Package 'xVA'

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Type Package

Title Calculates Credit Risk Valuation Adjustments

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Description Calculates a number of valuation adjustments including CVA, DVA, FBA, FCA, MVA and KVA. A two-way margin agreement has been implemented. For the KVA calculation three regulatory frameworks are supported: CEM, SA-CCR and IMM. The probability of default is implied through the credit spreads curve. Currently, only IRSwaps are supported.

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LazyData TRUE

Collate 'CSAb.R' 'CalcNGR.R' 'CalcPD.R' 'CalcSimulatedExposure.R' 'CalcVA.R' 'Curve.R' 'GenerateTimeGrid.R' 'HashTable.R' 'Trade.R' 'IRD.R' 'calcCVACapital.R' 'calcDefCapital.R' 'calcEAD.R' 'calcEffectiveMaturity.R' 'calcKVA.R' 'xVACalculator.R' 'xVACalculatorExample.R'

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R topics documented:

`calcCVACapital` *Calculates the CVA Capital Charge*

Description

Calculates the CVA capital charge based on the standardized approach

Usage

```
calcCVACapital(trades, EAD, cpty_rating, effective_maturity)
```

Arguments

`trades`	The full list of the Trade Objects
`EAD`	Exposure-at-Default
`cpty_rating`	the rating of the counterparty
`effective_maturity`	The effective maturity of the trades of the netting set

Value

The CVA capital charge of the trade set

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

calcDefCapital *Calculates the Default Capital Charge*

Description

Calculates the default capital charge using the advanced IRB methodology and the stressed R

Usage

```
calcDefCapital(trades, EAD, reg_data, effective_maturity)
```

Arguments

trades	The full list of the Trade Objects
EAD	The Exposure-At-Default of the trades as per the selected regulatory framework
reg_data	A list containing data related to the regulatory calculations (for example the regulatory probability-of-default, the regulatory loss-given-default etc)
effective_maturity	The effective maturity of the trades of the netting set

Value

The default capital charge

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

calcEAD *Calculates the Exposure-At-Default (EAD)*

Description

Calculates the Exposure-At-Default (EAD) based on the given regulatory framework. It supports the CEM, SA-CCR and IMM frameworks

Usage

```
calcEAD(trades, framework, col, EEE, time_points)
```

Arguments

trades	The full list of the Trade Objects
framework	Specifies the regulatory framework used in the calculations. It can take the values of 'IMM', 'CEM', 'SA-CCR'
col	The margin agreement with the counterparty
EEE	A vector containing the effective expected exposure against the counterparty
time_points	The timepoints that the analysis is performed on

Value

The Exposure-At-Default

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

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calcEffectiveMaturity *Calculates the Effective Maturity*

Description

Calculates the effective maturity based on the specified regulatory framework

Usage

```
calcEffectiveMaturity(trades, time_points, framework, simulated_exposure)
```

Arguments

trades	The full list of the Trade Objects
time_points	The timepoints that the analysis is performed on
framework	Specifies the regulatory framework used in the calculations. It can take the values of 'IMM', 'CEM', 'SA-CCR'
simulated_exposure	The exposure profile list containing the EE, EEE etc

Value

The effective maturity of the trade set

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

calcKVA *Calculates the Capital Valuation Adjustment (KVA)*

Description

Calculates the capital valuation adjustment by computing the default capital charge and the CVA capital charge and applying the required return-on-capital

Usage

```
calcKVA(exposure_profile, col, trades, reg_data, time_points)
```

Arguments

exposure_profile	The exposure profile list containing the EE, EEE etc
col	The margin agreement with the counterparty
trades	The full list of the Trade Objects
reg_data	A list containing data related to the regulatory calculations (for example the 'framework' member variable can be 'IMM','SACCR','CEM')
time_points	The timepoints that the analysis is performed on

Value

The capital valuation adjustment (KVA)

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

CalcNGR *Calculates the Net/Gross ratio (NGR)*

Description

Calculates the Net/Gross ratio used under the CEM regulatory framework

Usage

```
CalcNGR(MtM_Vector)
```

Arguments

MtM_Vector	A vector containing the trades to be netted

Value

The Net-Gross ratio (NGR)

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

CalcPD *Calculates the Probablity of Default*

Description

Calculates the probablity of the default on specific time points by using the spread of the corresponding credit curve and the loss given default

Usage

```
CalcPD(spread, LGD, time_points)
```

Arguments

spread	The spread based on the credit curve
LGD	The loss-given-default
time_points	The timepoints that the analysis is performed on

Value

A vector containing the probablity of default on the specified timepoints

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

CalcSimulatedExposure *Calculated the Simulated Exposure Profile*

Description

Calculates the simulated exposure profile (EE, NEE, PFE, EEE) by use of the Hull-White model. Two sets of results are provided: one after taking into account the marging agreement and one assuming that there is no marging agreement present

Usage

```
CalcSimulatedExposure(discount_factors, time_points, spot_curve, col, trades,
  sim_data)
```

Arguments

discount_factors	The discount curve derived from the spot curve
time_points	The timepoints that the analysis is performed on
spot_curve	The curve derived from interpolating the market spot rates
col	The margin agreement
trades	The list of the trade objects
sim_data	A list containing simulation-related data (model parameters and number of simulation)

Value

A list containing the exposure profile (both collateralized and uncollateralized)

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

CalcVA *Calculates the Valuation Adjustment*

Description

Calculates the Valuation Adjustment based on the exposure, the probability-of-default and the loss-given-default

Usage

```
CalcVA(exposure, discount_factors, PD, LGD)
```

Arguments

exposure	A vector containing the exposure values on which the credit risk adjustment will be calculated
discount_factors	The Discount Curve
PD	The probability-of-Default
LGD	The Loss-Given-Default

Value

The Valuation Adjustment Value

Author(s)

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CSAb-class *CSAb Class*

Description

Creates a collateral agreement Object containing all the relevant data and methods regarding the maturity factor and the calculation of the exposures after applying the relevant threshold

Arguments

thres_cpty	The maximum exposure that the counterparty can generate before collateral will need to be posted
thres_PO	The maximum exposure that the processing organization can generate before collateral will need to be posted
MTA_cpty	The minimum transfer amount for the counterparty
MTA_PO	The minimum transfer amount for the processing organization
IM_cpty	The initial margin that is posted by the counterparty
IM_PO	The initial margin that is posted by the processing organization
mpor_days	The margin period of risk in days
remargin_freq	The frequency of re-margining the exposure in days
rounding	The rounding amount of the transfers

Value

An object of type CSAb

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

References

Basel Committee: The standardised approach for measuring counterparty credit risk exposures http://www.bis.org/publ/bcbs279.htm

Examples

```
## the margin agreement given in the Basel regulation example
coll = CSAb(thres_cpty = 0, MTA_cpty = 5, IM_cpty = 150, remargin_freq = 5)
```

Curve-class *Curve Class*

Description

Creates a Curve Object containing pairs of Tenors with relevant rates and the interpolation function. Also, methods for populating the object via a .csv file and the generation of the interpolation function via cubic splines are included.

Arguments

Tenors	The Tenors of the curve
Rates	The rates on the corresponding tenors
interp_function	(Optional) The interpolation function of the curve. Can be populated via the 'CalcInterpPoints' method

Value

An object of type Curve

Author(s)

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HashTable-class *Hashtable Class*

Description

Creates a hashtable-like object so as to represent data with a key structure (for example addon tables, rating-based factors etc). Also, it includes methods for populating the object via a .csv file and finding a value based on a specific key on an interval of keys

Arguments

keys	A vector of keys
values	A vector of values mapping to the keys
keys_type	The type of the keys

Value

values_type The type of the values

Author(s)

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IRSwap-class *IR Swap Class*

Description

Creates an IR Swap Object with the relevant info needed to calculate the Exposure-at-Default (EAD)

Arguments

Notional	The notional amount of the trade
MTM	The mark-to-market valuation of the trade
Currency	The currency set that the trade belongs to
Si	The number of years that the trade will take to start (zero if already started)
Ei	The number of years that the trade will expire
BuySell	Takes the values of either 'Buy' or 'Sell'
swap_rate	The rate of the fixed leg of the swap

Value

An object of type IRSwap

Examples

```
# the IR Swap trade given in the Basel regulation IR example
tr1 = IRSwap(Notional=10000,MtM=30,Currency="USD",Si=0,Ei=10,BuySell='Buy')
```

xVACalculator *Calculates the xVA values*

Description

Calculates the xVA values (CVA, DVA, FVA, FBA, MVA, KVA)

Usage

```
xVACalculator(trades, col, sim_data, reg_data, credit_curve_PO,
  credit_curve_cpty, funding_curve, spot_rates, cpty_LGD, PO_LGD)
```

Arguments

trades	The full list of the Trade Objects
col	The margin agreement with the counterparty
sim_data	A list containing data related to the calculation of simulated exposures (for example the model parameters and the number of simulations)
reg_data	A list containing data related to the regulatory calculations (for example the 'framework' member variable can be 'IMM','SACCR','CEM')
credit_curve_PO	The credit curve of the processing organisation
credit_curve_cpty	The credit curve of the processing organisation
funding_curve	A curve containing the credit spread for the funding of the collateral
spot_rates	The spot rates curve
cpty_LGD	The loss-given-default of the counterparty
PO_LGD	The loss-given-default of the processing organisation

Value

A list containing the xVA values

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

References

Gregory J., The xVA Challenge, 2015, Wiley

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xVACalculatorExample *xVA calculation example*

Description

Calculates the xVA values for a simple example containing two IR swaps.

Usage

```
xVACalculatorExample()
```

Value

A list with the values of various valuations' adjustments

Author(s)

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