Type Package

Title Solves a Generic Stochastic Growth Model with a Representative Agent

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Description It computes the solutions to a generic stochastic growth model for a given set of user supplied parameters. It includes

- the solutions to the model, plots of the solution,
- a summary of the features of the model, a function that covers different types of consumption preferences,
- and a function that computes the moments of a Markov process.


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The function `Markovmoments` computes the expectation, variance, autocovariance and autocorrelation of a Markov process.

**Usage**

```r
Markovmoments(states, ptm, ...)
```

**Arguments**

- `states`: A numerical vector with the states of the Markov process.
- `ptm`: The probability transition matrix, a square matrix of dimension length(states) whose columns sum to one.
- `...`: Additional arguments.

**Value**

It returns a list containing:

- **Expectation**: The mean of the process.
- **Variance**: The variance of the process.
- **Autocovariance**: The autocovariance of the process.
- **Autocorrelation**: The autocorrelation of the process.
- **Stationary distribution**: The stationary distribution of the process, used for the computation of the moments.

**Examples**

```r
a <- c(-1, 1)
A <- matrix(c(0.5, 0.6,
              0.5, 0.4), 2, 2)
Markovmoments(a, A)
```
Description

The sgmodel package provides three important functions: sgmod, util and Markovmoments.

The sgmodel function

The sgmodel function solves a standard stochastic growth model using value function iteration. The stochastic component follows an autoregressive process of order one, and is discretized by a finite state Markov process.

The util function

It computes values for various utility functions encountered in economic theory.

The Markovmoments function

It computes the four moments of a finite state Markov chain: expectation, variance, autocovariance and autocorrelation.

Description

The function plot_sgmod returns a plot of the Savings value of a sgmodel object on the Capital grid value.

Usage

plot_sgmod(x, ...)

Arguments

x           A sgmod object.
...         Additional arguments.

Value

It returns a plot using ggplot that graphs the Savings decisions from the sgmodel object on the Capital grid. The plot shows as many facets as length(Z) where Z is the vector of states of the TFP process.
References


Examples

```r
model <- sgmodel( grid = 100, rho = 0.2, sigma = 0.02)
plot_sgmod(model)
grid <- 200
utiltype <- "CRRA"
utilparam <- 4
A <- 1
depre <- 0.03
discount <- 0.95
prod <- 0.3
states <- 5
m <- 2
rho <- 0.2
sigma <- 0.02
model <- sgmodel(grid, utiltype, utilparam, A, depre, discount, prod, states, m, rho, sigma)
plot_sgmod(model)
```

Description

The function `print.summary_sgmod` prints a summary for a `sgmodel` object.

Usage

```r
## S3 method for class 'summary_sgmod'
print(x, ...)
```

Arguments

- `x`  
  An object of class `sgmod`.

- `...`  
  Additional arguments.

Value

It returns a list with the model parameters. It includes:

- **Utility function**  
  The type of utility function. See the details of `util` for the available types

- **Capital share**  
  The exponent on capital in the Cobb-Douglas production function.

- **Discount factor**  
  The discount factor used in the model.

- **Depreciation**  
  The depreciation rate of capital used in the model.
Rho \hspace{1cm} \text{Autocorrelation of the TFP AR(1) process.}
Sigma \hspace{1cm} \text{Standard deviation of the white noise in the TFP process.}
\textbf{Number of TFP states} \hspace{1cm} \text{Number of states of the TFP process.}

**Examples**

```r
grid <- 200
utiltype <- "CRRA"
utilparam <- 4
A <- 1
depr <- 0.03
discount <- 0.95
prod <- 0.3
states <- 3
m <- 4
rho <- 0.2
sigma <- 0.02
model <- sgmodel(grid, utiltype, utilparam, A, depr, discount, prod, states, m, rho, sigma)
summary_sgmod(model)
```

**Description**

The function `print_sgmod` prints results of the `sgmodel` function.

**Usage**

```r
print_sgmod(x, ...)
```

**Arguments**

- `x` \hspace{1cm} A `sgmodel` object.
- `...` \hspace{1cm} Additional arguments.

**Value**

The function prints the call of the function, the Savings, Consumption and Capital grid vectors from `sgmodel`. 
Examples

```r
grid <- 200
utiltype <- "CRRA"
utilparam <- 4
A <- 1
depre <- 0.03
discount <- 0.95
prod <- 0.3
states <- 3
m <- 5
rho <- 0.2
sigma <- 0.02
model <- sgmodel(grid, utiltype, utilparam, A, depre, discount, prod, states, m, rho, sigma)
print_sgmod(model)
```

sgmodel  

Sgmodel

Description

The function sgmodel computes the solutions to a generic stochastic growth model after discretizing the distribution of the stochastic element.

Usage

```r
sgmodel(grid, utiltype, utilparam, A, depre, discount, prod, states, m, rho, sigma, ...)
```

Arguments

- **grid**: A numerical value, the number of capital grid points to consider for \( k (t) \). Default value set to 1000.
- **utiltype**: The type of preference for the util function. Can be "log", "CRRA", "CARA", "Cobb-Douglas", "CES". See description of util for details. Default type set to "log".
- **utilparam**: Numerical value, preference parameter for the util function. See description of util for details. Default set to 1.
- **A**: Numerical value, preference parameter for the util function. See description of util for details. Default set to 1.
- **depre**: Numerical value for the depreciation parameter. Must be between 0 and 1. Default value set to 1.
- **discount**: Numerical value for the discount factor. Must be (strictly) between 0 and 1. Default value set to 0.95.
- **prod**: Numerical value for the Cobb-Douglas production function. Must be (strictly) between 0 and 1. Default value set to 0.3.
sgmodel

states Numerical value for the number of states of the Markov process approximating
the TFP process. Default value set to 2.

m Numerical value for the Rtauchen function. See description of Rtauchen for
details. Default value set to 3.

rho Autocorrelation of the TFP AR(1) process, used to approximate the process with
a Markov process.

sigma Standard deviation of the white noise in the TFP process, used to approximate
the process with a Markov process.

... Additional arguments.

Value

The function returns a list containing:

Capital grid Vector of values for capital.
Savings Vector of size (grid x States) indicating which coordinates of the capital grid
are the optimal savings decision.
Consumption Vector of size (grid x States) indicating the optimal consumption decisions us-
using the optimal savings decision, and given the capital level of the corresponding
coordinate of Capital grid.
Z States of the TFP process.
PTM The probability transition matrix of the process.
Production parameter The exponent on capital in the Cobb-Douglas production function.
Utility type The type of utility function. See the details of "util" for the available types
Discount factor The discount factor used in the model.
Depreciation The depreciation rate of capital used in the model.
Rho Autocorrelation of the TFP AR(1) process.
Sigma Standard deviation of the white noise in the TFP process.

References

Tauchen G (1986), Finite state markov-chain approximations to univariate and vector autoregres-

Merton R. C (1971), Optimum consumption and portfolio rules in a continuous-time model. Journal
pii/002205317190038X

Examples

model <- sgmodel(grid= 100, rho = 0.2, sigma = 0.02)

grid <- 200
utiltype <- "CRRA"
utilparam <- 4
A <- 1
derepre <- 0.03
discount <- 0.95
prod <- 0.3
states <- 5
m <- 10
rho <- 0.2
sigma <- 0.02
model <- sgmodel(grid, utiltype, utilparam, A, depre, discount, prod, states, m, rho, sigma)

summary_sgmod

Description

The function summary_sgmod prints a summary for results of the sgmodel function.

Usage

summary_sgmod(object, ...)

Arguments

object A sgmodel object.
...

Arguments

... Additional arguments.

Value

It returns a list with the model parameters. It includes:

Utility function
The type of utility function. See the details of util for the available types

Capital share
The exponent on capital in the Cobb-Douglas production function.

Discount factor
The discount factor used in the model.

Depreciation
The depreciation rate of capital used in the model.

Rho
Autocorrelation of the TFP AR(1) process.

Sigma
Standard deviation of the white noise in the TFP process.

Number of TFP states
Number of states of the TFP process.
Examples

```r
grid <- 200
type <- "CRRA"
utilparam <- 4
A <- 1
depre <- 0.03
discount <- 0.95
prod <- 0.3
states <- 3
m <- 3
rho <- 0.2
sigma <- 0.02
model <- sgmodel(grid, utiltype, utilparam, A, depre, discount, prod, states, m, rho, sigma)
summary_sgmod(model)
```

### Description

The function `util` computes values for different types of utility functions and different parameters. See `sgmodel_vignette` for detailed functional forms.

### Usage

```r
util(x, A, prefparam, type = c("log", "CRRA", "CARA", "Cobb-Douglas", "CES"),
     ngoods, ...)
```

### Arguments

- **x**: A numeric vector of length `ngoods` with values to compute utility for.
- **A**: A numerical value that will premultiply the utility function. Default value set to 1.
- **prefparam**: A numerical value, the preference parameter applied to the utility function depending on `type`.
- **type**: A character for the Type of utility function. Can be "log", "CRRA", "CARA", "Cobb-Douglas", "CES". Default type set to "log".
- **ngoods**: Numerical value for the number of goods to consider. Default value set to 1.
- **...**: Additional arguments.

### Value

A numerical value, the utility function evaluated at the arguments.
References


Examples

```r
x <- c(exp(1), exp(1))
A <- 2
type <- "log"
ngoods <- 2
util(x = x, A = A, type = type, ngoods = ngoods)
```
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