Package 'Trading'

November 20, 2016

Type Package

Title Trades, Curves, Rating Tables, Add-on Tables, CSAs

Version 1.1

Date 2016-11-13

Author Tasos Grivas

Maintainer Tasos Grivas <info@openriskcalculator.com>

Description Contains trades from the five major assets classes and also functionality to use pricing curves, rating tables, CSAs and add-on tables. The implementation follows an object oriented logic whereby each trade inherits from more abstract classes while also the curves/tables are objects. There is a lot of functionality focusing on the counterparty credit risk calculations however the package can be used for trading applications in general.

Imports methods

URL www.openriskcalculator.com

License GPL-3

LazyData TRUE

Collate 'Swap.R' 'Vol.R' 'Option.R' 'Trade.R' 'IRD.R' 'Bond.R' 'CSA.R' 'Collateral.R' 'Commodity.R' 'Credit.R' 'Curve.R' 'Equity.R' 'FX.R' 'GetTradeDetails.R' 'HashTable.R' 'ParseTrades.R'

RoxygenNote 5.0.1

NeedsCompilation no

Repository CRAN

Date/Publication 2016-11-20 23:14:06

R topics documented:

`Bond-class` *Bond Class*

Description

Creates a Bond 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)
`BuySell`	Takes the values of either 'Buy' or 'Sell'
`yield`	The yield of the Bond
`ISIN`	The ISIN of the Bond,
`payment_frequency`	the frequency that the bond pays coupon (Quarter, SA etc)
`maturity_date`	the maturity date of the bond
`coupon_type`	The coupon type of the bond (fixed, floating, flipper etc)
`credit_risk_weight`	The percentage weight of the exposure of the bond that should be attributed to the 'Credit' asset class
`Issuer`	The issuer of the bond

Value

An object of type Bond

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

Examples

```
tr1 = Bond(Notional=10000,MtM=30,Currency="EUR",Si=0,maturity_date="2026-04-04",
BuySell='Buy',payment_frequency="SA",
credit_risk_weight=0.2,coupon_type="Fixed",Issuer="FirmA",ISIN = "XS0943423")
```

BondFuture-class *Bond Future Class*

Description

Creates a Bond Future 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'
yield	The yield of the Underlying Bond
isin	The ISIN of the Underlying Bond,
payment_frequency	the frequency that the bond pays coupon (Quarter, SA etc)
maturity_date	the maturity date of the bond
coupon_type	The coupon type of the bond (fixed, floating, flipper etc)
Issuer	The issuer of the bond

Value

An object of type Bond

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

Examples

```
example_trades = ParseTrades()
bondfuture_trade = example_trades[[17]]
tr1 = BondFuture(Notional=10000,MtM=30,Currency="EUR",Si=0,Ei=10,BuySell='Buy',
payment_frequency="SA",coupon_type="Fixed",Issuer="CountryA",ISIN = "XS0943423")
```

CDOTranche-class *CDO tranche Class*

Description

Creates a CDO tranche 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 belongs
Si	The number of years after which the trade will start (zero if already started)
Ei	The number of years that the trade will expire
BuySell	Takes the values of either 'Buy' or 'Sell'
attach_point	The attachment point of the tranche
detach_point	The detachment point of the tranche

Value

An object of type CDOtrance

Examples

```
## a CDO trance object
tr3 = CDOTranche(Notional=10000,MtM=0,Currency="USD",Si=0,Ei=5,
BuySell='Buy',SubClass='IG',RefEntity='CDX.IG',attach_point=0.3,detach_point=0.5)
```

Collateral-class *Collateral Class*

Description

Creates a Collateral amount object which needs to be linked with a CSA ID

Arguments

ID	The ID of each object
Amount	The collateral amount
csa_id	The csa_id that this object is linked with
type	Describes the type of the collateral: can be "ICA", "VariationMargin" etc

Value

An object of type Collateral

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

```
colls = list()
coll_raw = read.csv(system.file("extdata", "coll.csv", package = "Trading"),header=TRUE,
stringsAsFactors = FALSE)

for(i in 1:nrow(coll_raw))
{
 colls[[i]] = Collateral()
 colls[[i]]$PopulateViaCSV(coll_raw[i,])
}
```

`Commodity-class` *Commodity Class*

Description

Creates a Commodity 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)
`BuySell`	Takes the values of either 'Buy' or 'Sell'
`commodity_type`	Takes the values of 'Oil/Gas','Silver','Electricity' etc.

Value

An object of type Commodity

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

```
tr1 = Commodity(Notional=10000,MtM=-50,Si=0,
BuySell='Buy',SubClass='Energy',commodity_type='Oil/Gas')
```

CommodityForward-class
Commodity Forward Class

Description

Creates a Commodity Forward 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'
`commodity_type`	Takes the values of 'Oil/Gas','Silver','Electricity' etc.

Value

An object of type Commodity Forward

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 Commodity Forward trade given in the Basel regulation Commodity example
tr1 = CommodityForward(Notional=10000,MtM=-50,Si=0,Ei=0.75,
BuySell='Buy',SubClass='Energy',commodity_type='Oil/Gas')
```

CommSwap-class *Commodity Swap Class*

Description

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

Value

An object of type CommSwap

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

CreditIndex-class *Credit Index Class*

Description

Creates a Credit Index 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 belongs
`Si`	The number of years after which the trade will start (zero if already started)
`Ei`	The number of years that the trade will expire
`BuySell`	Takes the values of either 'Buy' or 'Sell'

Value

An object of type CreditIndex

Examples

```
## the CreditIndex trade given in the Basel regulation Credit example
tr3 = CreditIndex(Notional=10000,MtM=0,Currency="USD",Si=0,Ei=5,
BuySell='Buy',SubClass='IG',RefEntity='CDX.IG')
```

CreditSingle-class *Credit Single Class*

Description

Creates a Credit Single 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'

Value

An object of type CreditSingle

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 CreditSingle trade given in the Basel regulation Credit example
tr1 = CreditSingle(Notional=10000,MtM=20,Currency="USD",Si=0,Ei=3,BuySell='Buy',
SubClass='AA',RefEntity='FirmA')
```

`CSA-class` *CSA 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

`ID`	The ID of the CSA ID
`Counterparty`	The counterparty the CSA is linked to
`Currency`	The currency that the CSA applies to (can be a list of different currencies)
`TradeGroups`	The trade groups that the CSA applies to
`Values_type`	The type of the numerical values (can be "Actual" or "Perc" whereby the values are percentages of the MtM)
`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 CSA

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

```
  csa_raw = read.csv(system.file("extdata", "CSA.csv", package = "Trading"),
  header=TRUE,stringsAsFactors = FALSE)

csas = list()
for(i in 1:nrow(csa_raw))
{
 csas[[i]] = CSA()
 csas[[i]]$PopulateViaCSV(csa_raw[i,])
}
```

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)

Tasos Grivas <tasos@openriskcalculator.com>

Examples

```
## generating a curve either directly or through a csv -
## the spot_rates.csv file can be found on the extdata folder in the installation library path
funding_curve =  Curve(Tenors=c(1,2,3,4,5,6,10),Rates=c(4,17,43,47,76,90,110))
spot_rates = Curve()
spot_rates$PopulateViaCSV('spot_rates.csv')
time_points = seq(0,5,0.01)
spot_curve     = spot_rates$CalcInterpPoints(time_points)
```

Equity-class *Equity Class*

Description

Creates an Equity object

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
BuySell	Takes the values of either 'Buy' or 'Sell'
ISIN	the ISIN of the Equity
traded_price	the price that trade was done
Issuer	the issuer of the stock

Value

An object of type Equity

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

Examples

```
tr1 = Equity(external_id="ext1",Notional=10000,MtM=30,Currency="EUR",BuySell='Buy',
traded_price = 10,ISIN = "XS04340432",Issuer='FirmA')
```

EquityIndexFuture-class *Equity Index Future Class*

Description

Creates an Equity Index Future 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'
`traded_price`	the price that trade was done

Value

An object of type EquityIndexFuture

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

Examples

```
example_trades = ParseTrades()
Equity_Index_Future_trade = example_trades[[18]]
```

`FXSwap-class` *FX Swap Class*

Description

Creates an FX 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'
`traded_price`	the price that trade was done

Value

An object of type FXSwap

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

```
tr1 = FXSwap(Notional=10000,MtM=30,ccyPair="EUR/USD",Si=0,Ei=10,BuySell='Buy')
```

GetTradeDetails *Returns a list with the populated fields of a Trade Object*

Description

Returns a list with the populated fields of a Trade Object

Usage

```
GetTradeDetails(trade)
```

Arguments

`trade`	A trade Object

Value

A list of fields

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

Examples

```
example_trades = ParseTrades()
Equity_Index_Future_trade = example_trades[[18]]
populated_fields = GetTradeDetails(Equity_Index_Future_trade)
```

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 For examples of the format of the CSVs files, please view RatingsMapping.csv or AddonTable.csv on the extdata folder in the installation folder of the library

Arguments

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

Value

An object of type HashTable

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

Examples

```
## loading a ratings' mapping matrix from the extdata folder
rating_table = HashTable('RatingsMapping.csv',"character","numeric")
reg_weight =rating_table$FindValue("AAA")
```

IRDSwap-class *IRD Swap Class*

Description

Creates an IRD 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'

Value

An object of type IRDSwap

Examples

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

`IRDSwaption-class` *IRD Swaption Class*

Description

Creates an IRD Swaption 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'
`OptionType`	Takes the values of either 'Put' or 'Call'
`UnderlyingPrice`	The current price of the underlying
`StrikePrice`	The strike price of the option

Value

An object of type IRDSwaption

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 Swaption trade given in the Basel regulation IRD example
tr3 = IRDSwaption(Notional=5000,MtM=50,Currency="EUR",Si=1,Ei=11,BuySell='Sell',
OptionType='Put',UnderlyingPrice=0.06,StrikePrice=0.05)
```

`IRDSwapVol-class` *IRD Swap Volatility Class*

Description

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

Value

An object of type IRDSwapVol

`ParseTrades` *Parse trades through a .csv file.*

Description

Parse trades through a .csv file. In case no file name is given, an example file is automatically loaded containing trades corresponding to Basel's SA-CCR regulation (the example trades file can be found on the extdata folder in the installation library path)

Usage

```
ParseTrades(csvfilename)
```

Arguments

`csvfilename`	the name of csv file containing the trades

Value

A list of trades

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

Examples

```
## calling ParseTrades() without an argument loads a test file containing all
## the different trade types supported
example_trades = ParseTrades()
```

Index