Package 'xVA'

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Type Package

Title Credit Risk Valuation Adjustments

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Author Tasos Grivas [aut, cre]

Maintainer Tasos Grivas <info@openriskcalculator.com>

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 four regulatory frameworks are supported: CEM, (simplified) SA-
CCR, OEM
and IMM. The probability of default is implied through the credit spreads curve.
The package supports an exposure calculation based on SA-
CCR which includes several trade types
and a simulated path which is currently available only for Interest Rate Swaps. The latest regulatory capital charge methodologies
have been implementing including BA-CVA & SA-CVA.

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Imports methods, SACCR, Trading, data.table

URL https://openriskcalculator.com/

Collate 'CalcNGR.R' 'CalcPD.R' 'CalcSimulatedExposure.R' 'CalcVA.R'
'GenerateTimeGrid.R' 'calcDefCapital.R' 'calcEADRegulatory.R'
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'IS_IG.R' 'LoadSupervisoryCVAData.R' 'calcCVACapital.R'

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Contents

`calcCVACapital` *Calculates the CVA Capital Charge*

Description

Calculates the CVA capital charge based on the standardized approach

Usage

```
calcCVACapital(
  trades,
  EAD,
  reg_data,
  superv,
  effective_maturity,
  cva_sensitivities
)
```

Arguments

`trades`	The full list of the Trade Objects
`EAD`	Exposure-at-Default
`reg_data`	A list containing data related to the regulatory calculations
`superv`	A list containing supervisory data including correlations, risk weights etc
`effective_maturity`	The effective maturity of the trades of the netting set
`cva_sensitivities`	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>

`calcEADRegulatory` *Calculates the Exposure-At-Default (EAD)*

Description

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

Usage

```
calcEADRegulatory(
  trades,
  framework,
  sa_ccr_simplified = "",
  CSA,
  collateral,
  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'
`sa_ccr_simplified`	(Optional) Specifies whether the standard SACCR or its simplified version or the OEM will be implemented. It can take the values of '', 'simplified', 'OEM'
`CSA`	The margin agreement with the counterparty
`collateral`	The amount of collaterals currently exchanged 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>

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(
  trades,
  reg_data,
  EAD,
  effective_maturity,
  ignore_def_charge = TRUE,
  cva_capital_charge
)
```

Arguments

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')
EAD	The Exposure-at-default calculated based on the prescribed framework as appearing in the 'reg_data'
effective_maturity	The effective maturity of the trades performed with a specific counterparty
ignore_def_charge	if set to true the default capital charge is set to zero
cva_capital_charge	The CVA Capital Charge linked to this portfolio

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,
  CSA,
  trades,
  sim_data,
  framework,
  seed = NULL
)
```

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
CSA	The margin agreement
trades	The list of the trade objects
sim_data	A list containing simulation-related data (model parameters and number of simulation)
framework	regulatory framework can be 'IMM','SACCR','CEM'
seed	The seed for the simulations

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)

Tasos Grivas <tasos@openriskcalculator.com>

`IS_ELIGIBLE_CCY` *Checks if specified currency is low risk*

Description

Checks if the specified currency is eligible to receive reduced regulatory risk weights

Usage

```
IS_ELIGIBLE_CCY(ccy)
```

Arguments

`ccy`	The currency to be checked

Value

TRUE if the currency is is eligible to receive reduced regulatory risk weights

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

References

https://www.bis.org/basel_framework/chapter/MAR/50.htm?inforce=20230101&published=20200708

Examples

```
TRUE == IS_ELIGIBLE_CCY('EUR')
```

IS_IG *Checks if Credit rating is Investment Grade*

Description

Checks if the credit rating is investment grade or not (if not rating not recognised will be unrated)

Usage

```
IS_IG(credit_rating)
```

Arguments

credit_rating	The Credit Rating to be checked

Value

TRUE if Rating is Investment Grade

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

References

https://en.wikipedia.org/wiki/Credit_rating

Examples

```
TRUE == IS_IG('AAA')
```

LoadSupervisoryCVAData *Supervisory Data Loading*

Description

Loads the supervisory data (factors, correlation and option volatility) for each Asset Class and SubClass

Usage

```
LoadSupervisoryCVAData()
```

Value

A list with the required data

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

References

MAR50 - Credit Value Adjustment Framework https://www.bis.org/basel_framework/chapter/MAR/50.htm?inforce=202301

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xVACalculator *Calculates the xVA values*

Description

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

Usage

```
xVACalculator(
  trades,
  CSA,
  collateral,
  sim_data,
  reg_data,
  credit_curve_PO,
  credit_curve_cpty,
  funding_curve,
  spot_rates,
  cpty_LGD,
  PO_LGD,
  no_simulations
)
```

Arguments

trades	The full list of the Trade Objects
CSA	The margin agreement with the counterparty
collateral	The amount of collateral currently exchanged 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 'ccr_framework' member variable can be 'IMM','SACCR','CEM')
credit_curve_PO	The credit curve of the processing organization

credit_curve_cpty	The credit curve of the processing organization
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 organization
no_simulations	if true, no simulated exposure will be generated and the regulatory framework should be SA-CCR

Value

A list containing the xVA values and the cva capital charge

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)

Tasos Grivas <tasos@openriskcalculator.com>

Examples

```
## run the example

xVACalculatorExample()
```

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