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.
Merton, Robert C (1971) <doi:10.1016/0022-0531(71)90038-X>,
Tauchen, George (1986) <doi:10.1016/0165-1765(86)90168-0>,
Wickham, Hadley (2009, ISBN:978-0-387-98140-6).

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Suggests knitr, rmarkdown, testthat

Imports ggplot2, ramify, Rtauchen

VignetteBuilder knitr

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NeedsCompilation no

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R topics documented:

`Markovmoments` *Markovmoments*

Description

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

Usage

```
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

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

`package_sgmodel` *sgmodel: A package for computating the solutions to a generic stochastic growth model.*

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 uility functions encountered in economic theory.

The `Markovmoments` function

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

`plot_sgmod` *plot_sgmod*

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

Wickham H (2009), ggplot2: Elegant Graphics for Data Analysis.

Examples

```
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)
```

---

print.summary_sgmod *print.summary_sgmod*

Description

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

Usage

```
## 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	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

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

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print_sgmod *print_sgmod*

Description

The function print_sgmod prints results of the sgmodel function.

Usage

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

Arguments

x	A sgmodel object.
...	Additional arguments.

Value

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

Examples

```
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

```
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.

states	umerical 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 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 autoregressions. *Economics letters*, **20**(2), 177–181.

Merton R. C (1971), Optimum consumption and portfolio rules in a continuous-time model. *Journal of Economic Theory*, **3**(4), 373–413. URL https://www.sciencedirect.com/science/article/pii/002205317190038X

Examples

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

grid <- 200
utiltype <- "CRRA"
```

```
utilparam <- 4
A <- 1
depre <- 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)
```

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summary_sgmod *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.
...	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

```
grid <- 200
utiltype <- "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)
```

`util` *Util*

Description

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

Usage

```
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

Merton R. C (1971), Optimum consumption and portfolio rules in a continuous-time model. *Journal of Economic Theory*, **3**(4), 373–413. URL https://www.sciencedirect.com/science/article/pii/002205317190038X.

Examples

```
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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