Package 'mbbefd'

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Type Package

Title Maxwell Boltzmann Bose Einstein Fermi Dirac Distribution and Destruction Rate Modelling

Version 0.7

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Description Distributions that are typically used for exposure rating in general insurance, in particular to price reinsurance contracts. The vignettes show code snippets to fit the distribution to empirical data.

License GPL-2

Depends R (>= 2.14), actuar, gsl

ByteCompile yes

Suggests testthat, copula, fitdistrplus, pander, knitcitations, rmarkdown, knitr, lattice

LinkingTo Rcpp

Imports Rcpp

URL http://github.com/spedygiorgio/mbbefd

BugReports http://github.com/spedygiorgio/mbbefd/issues

VignetteBuilder knitr

NeedsCompilation yes

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R topics documented:

`mbbefd-package` *MBBEFD distribution and exposure curve*

Description

It contains the definition of MBBEFD distribution (distribution function, density, quantile functions) as well as MBBEFD exposure curve. The vignette shows code snippets to fit the distribution to empirical data.

Details

Package:	mbbefd
Type:	Package
Version:	0.6.3
Date:	2015-03-29
License:	GPL 2

Author(s)

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References

BERNEGGER, STEFAN. THE SWISS RE EXPOSURE CURVES AND THE MBBEFD DISTRIBUTION CLASS. Astin Bulletin (1997): 99.

Examples

```
#sample variates
losses<-rmbbefd(n=10,a=0.2,b=0.04)
```

`eecf` *Empirical Exposure Curve Function*

Description

Compute an empirical exposure curve function.

Usage

```
eecf(x)
```

Arguments

`x`	numeric vector of the observations for `eecf`; for the methods, an object of class `"eecf"`.

Details

TODO!

Value

A numeric value or a vector.

Author(s)

Dutang Christophe

References

TODO

See Also

`mbbefdExposure`.

Examples

```
#TODO
```

`etl` *Empirical total loss*

Description

Compute the empirical total loss.

Usage

```
etl(x)
```

Arguments

`x`	numeric vector of the observations.

Details

TODO!

Value

A numeric value or a vector.

Author(s)

Dutang Christophe

References

TODO

Examples

```
#TODO
```

g2a *Get a parameter known g and b*

Description

g2a returns the a parameter known g and b

Usage

```
g2a(g, b)
```

Arguments

g	the g parameter
b	the b parameter

Value

a real value

Examples

```
g2a(10,2)
```

mbbefd-distr *The MBBEFD distribution (two parametrizations)*

Description

These functions perform probabilistic analysis as well as random sampling on the MBBEFD distribution.

Usage

```
rmbbefd(n, a, b, g)

dmbbefd(x, a, b, g)

qmbbefd(p, a, b, g)

pmbbefd(q, a, b, g)


dmbbefdR(x, a, b, log=FALSE)
pmbbefdR(q, a, b, lower.tail = TRUE, log.p = FALSE)
```

```
qmbbefdR(p, a, b, lower.tail = TRUE, log.p = FALSE)
rmbbefdR(n, a, b)
ecmbbefdR(x, a, b)
mmbbefdR(order, a, b)
tlmbbefdR(a, b)

dMBBEFDR(x, g, b, log=FALSE)
pMBBEFDR(q, g, b, lower.tail = TRUE, log.p = FALSE)
qMBBEFDR(p, g, b, lower.tail = TRUE, log.p = FALSE)
rMBBEFDR(n, g, b)
ecMBBEFDR(x, g, b)
mMBBEFDR(order, g, b)
tlMBBEFDR(g, b)
```

Arguments

`x, q`	vector of quantiles.
`p`	vector of probabilities.
`n`	number of observations. If `length(n) > 1`, the length is take to be the number required.
`a, b, g`	shape parameters. For `.mbbefd` functions, `g` is computed from `a`.
`order`	order of the raw moment.
`log, log.p`	logical; if `TRUE`, probabilities `p` are given as log(p).
`lower.tail`	logical; if `TRUE` (default), probabilities are $P[X <= x]$, otherwise, $P[X > x]$.

Details

it shall be remebered that $g = \frac{1}{p_1} = \frac{a+b}{(a+1)*b}$.

Value

A numeric value or a vector.

Author(s)

Giorgio Spedicato, Dutang Christophe

References

BERNEGGER, STEFAN. THE SWISS RE EXPOSURE CURVES AND THE MBBEFD DISTRIBUTION CLASS. Astin Bulletin (1997): 99.

See Also

`swissRe`, `mbbefdExposure`

Examples

```
#few examples of the functions
aPar=0.2
bPar=0.04
rmbbefd(n=1000,a=aPar,b=bPar) #for random generation
qmbbefd(p=0.7,a=aPar,b=bPar) #for quantiles
dmbbefd(x=0.5,b=.04,g=20) #for density
pmbbefd(q=0.5,b=.04,g=20) #for distribution function
```

`mbbefdExposure` *MBBEFD exposure curves and its derivative*

Description

The functions evaluate MBBEFD distribution exposure curve (and its derivative). An exposure curve is defined between x between 0 and 1 and represents the ratio of the limited expected value to unlimited expected value

Usage

```
mbbefdExposure(x, a, b, g)
dG(x, a, b, g)

ecbeta(x, shape1, shape2)
ecunif(x, min = 0, max =1)
```

Arguments

`x`	x value, percentage of damage to total loss
`a`	a parameter
`b`	b parameter
`g`	g parameter, used if a not given.
`shape1, shape2`	parameters for the beta distribution.
`min, max`	parameters for the uniform distribution.

Details

g parameter is the inverse of total loss probability and it is used if a not given.

`ecbeta`, `ecunif` is the theoretical exposure curve function for beta and uniform distribution.

Value

A numeric value

Author(s)

Giorgio Spedicato

References

BERNEGGER, STEFAN. THE SWISS RE EXPOSURE CURVES AND THE MBBEFD DISTRIBUTION CLASS. Astin Bulletin (1997): 99.

See Also

dmbbefd, swissRe

Examples

```
mbbefdExposure(x=0.2,b=0.04,g=20)
```

---

oibeta *One-inflated beta distribution*

Description

These functions perform probabilistic analysis as well as random sampling on one-inflated beta distribution.

Usage

```
doibeta(x, shape1, shape2, p1, ncp=0, log=FALSE)
poibeta(q, shape1, shape2, p1, ncp=0, lower.tail = TRUE, log.p = FALSE)
qoibeta(p, shape1, shape2, p1, ncp=0, lower.tail = TRUE, log.p = FALSE)
roibeta(n, shape1, shape2, p1, ncp=0)
ecoibeta(x, shape1, shape2, p1, ncp=0)
moibeta(order, shape1, shape2, p1, ncp=0)
```

Arguments

x, q	vector of quantiles.
p	vector of probabilities.
n	number of observations. If length(n) > 1, the length is take to be the number required.
p1, shape1, shape2, ncp	parameters.
order	order of the raw moment.
log, log.p	logical; if TRUE, probabilities p are given as log(p).
lower.tail	logical; if TRUE (default), probabilities are $P[X <= x]$, otherwise, $P[X > x]$.

Details

`d,p,q,ec,m-oibeta` functions computes the density function, the distribution function, the quantile function, the exposure curve function and raw moments of the one-inflated beta distribution. `roibeta` generates random variates of this distribution.

Value

A numeric value or a vector.

Author(s)

Dutang Christophe

See Also

`mbbefd-distr` and `oidistribution`.

Examples

```
#TODO
```

`oidistribution` *One-inflated distributions*

Description

These functions perform probabilistic analysis as well as random sampling on one-inflated distributions.

Usage

```
doifun(x, dfun, p1, log=FALSE, ...)
poifun(q, pfun, p1, lower.tail = TRUE, log.p = FALSE, ...)
qoifun(p, qfun, p1, lower.tail = TRUE, log.p = FALSE, ...)
roifun(n, rfun, p1, ...)
ecoifun(x, ecfun, mfun, p1, ...)
moifun(order, mfun, p1, ...)
```

Arguments

`x, q`	vector of quantiles.
`p`	vector of probabilities.
`n`	number of observations. If `length(n) > 1`, the length is take to be the number required.

dfun, pfun, qfun, rfun	d, p, q, r functions of the original distribution.
p1	parameter for the probability at x=1.
ecfun, mfun	exposure curve and moment functions which should have arguments x, ... and order, ... respectively.
order	order of the raw moment.
log, log.p	logical; if TRUE, probabilities p are given as log(p).
lower.tail	logical; if TRUE (default), probabilities are $P[X <= x]$, otherwise, $P[X > x]$.
...	further arguments to pass to dfun, pfun, qfun, rfun, ecfun, mfun.

Details

d,p,q,ec,m functions of oifun computes the density function, the distribution function, the quantile function, the exposure curve function and raw moments of an one-inflated distribution of an original distribution specified by d,p,q,ec,m-fun. roifun generates random variates of the resulting distribution.

Value

A numeric value or a vector.

Author(s)

Dutang Christophe

See Also

oibeta, oiunif, oistpareto and oidistribution.

Examples

```
#TODO
```

---

oistpareto *One-inflated shifted truncated pareto distribution*

Description

These functions perform probabilistic analysis as well as random sampling on one-inflated shifted truncated pareto distribution.

Usage

```
doistpareto(x, a, p1, log=FALSE)
poistpareto(q, a, p1, lower.tail = TRUE, log.p = FALSE)
qoistpareto(p, a, p1, lower.tail = TRUE, log.p = FALSE)
roistpareto(n, a, p1)
ecoistpareto(x, a, p1)
moistpareto(order, a, p1)
```

Arguments

x, q	vector of quantiles.
p	vector of probabilities.
n	number of observations. If length(n) > 1, the length is take to be the number required.
a, p1	parameters.
order	order of the raw moment.
log, log.p	logical; if TRUE, probabilities p are given as log(p).
lower.tail	logical; if TRUE (default), probabilities are $P[X <= x]$, otherwise, $P[X > x]$.

Details

d,p,q,ec,m-oistpareto functions computes the density function, the distribution function, the quantile function, the exposure curve function and raw moments of the one-inflated shifted truncated pareto distribution. roistpareto generates random variates of this distribution.

Value

A numeric value or a vector.

Author(s)

Dutang Christophe

See Also

mbbefd-distr and oidistribution.

Examples

```
#TODO
```

oiunif *One-inflated uniform distribution*

Description

These functions perform probabilistic analysis as well as random sampling on one-inflated uniform distribution.

Usage

```
doiunif(x, p1, log=FALSE)
poiunif(q, p1, lower.tail = TRUE, log.p = FALSE)
qoiunif(p, p1, lower.tail = TRUE, log.p = FALSE)
roiunif(n, p1)
ecoiunif(x, p1)
moiunif(order, p1)
```

Arguments

x, q	vector of quantiles.
p	vector of probabilities.
n	number of observations. If length(n) > 1, the length is take to be the number required.
p1	parameter.
order	order of the raw moment.
log, log.p	logical; if TRUE, probabilities p are given as log(p).
lower.tail	logical; if TRUE (default), probabilities are $P[X <= x]$, otherwise, $P[X > x]$.

Details

d,p,q,ec,m-oiunif functions computes the density function, the distribution function, the quantile function, the exposure curve function and raw moments of the one-inflated uniform distribution. roiunif generates random variates of this distribution.

Value

A numeric value or a vector.

Author(s)

Dutang Christophe

See Also

mbbefd-distr and oidistribution.

Examples

```
#TODO
```

`rstpareto` *The shifted truncated Pareto distribution*

Description

These functions perform probabilistic analysis as well as random sampling on the shifted truncated Pareto distribution.

Usage

```
dstpareto(x, a, log=FALSE)
pstpareto(q, a, lower.tail = TRUE, log.p = FALSE)
qstpareto(p, a, lower.tail = TRUE, log.p = FALSE)
rstpareto(n, a)
mstpareto(order, a)
ecstpareto(x, a)
```

Arguments

`x, q`	vector of quantiles.
`p`	vector of probabilities.
`n`	number of observations. If `length(n) > 1`, the length is take to be the number required.
`order`	order of the raw moment.
`a`	shape parameter.
`log, log.p`	logical; if `TRUE`, probabilities p are given as log(p).
`lower.tail`	logical; if `TRUE` (default), probabilities are $P[X <= x]$, otherwise, $P[X > x]$.

Details

TODO!

Value

A numeric value or a vector.

Author(s)

Dutang Christophe

References

TODO

See Also

mbbefd-distr, mbbefdExposure

Examples

```
dstpareto(0:4/4, 2)

pstpareto(0:4/4, 1/2)
```

---

swissRe *Swiss Re exposure curve generation function*

Description

This function turns out the MBBEFD b and g parameters for the famous Swiss Re (SR) exposure curves.

Usage

```
swissRe(c)
```

Arguments

c	A numeric value

Details

The four Swiss Re Y1-Y4 are defined for c=1.5, 2, 3, 4. In addition c=5 coincides with a curve used by Lloyds for industrial risks exposure rating.

Value

A named two dimensional vector

Author(s)

Giorgio Spedicato

References

BERNEGGER, STEFAN. THE SWISS RE EXPOSURE CURVES AND THE MBBEFD DISTRIBUTION CLASS. Astin Bulletin (1997): 99.

See Also

dmbbefd

Examples

```
pars<-swissRe(4)
losses<-rmbbefd(n=1000,b=pars[1],g=pars[2])
mean(losses)
```

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