Package ‘NetSimR’

December 2, 2023

Type  Package
Title  Actuarial Functions for Non-Life Insurance Modelling
Version  0.1.5
Author  Yiannis Parizas [aut, cre]
Maintainer  Yiannis Parizas <yiannis.parizas@gmail.com>
Description  Assists actuaries and other insurance modellers in pricing, reserving and capital modelling for non-life insurance and reinsurance modelling. Provides functions that help model excess levels, capping and pure Incurred but not reported claims (pure IBNR).
Includes capped mean, exposure curves and increased limit factor curves (ILFs) for LogNormal, Gamma, Pareto, Sliced LogNormal-Pareto and Sliced Gamma-Pareto distributions.
Includes mean, probability density function (pdf), cumulative probability function (cdf) and inverse cumulative probability function for Sliced LogNormal-Pareto and Sliced Gamma-Pareto distributions.
Includes calculating pure IBNR exposure with LogNormal and Gamma distribution for reporting delay.
Includes three shiny tools, one to simulate insurance claims applying reinsurance structures, fit generalised linear models and fit claims frequency or severity distributions.
Methods used in the package refer to:
Free for All by Yiannis Parizas (2023) <https://www.theactuary.com/2023/03/02/free-all>;
License  GPL-3
Encoding  UTF-8
Imports  rmarkdown, shiny, shinybusy, future.apply, scales, future, methods, DBI, RMySQL, RODBC, RPostgreSQL, RSQLite, plotly, shinyjs, MASS, fitdistrplus, shinyWidgets, Pareto
Suggests knitr, crch, testthat
VignetteBuilder knitr
RoxygenNote 7.2.3
NeedsCompilation no
Repository CRAN
Date/Publication 2023-12-02 08:10:02 UTC

R topics documented:

apply_deductible_limit ........................................... 3
apply_severity_cap .............................................. 4
distributionClass-class .......................................... 4
distribution_fitting_tool_Server ......................... 5
distribution_fitting_tool_UI ............................ 5
dSlicedGammaPareto ................................................ 6
dSlicedLNormPareto ............................................. 7
erf ................................................................. 8
ExposureCurveGamma .............................................. 8
ExposureCurveLNorm ............................................ 9
ExposureCurvePareto ........................................... 10
ExposureCurveSlicedGammaPareto ...................... 10
ExposureCurveSlicedLNormPareto ..................... 11
freq_dist_options ............................................. 12
freq_dist_parameter_placeholders ..................... 12
GammaCappedMean ............................................. 13
GLMFittingToolServer ......................................... 13
GLMFittingToolUI ................................................ 14
IGamma ........................................................... 14
ILFGamma .......................................................... 15
ILFLNorm .......................................................... 15
ILFPareto ......................................................... 16
ILFSlicedGammaPareto ......................................... 17
ILFSlicedLNormPareto ....................................... 18
LNormCappedMean ............................................. 19
max_number_of_pareto_slices ....................... 19
NetSimR ............................................................ 20
ParetoCappedMean ............................................... 21
ParetoCappedMeanCalc ....................................... 21
pSlicedGammaPareto ........................................... 22
pSlicedLNormPareto ............................................ 23
PureIBNRGamma .................................................. 24
PureIBNRLNorm .................................................. 25
qSlicedGammaPareto ............................................ 26
qSlicedLNormPareto ............................................ 27
reinsurance_structures_options ..................... 28
rpareto .......................................................... 28
**apply_deductible_limit**

Apply a deductible and limit to claims

**Description**

Apply a deductible and limit to claims

**Usage**

```r
apply_deductible_limit(
  gross_claims_data,
  reinsurance_structure,
  deductible,
  limit
)
```

**Arguments**

- `gross_claims_data`  
  A vector of Claims.

- `reinsurance_structure`  
  The chosen reinsurance structure. Options are: 'No Reinsurance Structure', 'Unlimited Layer', 'Limited Layer', 'Exclude Layer'.

- `deductible`  
  The deductible of the reinsurance structure.

- `limit`  
  The limit of the reinsurance structure.

**Value**

The ceded claims for the structure, with the chosen deductible and limit.
Examples

apply_deductible_limit(c(100, 50, 20), 'Limited Layer', 40, 20)
apply_deductible_limit(c(100, 50, 20), 'Limited Layer', 10, 30)

apply_severity_cap Apply severity cap function

Description

Apply severity cap function

Usage

apply_severity_cap(claims, severity_cap_boolean, severity_cap_amount)

Arguments

claims A vector of Claims.
severity_cap_boolean A variable that if true, the function will cap the claims, otherwise will just return them.
severity_cap_amount The claim cap value.

Value

If severity_cap_boolean is true, then will return the minimum of severity_cap_amount or claims otherwise will return claims. The operation is vectorised.

distributionClass-class

The class of the distribution objects

Description

The class of the distribution objects
### distribution_fitting_tool_Server

*Server function for the Distribution Fitting tool application*

**Description**

Server function for the Distribution Fitting tool application

**Usage**

`distribution_fitting_tool_Server(input, output, session)`

**Arguments**

- `input`: Input for the server function.
- `output`: Output for the server function.
- `session`: Session for the server function.

**Value**

Returns server rendering for the shiny application.

### distribution_fitting_tool_UI

*UI file for the Shiny glm fitting tool*

**Description**

UI file for the Shiny glm fitting tool

**Usage**

`distribution_fitting_tool_UI`

**Format**

An object of class `shiny.tag.list` (inherits from `list`) of length 4.

**Value**

Returns the UI code for the shiny application.
The probability density function (pdf) of a Sliced Gamma Pareto severity distribution

**Description**

The probability density function (pdf) of a Sliced Gamma Pareto severity distribution

**Usage**

\[ \text{dSlicedGammaPareto}(x, \text{GShape}, \text{GRate}, \text{SlicePoint}, \text{PShape}) \]

**Arguments**

- **x**: A positive real number - the claim amount where the probability density function (pdf) will be evaluated.
- **GShape**: A positive real number - the shape parameter of the attritional Claim Severity’s Gamma distribution.
- **GRate**: A positive real number - the rate parameter of the attritional Claim Severity’s Gamma distribution.
- **SlicePoint**: A positive real number - the slice point and the scale parameter of the tail Claim Severity’s Pareto distribution.
- **PShape**: A positive real number - the shape parameter of the tail Claim Severity’s Pareto distribution.

**Value**

The value of the probability density function (pdf) at \( x \) with an attritional claim Gamma distribution with parameters GShape and GRate and a large claim Pareto distribution with parameters SlicePoint and PShape.

**Examples**

- \( \text{dSlicedGammaPareto}(3000, 1, 0.0005, 1000, 1.2) \)
- \( \text{dSlicedGammaPareto}(1000, 1.1, 0.0006, 2000, 1.6) \)
- \( \text{dSlicedGammaPareto}(2000, 1.2, 0.0004, 3000, 1.4) \)
**dSlicedLNormPareto**  
The probability density function (pdf) of a Sliced LogNormal Pareto severity distribution

---

**Description**

The probability density function (pdf) of a Sliced LogNormal Pareto severity distribution

**Usage**

dSlicedLNormPareto(x, mu, sigma, SlicePoint, shape)

**Arguments**

- **x**: A positive real number - the claim amount where the probability density function (pdf) will be evaluated.
- **mu**: A real number - the first parameter of the attritional Claim Severity’s LogNormal distribution.
- **sigma**: A positive real number - the second parameter of the attritional Claim Severity’s LogNormal distribution.
- **SlicePoint**: A positive real number - the slice point and the scale parameter of the Claim Severity’s Pareto distribution.
- **shape**: A positive real number - the shape parameter of the Claim Severity’s Pareto distribution.

**Value**

The value of the probability density function (pdf) at x with an attritional claim LogNormal distribution with parameters mu and sigma and a large claim Pareto distribution with parameters SlicePoint and shape.

**Examples**

dSlicedLNormPareto(1200, 6, 1.5, 1000, 1.2)  
dSlicedLNormPareto(4000, 7, 1.6, 3000, 1.4)
**erf** \hspace{1cm} *Error function*

---

**Description**

Error function

**Usage**

\[
\text{erf}(x)
\]

**Arguments**

\[
x
\hspace{1cm} \text{A real number.}
\]

**Value**

The value of the error function at \( x \).

**Examples**

\[
\begin{align*}
\text{erf}(0.1) \\
\text{erf}(0.5)
\end{align*}
\]

---

**ExposureCurveGamma** \hspace{1cm} *Exposure Curve from a Gamma severity distribution*

---

**Description**

Exposure Curve from a Gamma severity distribution

**Usage**

\[
\text{ExposureCurveGamma}(x, \text{shape}, \text{rate})
\]

**Arguments**

\[
x
\hspace{1cm} \text{A positive real number - the claim amount where the exposure curve will be evaluated.}
\]

\[
\text{shape}
\hspace{1cm} \text{A positive real number - the shape parameter of the Claim Severity’s Gamma distribution.}
\]

\[
\text{rate}
\hspace{1cm} \text{A positive real number - the rate parameter of the Claim Severity’s Gamma distribution.}
\]
**Value**

The value of the Exposure curve at \( x \) with Claim Severity from a Gamma distribution with parameters \( \text{shape} \) and \( \text{rate} \).

**Examples**

- \( \text{ExposureCurveGamma}(700, 1, 0.0005) \)
- \( \text{ExposureCurveGamma}(1000, 1.5, 0.0006) \)

---

**ExposureCurveLNorm**

*Exposure Curve from LogNormal a severity distribution*

**Description**

Exposure Curve from LogNormal a severity distribution.

**Usage**

\( \text{ExposureCurveLNorm}(x, \mu, \sigma) \)

**Arguments**

- **x**: A positive real number - the claim amount where the exposure curve will be evaluated.
- **\( \mu \)**: A real number - the first parameter of the Claim Severity’s LogNormal distribution.
- **\( \sigma \)**: A positive real number - the second parameter of the Claim Severity’s LogNormal distribution.

**Value**

The value of the Exposure curve at \( x \) with Claim Severity from a LogNormal distribution with parameters \( \mu \) and \( \sigma \).

**Examples**

- \( \text{ExposureCurveLNorm}(2000, 6, 1.5) \)
- \( \text{ExposureCurveLNorm}(1000, 5, 1.6) \)
ExposureCurvePareto

*Exposure Curve from a Pareto severity distribution*

**Description**

Exposure Curve from a Pareto severity distribution

**Usage**

ExposureCurvePareto(x, scale, shape)

**Arguments**

- **x**: A positive real number - the claim amount where the exposure curve will be evaluated.
- **scale**: A positive real number - the scale parameter of the Claim Severity’s Pareto distribution.
- **shape**: A positive real number - the shape parameter of the Claim Severity’s Pareto distribution.

**Value**

The value of the Exposure curve at x with Claim Severity from a Pareto distribution with parameters scale and shape.

**Examples**

ExposureCurvePareto(700,500,1.2)
ExposureCurvePareto(20000,200,1.1)

ExposureCurveSlicedGammaPareto

*Exposure Curve from a Sliced Gamma Pareto severity distribution*

**Description**

Exposure Curve from a Sliced Gamma Pareto severity distribution

**Usage**

ExposureCurveSlicedGammaPareto(x, GShape, GRate, SlicePoint, PShape)
Arguments

x  A positive real number - the claim amount where the exposure curve will be evaluated.
GShape  A positive real number - the shape parameter of the Claim Severity’s Gamma distribution.
GRate  A positive real number - the rate parameter of the Claim Severity’s Gamma distribution.
SlicePoint  A positive real number - the slice point and the scale parameter of the Claim Severity’s Pareto distribution.
PShape  A positive real number - the shape parameter of the Claim Severity’s Pareto distribution.

Value

The value of the Exposure curve at x with an attritional claim Gamma distribution with parameters GShape and GRate and a large claim Pareto distribution with parameters SlicePoint and PShape.

Examples

ExposureCurveSlicedGammaPareto(3000,1,0.0005,1000,1.2)
ExposureCurveSlicedGammaPareto(1000,1.1,0.0006,2000,1.6)
ExposureCurveSlicedGammaPareto(2000,1.2,0.0004,3000,1.4)

ExposureCurveSlicedLNormPareto

Exposure Curve from a Sliced LogNormal Pareto severity distribution

Description

Exposure Curve from a Sliced LogNormal Pareto severity distribution

Usage

ExposureCurveSlicedLNormPareto(x, mu, sigma, SlicePoint, shape)

Arguments

x  A positive real number - the claim amount where the exposure curve will be evaluated.
mu  A real number - the first parameter of the attritional Claim Severity’s LogNormal distribution.
sigma  A positive real number - the second parameter of the attritional Claim Severity’s LogNormal distribution.
SlicePoint  A positive real number - the slice point and the scale parameter of the tail Claim Severity’s Pareto distribution.
shape  A positive real number - the shape parameter of the tail Claim Severity’s Pareto distribution.
Value

The value of the Exposure curve at $x$ with an attritional claim LogNormal distribution with parameters $\mu$ and $\sigma$ and a large claim Pareto distribution with parameters SlicePoint and shape.

Examples

```
ExposureCurveSlicedLNormPareto(1200, 6, 1.5, 1000, 1.2)
ExposureCurveSlicedLNormPareto(4000, 7, 1.6, 3000, 1.4)
```

freq_dist_options  A vector with the frequency distribution objects

Description

A vector with the frequency distribution objects

Usage

freq_dist_options

Format

An object of class list of length 4.

Value

The frequency distribution objects.

freq_dist_parameter_placeholders

Description

A data frame with the frequency distribution parameter placeholders

Usage

freq_dist_parameter_placeholders

Format

An object of class data.frame with 2 rows and 2 columns.

Value

The frequency distribution parameter placeholders.
**GammaCappedMean** *Gamma capped mean*

**Description**
Gamma capped mean

**Usage**
GammaCappedMean(cap, shape, rate)

**Arguments**
cap A positive real number - the claim severity cap.
shape A positive real number - the shape parameter of the Claim Severity’s Gamma distribution.
rate A positive real number - the rate parameter of the Claim Severity’s Gamma distribution.

**Value**
The mean of the claim severity capped at cap with a Gamma distribution with parameters shape and rate.

**Examples**
GammaCappedMean(700, 1, 0.0005)
GammaCappedMean(1000, 1.5, 0.0006)

---

**GLMFittingToolServer** *Server function for the GLM Fitting tool application*

**Description**
Server function for the GLM Fitting tool application

**Usage**
GLMFittingToolServer(input, output, session)

**Arguments**
input Input for the server function.
output Output for the server function.
session Session for the server function.
Value

Returns server rendering for the shiny application.

GLMFittingToolUI

UI file for the Shiny glm fitting tool

Description

UI file for the Shiny glm fitting tool

Usage

GLMFittingToolUI

Format

An object of class shiny.tag.list (inherits from list) of length 4.

Value

Returns the UI code for the shiny application.

IGamma

Lower incomplete gamma function

Description

Lower incomplete gamma function

Usage

IGamma(a, x)

Arguments

<table>
<thead>
<tr>
<th>a</th>
<th>A positive real number.</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>A positive real number.</td>
</tr>
</tbody>
</table>

Value

The value of the lower incomplete gamma function at x with shape parameter a.

Examples

IGamma(1,1)
IGamma(0.1,2)
**ILFGamma**

*Increased Limit Factor Curve from a Gamma severity distribution*

**Description**

Increased Limit Factor Curve from a Gamma severity distribution

**Usage**

`ILFGamma(xLow, xHigh, shape, rate)`

**Arguments**

- `xLow` A positive real number - the claim amount where the Increased Limit Factor Curve will be evaluated from.
- `xHigh` A positive real number - the claim amount where the Increased Limit Factor Curve will be evaluated to.
- `shape` A positive real number - the shape parameter of the Claim Severity’s Gamma distribution.
- `rate` A positive real number - the rate parameter of the Claim Severity’s Gamma distribution.

**Value**

The value of the Increased Limit Factor curve from `xLow` to `xHigh` with Claim Severity from a Gamma distribution with parameters `shape` and `rate`.

**Examples**

```
ILFGamma(1000, 700, 1, 0.0005)
ILFGamma(1200, 1000, 1.5, 0.0006)
```

**ILFLNorm**

*Increased Limit Factor Curve from a LogNormal severity distribution*

**Description**

Increased Limit Factor Curve from a LogNormal severity distribution

**Usage**

`ILFLNorm(xLow, xHigh, mu, sigma)`

**Examples**

```
ILFLNorm(1000, 700, 1, 0.0005)
ILFLNorm(1200, 1000, 1.5, 0.0006)
```
Arguments

- **xLow**: A positive real number - the claim amount where the Increased Limit Factor Curve will be evaluated from.
- **xHigh**: A positive real number - the claim amount where the Increased Limit Factor Curve will be evaluated to.
- **mu**: A real number - the first parameter of the Claim Severity’s LogNormal distribution.
- **sigma**: A positive real number - the second parameter of the Claim Severity’s LogNormal distribution.

Value

The value of the Increased Limit Factor curve from xLow to xHigh with Claim Severity from a LogNormal distribution with parameters mu and sigma.

Examples

- `ILFLNorm(1000,2000,6,1.5)`
- `ILFLNorm(1000,1500,5,1.6)`

**Description**

Increased Limit Factor Curve from a Pareto severity distribution

**Usage**

`ILFPareto(xLow, xHigh, scale, shape)`

Arguments

- **xLow**: A positive real number - the claim amount where the Increased Limit Factor Curve will be evaluated from.
- **xHigh**: A positive real number - the claim amount where the Increased Limit Factor Curve will be evaluated to.
- **scale**: A positive real number - the scale parameter of the Claim Severity’s Pareto distribution.
- **shape**: A positive real number - the shape parameter of the Claim Severity’s Pareto distribution.

Value

The value of the Increased Limit Factor curve from xLow to xHigh with Claim Severity from a Pareto distribution with parameters scale and shape.
ILFSlicedGammaPareto

**Examples**

ILFPareto(700,1200,500,1.2)
ILFPareto(1200,20000,200,1.1)

---

ILFSlicedGammaPareto  *Increased Limit Factor Curve from a Sliced Gamma Pareto severity distribution*

---

**Description**

Increased Limit Factor Curve from a Sliced Gamma Pareto severity distribution

**Usage**

ILFSlicedGammaPareto(xLow, xHigh, GShape, GRate, SlicePoint, PShape)

**Arguments**

- **xLow**: A positive real number - the claim amount where the Limit Factor Curve will be evaluated from.
- **xHigh**: A positive real number - the claim amount where the Limit Factor Curve will be evaluated to.
- **GShape**: A positive real number - the shape parameter of the attritional Claim Severity’s Gamma distribution.
- **GRate**: A positive real number - the rate parameter of the attritional Claim Severity’s Gamma distribution.
- **SlicePoint**: A positive real number - the slice point and the scale parameter of the tail Claim Severity’s Pareto distribution.
- **PShape**: A positive real number - the shape parameter of the tail Claim Severity’s Pareto distribution.

**Value**

The value of the Increased Limit Factor curve from xLow to xHigh with an attritional claim Gamma distribution with parameters GShape and GRate and a large claim Pareto distribution with parameters SlicePoint and PShape.

**Examples**

ILFSlicedGammaPareto(2000,3000,1,0.0005,1000,1.2)
ILFSlicedGammaPareto(800,1000,1.1,0.0006,2000,1.6)
ILFSlicedGammaPareto(1200,2000,1.2,0.0004,3000,1.4)
**ILFSlicedLNormPareto**  
*Increased Limit Factor Curve from a Sliced LogNormal Pareto severity distribution*

### Description

Increased Limit Factor Curve from a Sliced LogNormal Pareto severity distribution

### Usage

\[
\text{ILFSlicedLNormPareto}(x_{\text{Low}}, x_{\text{High}}, \mu, \sigma, \text{SlicePoint}, \text{shape})
\]

### Arguments

- **xLow**: A positive real number - the claim amount where the Limit Factor Curve will be evaluated from.
- **xHigh**: A positive real number - the claim amount where the Limit Factor Curve will be evaluated to.
- **\(\mu\)**: A real number - the first parameter of the attritional Claim Severity’s LogNormal distribution.
- **\(\sigma\)**: A positive real number - the second parameter of the attritional Claim Severity’s LogNormal distribution.
- **SlicePoint**: A positive real number - the slice point and the scale parameter of the tail Claim Severity’s Pareto distribution.
- **shape**: A positive real number - the shape parameter of the tail Claim Severity’s Pareto distribution.

### Value

The value of the Increased Limit Factor curve from \(x_{\text{Low}}\) to \(x_{\text{High}}\) with an attritional claim LogNormal distribution with parameters \(\mu\) and \(\sigma\) and a large claim Pareto distribution with parameters \(\text{SlicePoint}\) and \(\text{shape}\).

### Examples

- \[
\text{ILFSlicedLNormPareto}(800,1200,6,1.5,1000,1.2)
\]
- \[
\text{ILFSlicedLNormPareto}(2000,4000,7,1.6,3000,1.4)
\]
LNormCappedMean

Lognormal capped mean

Description
Lognormal capped mean

Usage
LNormCappedMean(cap, mu, sigma)

Arguments
- **cap**: A positive real number - the claim severity cap.
- **mu**: A real number - the first parameter of the Claim Severity’s LogNormal distribution.
- **sigma**: A positive real number - the second parameter of the Claim Severity’s LogNormal distribution.

Value
The mean of the claim severity capped at cap with a LogNormal distribution with parameters mu and sigma.

Examples
LNormCappedMean(2000, 6, 1.5)
LNormCappedMean(1000, 5, 1.6)

max_number_of_pareto_slices
Parameter to set the maximum number of pareto slices

Description
Parameter to set the maximum number of pareto slices

Usage
max_number_of_pareto_slices

Format
An object of class numeric of length 1.

Value
The the maximum number of Pareto Slices.
NetSimR: A non-life insurance package for computing various statistics.

Description

The NetSimR package provides three categories of functions:

1. Capped means, Exposure and ILF curve from various severity distributions
2. Pure IBNR and UPR earned periods
3. Sliced distributions

NetSimR mean functions

SlicedGammaParetoMean SlicedLNormParetoMean

NetSimR capped mean functions

GammaCappedMean LNormCappedMean ParetoCappedMean SlicedGammaParetoCappedMean SlicedLNormParetoCappedMean

NetSimR exposure curve functions

ExposureCurveGamma ExposureCurveLNorm ExposureCurvePareto ExposureCurveSlicedGammaPareto ExposureCurveSlicedLNormPareto

NetSimR ILF curve functions

ILFGamma ILFLNorm ILFPareto ILFSlicedGammaPareto ILFSlicedLNormPareto

NetSimR pure IBNR functions

PureIBNRGamma PureIBNRLNorm

NetSimR Sliced distribution functions

dSlicedGammaPareto dSlicedLNormPareto pSlicedGammaPareto pSlicedLNormPareto qSlicedGammaPareto qSlicedLNormPareto
ParetoCappedMean

Description
Pareto capped mean

Usage
ParetoCappedMean(cap, scale, shape)

Arguments
- cap: A positive real number - the claim severity cap.
- scale: A positive real number - the scale parameter of the Claim Severity’s Pareto distribution.
- shape: A positive real number - the shape parameter of the Claim Severity’s Pareto distribution.

Value
The mean of the claim severity capped at cap with a Pareto distribution with parameters scale and shape.

Examples
ParetoCappedMean(600, 200, 1.2)
ParetoCappedMean(800, 100, 1)
ParetoCappedMean(1000, 500, 0.8)

ParetoCappedMeanCalc

Description
Pareto capped mean intermediary calculation

Usage
ParetoCappedMeanCalc(cap, scale, shape)
Arguments

cap A positive real number - the claim severity cap.
scale A positive real number - the scale parameter of the Claim Severity’s Pareto distribution.
shape A positive real number - the shape parameter of the Claim Severity’s Pareto distribution.

Value

An interim calculation for the mean of the claim severity capped at cap with a Pareto distribution with parameters scale and shape.

Examples

ParetoCappedMeanCalc(800,100,1.1)
ParetoCappedMeanCalc(1000,500,0.9)

pSlicedGammaPareto The cumulative density function (cdf) of a Sliced Gamma-Pareto severity distribution

Description

The cumulative density function (cdf) of a Sliced Gamma-Pareto severity distribution

Usage

pSlicedGammaPareto(x, GShape, GRate, SlicePoint, PShape)

Arguments

x A positive real number - the claim amount where the cumulative density function (cdf) will be evaluated.
GShape A positive real number - the shape parameter of the attritional Claim Severity’s Gamma distribution.
GRate A positive real number - the rate parameter of the attritional Claim Severity’s Gamma distribution.
SlicePoint A positive real number - the slice point and the scale parameter of the tail Claim Severity’s Pareto distribution.
PShape A positive real number - the shape parameter of the tail Claim Severity’s Pareto distribution.

Value

The value of the cumulative density function (cdf) at x with an attritional claim Gamma distribution with parameters GShape and GRate and a large claim Pareto distribution with parameters SlicePoint and PShape.
**Examples**

```
pSlicedGammaPareto(3000,1,0.0005,1000,1.2)
pSlicedGammaPareto(1000,1.1,0.0006,2000,1.6)
pSlicedGammaPareto(2000,1.2,0.0004,3000,1.4)
```

---

**pSlicedLNormPareto**

*The cumulative density function (cdf) of a Sliced LogNormal Pareto severity distribution*

---

**Description**

The cumulative density function (cdf) of a Sliced LogNormal Pareto severity distribution

**Usage**

```
pSlicedLNormPareto(x, mu, sigma, SlicePoint, shape)
```

**Arguments**

- **x**: A positive real number - the claim amount where the cumulative density function (cdf) will be evaluated.
- **mu**: A real number - the first parameter of the attritional Claim Severity’s LogNormal distribution.
- **sigma**: A positive real number - the second parameter of the attritional Claim Severity’s LogNormal distribution.
- **SlicePoint**: A positive real number - the slice point and the scale parameter of the tail Claim Severity’s Pareto distribution.
- **shape**: A positive real number - the shape parameter of the tail Claim Severity’s Pareto distribution.

**Value**

The value of the cumulative density function (cdf) at \( x \) with an attritional claim LogNormal distribution with parameters \( \mu \) and \( \sigma \) and a large claim Pareto distribution with parameters \( \text{SlicePoint} \) and \( \text{shape} \).

**Examples**

```
pSlicedLNormPareto(1200,6,1.5,1000,1.2)
pSlicedLNormPareto(4000,7,1.6,3000,1.4)
```
PureIBNRGamma

**Pure IBNR exposure from a Gamma reporting delay distribution**

**Description**

Pure IBNR exposure from a Gamma reporting delay distribution

**Usage**

PureIBNRGamma(IncDate, ExpDate, ValDate, shape, rate)

**Arguments**

- **IncDate**
  A date - the inception date of the period.

- **ExpDate**
  A date - the expiry date of the period. Must be greater than inception date.

- **ValDate**
  A date - the valuation date.

- **shape**
  A positive real number - the shape parameter of the reporting delay’s Gamma distribution.

- **rate**
  A positive real number - the rate parameter of the reporting delay’s Gamma distribution.

**Value**

Unearned and Pure IBNR exposure in days and as a percentage of the period’s duration, where the reporting delay has a Gamma distribution with parameters shape and rate.

**Examples**

```r
Dates = data.frame(
  inceptionDate = c("01/01/2006", "01/07/2006", "01/01/2007"),
  expiryDate = c("31/12/2006", "30/06/2007", "31/12/2007")
)
Dates$inceptionDate<-as.POSIXct(Dates$inceptionDate, format="%d/%m/%Y")
Dates$expiryDate<-as.POSIXct(Dates$expiryDate, format="%d/%m/%Y")
ValuationDate<-as.POSIXct("30/10/2007", format="%d/%m/%Y")
PureIBNRGamma(Dates$inceptionDate,Dates$expiryDate,ValuationDate,7,0.15)
```
PureIBNRLNorm

Pure IBNR exposure from a LogNormal reporting delay distribution

Description

Pure IBNR exposure from a LogNormal reporting delay distribution

Usage

PureIBNRLNorm(IncDate, ExpDate, ValDate, mu, sigma)

Arguments

IncDate A date - the inception date of the period.
ExpDate A date - the expiry date of the period. Must be greater than inception date.
ValDate A date - the valuation date.
mu A real number - the first parameter of the reporting delay’s LogNormal distribution.
sigma A positive real number - the second parameter of the reporting delay’s LogNormal distribution.

Value

Unearned and Pure IBNR exposure in days and as a percentage of the period’s duration, where the reporting delay has a LogNormal distribution with parameters mu and sigma.

Examples

Dates = data.frame(
  inceptionDate = c("01/01/2006", "01/07/2006", "01/01/2007"),
  expiryDate = c("31/12/2006", "30/06/2007", "31/12/2007")
)
Dates$inceptionDate<-as.POSIXct(Dates$inceptionDate, format="%d/%m/%Y")
DatesexpiryDate<-as.POSIXct(DatesexpiryDate, format="%d/%m/%Y")
ValuationDate<-as.POSIXct("30/10/2007", format="%d/%m/%Y")
PureIBNRLNorm(Dates$inceptionDate, DatesexpiryDate, ValuationDate, 4, 1.5)
The inverse cumulative density function of a Sliced Gamma Pareto severity distribution

Description

The inverse cumulative density function of a Sliced Gamma Pareto severity distribution

Usage

qSlicedGammaPareto(q, GShape, GRate, SlicePoint, PShape)

Arguments

q A real number between 0 and 1 - the probability where the inverse cumulative density function will be evaluated.
GShape A positive real number - the shape parameter of the attritional Claim Severity’s Gamma distribution.
GRate A positive real number - the rate parameter of the attritional Claim Severity’s Gamma distribution.
SlicePoint A positive real number - the slice point and the scale parameter of the tail Claim Severity’s Pareto distribution.
PShape A positive real number - the shape parameter of the tail Claim Severity’s Pareto distribution.

Value

The value of the inverse cumulative density function at q with an attritional claim Gamma distribution with parameters GShape and GRate and a large claim Pareto distribution with parameters SlicePoint and PShape.

Examples

qSlicedGammaPareto(0.5, 1, 0.0005, 1000, 1.2)
qSlicedGammaPareto(0.2, 1.1, 0.0006, 2000, 1.6)
qSlicedGammaPareto(0.8, 1.2, 0.0004, 3000, 1.4)
qSlicedLNormPareto

The inverse cumulative density function of a Sliced LogNormal Pareto severity distribution

Description

The inverse cumulative density function of a Sliced LogNormal Pareto severity distribution

Usage

qSlicedLNormPareto(q, mu, sigma, SlicePoint, shape)

Arguments

q A real number between 0 and 1 - the probability where the inverse cumulative density function will be evaluated.

mu A real number - the first parameter of the attritional Claim Severity’s LogNormal distribution.

sigma A positive real number - the second parameter of the attritional Claim Severity’s LogNormal distribution.

SlicePoint A positive real number - the slice point and the scale parameter of the tail Claim Severity’s Pareto distribution.

shape A positive real number - the shape parameter of the tail Claim Severity’s Pareto distribution.

Value

The value of the inverse cumulative density function at q with an attritional claim LogNormal distribution with parameters mu and sigma and a large claim Pareto distribution with parameters SlicePoint and shape.

Examples

qSlicedLNormPareto(0.5, 6, 1.5, 1000, 1.2)
qSlicedLNormPareto(0.7, 7, 1.6, 3000, 1.4)
reinsurance_structures_options

A vector with the reinsurance structure options

Description

A vector with the reinsurance structure options

Usage

reinsurance_structures_options

Format

An object of class character of length 4.

Value

The reinsurance structure options

rpareto  

Random Pareto generator

Description

Random Pareto generator

Usage

rpareto(n, alpha, x_m)

Arguments

n  
Number of values to generate.

alpha  
A positive real number. Alpha parameter of the Pareto distribution.

x_m  
A positive real number. The minimum value for the Pareto distribution.

Value

A vector of n random Pareto variables with parameters alpha and x_m.
**run_shiny_distribution_fitting_tool**

* A function to run the glm fitting tool application

**Description**

A function to run the glm fitting tool application

**Usage**

run_shiny_distribution_fitting_tool()

**Value**

Opens the glm fitting tool application

---

**run_shiny_glm_fitting_tool**

* A function to run the glm fitting tool application

**Description**

A function to run the glm fitting tool application

**Usage**

run_shiny_glm_fitting_tool()

**Value**

Opens the glm fitting tool application

---

**run_shiny_simulator**

* A function to run the shiny simulator application

**Description**

A function to run the shiny simulator application

**Usage**

run_shiny_simulator()

**Value**

Opens the shiny simulator application
sev_dist_options

A vector with the severity distribution objects

Description
A vector with the severity distribution objects

Usage
sev_dist_options

Format
An object of class list of length 6.

Value
The severity distribution objects.

sev_dist_parameter_placeholders

A data frame with the severity distribution parameter placeholders

Description
A data frame with the severity distribution parameter placeholders

Usage
sev_dist_parameter_placeholders

Format
An object of class data.frame with 2 rows and 2 columns.

Value
The severity distribution parameter placeholders.
shiny_simulator_server

*Server function for the Shiny Simulator application*

**Description**
Server function for the Shiny Simulator application

**Usage**
```
shiny_simulator_server(input, output, session)
```

**Arguments**
- `input`: Input for the server function.
- `output`: Output for the server function.
- `session`: Session for the server function.

**Value**
Returns server rendering for the shiny application.

---

shiny_simulator_ui

*UI file for the Shiny GLM Fitting Tool*

**Description**
UI file for the Shiny GLM Fitting Tool

**Usage**
```
shiny_simulator_ui
```

**Format**
An object of class `shiny.tag.list` (inherits from `list`) of length 4.

**Value**
Returns the UI code for the shiny application.
simulate_function

A function to simulate frequency - severity of insurance claims. The function applies severity cap, reinsurance structure for each and every loss claim, reinsurance structure for each and aggregate claims. The function allows for piecewise pareto slices.

Description

A function to simulate frequency - severity of insurance claims. The function applies severity cap, reinsurance structure for each and every loss claim, reinsurance structure for each and aggregate claims. The function allows for piecewise pareto slices.

Usage

```r
simulate_function(
  numOfSimulations,
  freq_params,
  sev_params,
  seedSetBinary,
  seedValue,
  freqDistr,
  sevDistr,
  paretoSlice,
  pareto_slice_times,
  slice_pareto_alphas,
  slice_pareto_x_ms,
  sevCapBinary,
  sev_cap_amount,
  reinsuranceStructureEEL,
  reinsurance_structure_eel_deductible_amount,
  reinsurance_structure_eel_limit_amount,
  reinsuranceStructureAL,
  reinsurance_structure_al_deductible_amount,
  reinsurance_structure_al_limit_amount,
  reinsuranceStructureLimitedReinstatements,
  reinsuranceStructureReinstatementLimit,
  multiprocessing
)
```

Arguments

- `numOfSimulations`: The number of simulations to run.
- `freq_params`: A vector of the frequency distribution parameters.
- `sev_params`: A vector of the severity distribution parameters.
- `seedSetBinary`: True if there is a fixed seed, otherwise false.
SlicedGammaParetoCappedMean

seedValue  The seed value.
freqDistr  The frequency distribution. Options are as per the freq_dist_options.
sevDistr  The severity distribution. Options are as per the sev_dist_options.
paretoSlice  True if there is Pareto slicing.
pareto_slice_times  The number of Pareto slices.
slice_pareto_alphas  A vector of Pareto slices’ alpha parameters.
slice_pareto_x_ms  A vector of Pareto slices’ x_m parameters.
sevCapBinary  True if there is a severity cap.
sev_cap_amount  The severity cap amount.
reinsuranceStructureEEL  The chosen reinsurance structure for each and every loss claim.
reinsurance_structure_eel_deductible_amount  The deductible for each and every loss reinsurance structure.
reinsurance_structure_eel_limit_amount  The limit for each and every loss reinsurance structure.
reinsuranceStructureAL  The chosen reinsurance structure for aggregate claims.
reinsurance_structure_al_deductible_amount  The deductible for aggregate reinsurance structure.
reinsurance_structure_al_limit_amount  The limit for aggregate reinsurance structure.
reinsuranceStructureLimitedReinstatements  True if there is a limit in reinstatements, otherwise false.
reinsuranceStructureReinstatementLimit  The reinstatement limit.
multiprocessing  True if multiprocessing is used, otherwise false.

Value
A data frame with claims counts, ceded claims and the number of reinstatements used.

SlicedGammaParetoCappedMean

Sliced Gamma Pareto capped mean

Description
Sliced Gamma Pareto capped mean
Usage

SlicedGammaParetoCappedMean(cap, GShape, GRate, SlicePoint, PShape)

Arguments

cap
A positive real number - the claim severity cap.

GShape
A positive real number - the shape parameter of the attritional Claim Severity’s Gamma distribution.

GRate
A positive real number - the rate parameter of the attritional Claim Severity’s Gamma distribution.

SlicePoint
A positive real number - the slice point and the scale parameter of the tail Claim Severity’s Pareto distribution.

PShape
A positive real number - the shape parameter of the tail Claim Severity’s Pareto distribution.

Value

The mean of the claim severity capped at cap with an attritional claim Gamma distribution with parameters GShape and GRate and a large claim Pareto distribution with parameters SlicePoint and PShape.

Examples

SlicedGammaParetoCappedMean(3000,1,0.0005,1000,1.2)
SlicedGammaParetoCappedMean(1000,1.1,0.0006,2000,1.6)
SlicedGammaParetoCappedMean(2000,1.2,0.0004,3000,1.4)

SlicedGammaParetoMean

Sliced Gamma Pareto mean

Description

Sliced Gamma Pareto mean

Usage

SlicedGammaParetoMean(GShape, GRate, SlicePoint, PShape)

Arguments

GShape
A positive real number - the shape parameter of the attritional Claim Severity’s Gamma distribution.

GRate
A positive real number - the rate parameter of the attritional Claim Severity’s Gamma distribution.

SlicePoint
A positive real number - the slice point and the scale parameter of the tail Claim Severity’s Pareto distribution.

PShape
A positive real number - the Shape parameter of the tail Claim Severity’s Pareto distribution.
**Value**

The mean of the claim severity with an attritional claim Gamma distribution with parameters \( \text{GShape} \) and \( \text{GRate} \) and a large claim Pareto distribution with parameters \( \text{SlicePoint} \) and \( \text{PShape} \).

**Examples**

SlicedGammaParetoMean(1,0.0005,1000,1.2)
SlicedGammaParetoMean(1.1,0.0006,2000,1.6)
SlicedGammaParetoMean(1.2,0.0004,3000,1.4)

---

**Description**

*Sliced LogNormal Pareto capped mean*

**Usage**

\[
\text{SlicedLNormParetoCappedMean}(\text{cap}, \mu, \sigma, \text{SlicePoint}, \text{shape})
\]

**Arguments**

- **cap**: A positive real number - the claim severity cap.
- **\( \mu \)**: A real number - the first parameter of the attritional Claim Severity’s LogNormal distribution.
- **\( \sigma \)**: A positive real number - the second parameter of the attritional Claim Severity’s LogNormal distribution.
- **\( \text{SlicePoint} \)**: A positive real number - the slice point and the scale parameter of the tail Claim Severity’s Pareto distribution.
- **\( \text{shape} \)**: A positive real number - the shape parameter of the tail Claim Severity’s Pareto distribution.

**Value**

The mean of the claim severity capped at \( \text{cap} \) with an attritional claim LogNormal distribution with parameters \( \mu \) and \( \sigma \) and a large claim Pareto distribution with parameters \( \text{SlicePoint} \) and \( \text{shape} \).

**Examples**

SlicedLNormParetoCappedMean(1200,6,1.5,1000,1.2)
SlicedLNormParetoCappedMean(2500,6.5,1.4,2000,1.6)
SlicedLNormParetoCappedMean(4000,7,1.6,3000,1.4)
**SlicedLNormParetoMean**  
*Sliced LogNormal Pareto mean*

**Description**
Sliced LogNormal Pareto mean

**Usage**
```
SlicedLNormParetoMean(mu, sigma, SlicePoint, shape)
```

**Arguments**

- **mu**
  A real number - the first parameter of the attritional Claim Severity’s LogNormal distribution.

- **sigma**
  A positive real number - the second parameter of the attritional Claim Severity’s LogNormal distribution.

- **SlicePoint**
  A positive real number - the slice point and the scale parameter of the tail Claim Severity’s Pareto distribution.

- **shape**
  A positive real number - the shape parameter of the tail Claim Severity’s Pareto distribution.

**Value**
The mean of the claim severity with an attritional claim LogNormal distribution with parameters `mu` and `sigma` and a large claim Pareto distribution with parameters `SlicePoint` and `shape`.

**Examples**

```r
SlicedLNormParetoMean(6, 1.5, 1000, 1.2)
SlicedLNormParetoMean(6.5, 1.4, 2000, 1.6)
SlicedLNormParetoMean(7, 1.6, 3000, 1.4)
```
Index

* datasets
  distribution_fitting_tool_UI, 5
  freq_dist_options, 12
  freq_dist_parameter_placeholders, 12
  GLMFittingToolUI, 14
  max_number_of_pareto_slices, 19
  reinsurance_structures_options, 28
  sev_dist_options, 30
  sev_dist_parameter_placeholders, 30
  shiny_simulator_ui, 31
  apply_deductible_limit, 3
  apply_severity_cap, 4
  distribution_fitting_tool_Server, 5
  distribution_fitting_tool_UI, 5
  distributionClass (distributionClass-class), 4
distributionClass-class, 4
dSlicedGammaPareto, 6, 20
dSlicedLNormPareto, 7, 20
erf, 8
ExposureCurveGamma, 8, 20
ExposureCurveLNorm, 9, 20
ExposureCurvePareto, 10, 20
ExposureCurveSlicedGammaPareto, 10, 20
ExposureCurveSlicedLNormPareto, 11, 20
freq_dist_options, 12
freq_dist_parameter_placeholders, 12
GammaCappedMean, 13, 20
GLMFittingToolServer, 13
GLMFittingToolUI, 14
ILFGamma, 14
ILFLNorm, 15, 20
ILFPareto, 16, 20
ILFSlicedGammaPareto, 17, 20
ILFSlicedLNormPareto, 18, 20
LNormCappedMean, 19, 20
max_number_of_pareto_slices, 19
NetSimR, 20
ParetoCappedMean, 20, 21
ParetoCappedMeanCalc, 21
pSlicedGammaPareto, 20, 22
pSlicedLNormPareto, 20, 23
PureIBNRGamma, 20, 24
PureIBNRLNorm, 20, 25
qSlicedGammaPareto, 20, 26
qSlicedLNormPareto, 20, 27
reinsurance_structures_options, 28
rpareto, 28
run_shiny_distribution_fitting_tool, 29
run_shiny_glm_fitting_tool, 29
run_shiny_simulator, 29
sev_dist_options, 30
sev_dist_parameter_placeholders, 30
shiny_simulator_server, 31
shiny_simulator_ui, 31
simulate_function, 32
SlicedGammaParetoCappedMean, 20, 33
SlicedGammaParetoMean, 20, 34
SlicedLNormParetoCappedMean, 20, 35
SlicedLNormParetoMean, 20, 36