

Package ‘Trading’

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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

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Collate 'Swap.R' 'Future.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'

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Bond-class	<i>Bond Class</i>
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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	<i>Bond Future Class</i>
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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 tranche 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	<i>Collateral Class</i>
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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	<i>Commodity Class</i>
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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	<i>Commodity Swap Class</i>
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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	<i>Credit Index Class</i>
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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	<i>Credit Single Class</i>
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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	<i>CSA Class</i>
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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]]
```

EquityOption-class	<i>Equity Option Class</i>
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Description

Creates an Equity Option 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 EquityOption

Author(s)

Tasos Grivas <tasos@openriskcalculator.com>

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")
```

IRDFuture-class	<i>IRD Future Class</i>
-----------------	-------------------------

Description

Creates an IRD 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'

Value

An object of type IRDFuture

IRDSwap-class	<i>IRD Swap Class</i>
---------------	-----------------------

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	<i>IRD Swaption Class</i>
-------------------	---------------------------

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	<i>Parse trades through a .csv file.</i>
-------------	--

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()
```

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