

Algorithmica Research AB

IRS, FRA, Tenor Basis Swaps and Currency Swaps and its curves in Database tool

< Setup guide for use of the dual bootstrap functionality >

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1. Introduction

This document describes the setup of plain vanilla IRS, FRA, Money Market Futures, Tenor Basis Swaps and the related curves, in order to use the functionality provided in the dual bootstrap library files, while maintaining backward compatibility with the <instrument> class. The intention is to support the instrument types mentioned above only for the purpose of constructing curves, hence, the definitions are as limited in scope as possible. Note that all core bootstrap functions can be used independent of how instruments and curves are setup in Database tool.

Throughout this document, we will, with a few exceptions, use the EUR market as example.

2. Instruments

2.2 IRS

2.2.1 Plain vanilla IRS Class

The fixed leg of a plain vanilla swap is defined in the “General”-tab. The float leg data is summarily defined in the “Tag”-tab.

The two snapshots below show the settings for a EUR IRS 6M Euribor (annual fixed leg vs. float leg indexed to 6M Euribor).

Current instrument class: *
EUR 6M SWAP

ID #329

General | Extended | Special | FRN | Rating Adj. | Deliverables | Tag

Long name:

Class: Type: * SWAP

Issue date: First coupon date:

Maturity *
 Date
 Code

Settle *
 Date
 Code

Coupon: % Coupon freq:

Ex-coupon code: Accrued day-count method: *

Face amount: Issued amount:

Currency:

Issuer: * Market:

Calc type: * Quote style: *

Figure 1 IRS fixed leg class settings [General]

Tag name	Value	From date	To date
flt_coupon_freq	2		
flt_coupon_freq_flat			
flt_currency_flat			
flt_daycount_method	ACT360		
flt_reset_days	2		

Figure 2 IRS float leg class settings [Tag]

flt_coupon_freq, flt_daycount_method and flt_reset_days needs to be defined as tags. Other settings (such as calendar, business day convention, etc) for the float leg are assumed the same as for the fixed leg.

Tag	Type	Comment
flt_coupon_freq	number	The coupon frequency of the float leg. Available choices are 1,2,4 and 12.
flt_daycount_method	string	The daycount method for the float leg. Available choices can be seen in the "Accrued daycount method"-dropdown in the general tab.
flt_reset_days	number	The number of reset days for the floating leg rates.

2.2.2 Plain vanilla IRS instrument

When the IRS instrument is defined based on a class (as in 2.2.1) it only needs to be complemented by a maturity (or maturity code) and the real-time link information.

The screenshot displays the 'General' tab of a software interface for defining a Fixed leg instrument. The 'Current instrument' is 'EURSwap1Y'. The instrument is derived from the 'EUR 6M SWAP' class. The 'Type' is 'SWAP'. The 'Long name' is 'EUR SWAP 1Y'. The 'Maturity' is set to 'Code' with the value '1Y_MF'. The 'Settle' is set to 'Code' with the value 'BD2'. The 'Coupon' is '100' and the 'Coupon freq' is '1'. The 'Ex-coupon code' is 'BD0'. The 'Accrued day-count method' is 'EU30360'. The 'Face amount' is '100' and the 'Currency' is 'EUR'. The 'Issuer' is 'Swap counterpart' and the 'Market' is 'TARGET'. The 'Calc type' is 'SWAP' and the 'Quote style' is 'Yield'. The interface also shows tabs for 'Extended', 'Special', 'FRN', 'Rating Adj.', 'Deliverables', 'Tag', and 'Realtime'.

Figure 3 Fixed leg settings [General]

Note:

1) to incorporate the end-of-month convention in a settlement code or maturity code (if the code is of type 'Y' or 'M'), check the "End of month"-checkbox in the Extended-tab.

2) if the settlement code or maturity code does not define a business day convention the default is according to the "Business day convention for payments"-setting in the Extended-tab (and if this setting is not available the defaults will be modified following (MF) for 'Y' and 'M' codes and following (F) otherwise.

These principles apply for all maturity codes and settlement codes discussed in this document.

2.3 FRA

2.3.1 Plain vanilla FRA class

The FRA is defined in the “General”-tab and in the “Tag”-tab.

The two snapshots below show the settings for a EUR 6M Euribor FRA.

Current instrument class: *
EUR 6M FRA ID #316

General | Extended | Special | FRN | Rating Adj. | Deliverables | Tag

Long name:

Class: Type: * FRA

Issue date: First coupon date:

Maturity *
 Date
 Code 6M_MF Edit...

Settle *
 Date
 Code Edit...

Coupon: % Coupon freq:

Ex-coupon code: Edit... Accrued day-count method: * ACT360

Face amount: Issued amount:

Currency:

Issuer: * Market:

Calc type: * Quote style: *

Figure 4 FRA class settings [General]

Tag name	Value	From date	To date
flt_coupon_freq	2		
flt_coupon_freq_flat			
flt_currency_flat			
flt_daycount_method			
flt_reset_days	2		

Figure 5 FRA class settings [Tag]

flt_coupon_freq and flt_reset_days needs to be defined as tags.

Tag	Type	Comment
flt_coupon_freq	number	The FRA tenor frequency. Available choices are 1,2,4 and 12.
flt_reset_days	number	The number of reset days for the floating leg rates.

Note: In the above case, it can be argued that also, the maturity code could be used to determine the tenor but if an explicit maturity is used instead of a code, it is no longer clear what the tenor is.

2.3.2 Plain vanilla FRA instrument

When the FRA instrument is defined based on a class (as in 2.3.1) it needs to be complemented by a settlement date (or settlement code) and the real-time link information.

The screenshot shows a software interface for configuring an FRA instrument. At the top, the 'Current instrument' is identified as 'EURFRA_6X12' with ID #125971. The interface is divided into several sections:

- General:** Long name 'EURFRA_6X12', Class 'EUR 6M FRA', and Type 'FRA'.
- Maturity:** Options for 'Date' or 'Code'. The 'Code' option is selected with the value '6M_MF'.
- Settlement:** Options for 'Date' or 'Code'. The 'Code' option is selected with the value 'BD2;6M_'.
- Couponing:** Fields for Coupon (with a percentage sign), Ex-coupon code, Coupon frequency, and Accrued day-count method (set to 'ACT360').
- Face and Issued Amount:** Face amount is set to '100' and Currency is 'EUR'. Issued amount is currently empty.
- Issuer and Market:** Issuer is 'FRA counterpart' and Market is 'TARGET'.
- Calculation and Quote:** Calc type is 'FRA' and Quote style is 'Yield'.

Figure 6 FRA settings

Note: the settlement code above is “BD2; 6M_MF”. This means that from any given trade date the settlement date will be calculated in two steps: first move 2 banking days and then from the resulting date move 6 months while applying the modified following business day convention.

2.4 Money Market Future

2.4.1 Money Market Future class

The money market future is defined in the “General”-tab and in the “Tag”-tab.

The two snapshots below show the settings for the EUR 3M Euribor future.

The screenshot shows a software interface for defining a Money Market Future class. The title bar indicates 'Current instrument class: *' and the main window title is 'EUR 3M FUT' with 'ID #45' on the right. The 'General' tab is selected, with other tabs including 'Extended', 'Special', 'FRN', 'Rating Adj.', 'Deliverables', and 'Tag'. The settings are as follows:

- Long name: (empty text box)
- Class: (empty dropdown)
- Type: * MM FUTURE (dropdown)
- Issue date: (empty dropdown)
- First coupon date: (empty dropdown)
- Maturity *:
 - Date (empty dropdown)
 - Code: 90CD_NC (text box) with an 'Edit...' button
- Settle *:
 - Date (empty dropdown)
 - Code: (empty text box) with an 'Edit...' button
- Coupon: (empty text box) %
- Coupon freq: (empty dropdown)
- Ex-coupon code: (empty text box) with an 'Edit...' button
- Accrued day-count method: ACT360 (dropdown)
- Face amount: 100 (text box)
- Issued amount: (empty text box)
- Currency: EUR (dropdown)
- Issuer: Eurex (dropdown)
- Calendars: TARGET (dropdown), followed by three empty dropdowns
- Calc type: FRA (dropdown)
- Quote style: MM Future (dropdown)

Figure 7 Money market future class settings [General]

Note specifically the type (MM FUTURE), the quote style (MM Future) and the maturity code (90CD_NONE = 90 calendar days without business day adjustments). Note also that maturity refers

to the underlying final maturity similarly to a FRA.

Tag name	Value	From date	To date
flt_coupon_freq	4		

Figure 8 Money market future class settings [Tag]

The flt_coupon_freq needs to be defined as a tag in order to know which tenor it belongs to.

Tag	Type	Comment
flt_coupon_freq	number	The tenor frequency of the future. Available choices are 1,2,4 and 12.

2.4.2 Money Market Future instrument

When the money market future instrument is defined based on a class (as in 2.4.1) it needs to be complemented by a settlement date and the real-time link information.

Current instrument: *

EUR3MDec11

from instrument ID #32023

General | Extended | Special | FRN | Callable | Rating Adj. | Deliverables

Long name: EUR3MDec11

Class: EUR 3M FUT Type: * MM FUTURE

Issue date: First coupon date:

Maturity * Settle *

Date Code 90CD_NC Edit... Date 2011-12-21 Code Edit...

Coupon: % Coupon freq:

Ex-coupon code: Edit... Accrued day-count method: ACT360

Face amount: 100 Issued amount:

Currency: EUR Issuer: Eurex

Calendars: TARGET

Calc type: FRA Quote style: MM Future

Figure 9 Money market future settings

2.5 Basis Swap (quoted as 2 swaps)

2.5.1 Basis Swap class (2 swaps)

The common fixed leg of a plain vanilla basis swap (2 swap) is defined in the “General”-tab. The two float legs are summarily defined in the “Tag”-tab.

The two snapshots below show the settings for a EUR 3M/6M Euribor Basis Swap (2 swap).

Current instrument class: *
EUR BASIS SWAP 3M/6M (2SWAP) ID #325

General | Extended | Special | FRN | Rating Adj. | Deliverables | Tag

Long name:

Class: Type: * BASIS SWAP (2S)

Issue date: First coupon date:

Maturity *
 Date
 Code Edit...

Settle *
Date
Code BD2 Edit...

Coupon: % Coupon freq: 1

Ex-coupon code: BD0 Edit... Accrued day-count method: * EU30360

Face amount: 100 Issued amount:

Currency: EUR

Issuer: * Swap counterpart Market: TARGET

Calc type: * SWAP Quote style: * Basis Point

Figure 10 Basis swap class settings [General]

Note specifically the type (BASIS SWAP (2SWP)) and the quote style (Basis point).

Current instrument class: *
EUR BASIS SWAP 3M/6M (2SWAP) ID #325

General | Extended | Special | FRN | Rating Adj. | Deliverables | Tag

Tag name	Value	Fro...	To d...
alt_matur_code			
flt_coupon_freq	4		
flt_coupon_freq_flat	2		
flt_currency_flat			
flt_daycount_method			
gics_code			
irs_class_name_base	EUR 3M SWAP		
irs_class_name_flat	EUR 6M SWAP		

Figure 11 Basis swap class settings [Tag]

5 tags need to be defined; flt_coupon_freq, flt_coupon_freq_flat, irs_class_name_base and irs_class_name_flat.

Tag	Type	Comment
flt_coupon_freq	number	The coupon frequency of the float leg of the “spreaded” IRS. Available choices are 1,2,4 and 12.
flt_coupon_freq_flat	number	The coupon frequency of the float leg of the IRS quoted without spread. Available choices are 1,2,4 and 12.
flt_reset_days	number	The number of reset days for the floating leg rates.
irs_class_name_base	string	Name of the underlying irs base leg instrument class.
irs_class_name_flat	string	Name of the underlying irs flat leg instrument class.

2.5.2 Basis Swap instrument (2 swaps)

When the basis swap instrument (quoted as 2 swaps) is defined based on a class (as in 2.5.1) it only needs to be complemented by a maturity (or maturity code) and the real-time link information.

Current instrument: *
EURSwap1Y_3M6M

from instrument class ID #126755

General | Extended | Special | FRN | Rating Adj. | Deliverables | Tag | Realtime

Long name: EUR SWAP 1Y 3M6M Basis

Class: EUR BASIS SWAP 3M/6M (2SWAP) Type: * BASIS SWAP (2S)

Issue date: First coupon date:

Maturity *
 Date
 Code 1Y_MF Edit...

Settle *
 Date
 Code BD2 Edit...

Coupon: % Coupon freq: 1

Ex-coupon code: BD0 Edit... Accrued day-count method: * EU30360

Face amount: 100 Issued amount:

Currency: EUR

Issuer: * Swap counterpart Market: TARGET

Calc type: * SWAP Quote style: * Basis Point

Figure 12 Basis swap settings [General]

Note: the quote for the basis swap above would be added to the EUR IRS 3M Euribor swap rates. In other words, EUR IRS 3M Euribor swap rates are obtained from the same maturity EUR IRS 6M Euribor swap rates minus same maturity 3M/6M basis swaps.

2.6 Basis Swap (quoted as 1 swap)

2.6.1 Basis Swap class (1 swap)

The “spreaded” float leg of a plain vanilla basis swap (1 swap) is defined in the “General”-tab. The flat float leg is summarily defined in the “Tag”-tab.

The two snapshots below show the settings for a EUR 3M/6M Basis Swap (1 swap).

Current instrument class: *
 EUR BASIS SWAP 3M/6M (1SWAP) ID #328

General | Extended | Special | FRN | Rating Adj. | Deliverables | Tag

Long name:

Class: Type: * BASIS SWAP (1S)

Issue date: First coupon date:

Maturity* Date Code Settle * Date Code

Coupon: % Coupon freq:

Ex-coupon code: Accrued day-count method: *

Face amount: Issued amount:

Currency:

Issuer: * Market:

Calc type: * Quote style: *

Figure 13 Basis swap class settings [General]

Note specifically the type (BASIS SWAP (1SWP)) and the quote style (Basis point).

Tag name	Value	From date	To date
flt_coupon_freq			
flt_coupon_freq_flat	2		
flt_currency_flat			
flt_daycount_method			
flt_reset_days	2		
gics_code			
irs_class_name_base	EUR 3M SWAP		
irs_class_name_flat	EUR 6M SWAP		

Figure 14 Basis swap class settings [Tag]

4 tags need to be defined; flt_coupon_freq_flat, flt_reset_days, irs_class_name_base and irs_class_name_flat.

Tag	Type	Comment
flt_coupon_freq_flat	number	The coupon frequency of the float leg quoted flat. Available choices are 1,2,4 and 12.
flt_reset_days	number	The number of reset days for

		the floating leg rates.
irs_class_name_base	string	Name of the underlying irs base leg instrument class.
irs_class_name_flat	string	Name of the underlying irs flat leg instrument class.

2.6.2 Basis Swap instrument (1 swap)

When the basis swap instrument (quoted as 1 swap) is defined based on a class (as in 2.6.1) it only needs to be complemented by a maturity (or maturity code) and the real-time link information.

The screenshot shows the 'General' tab of a configuration window for a 'Current instrument: *'. The instrument name is 'EURSwap1Y_3M6M_1SWAP' with ID #126779. It is derived from an instrument class. The configuration includes the following fields:

- Long name: EUR SWAP 1Y 3M6M Basis
- Class: EUR BASIS SWAP 3M/6M (1SWAP)
- Type: * BASIS SWAP (1S)
- Issue date: (empty)
- First coupon date: (empty)
- Maturity: *
 - Date: (empty)
 - Code: 1Y_MF (with Edit... button)
- Settle: *
 - Date: (empty)
 - Code: BD2 (with Edit... button)
- Coupon: (empty) %
- Coupon freq: 4
- Ex-coupon code: BD0 (with Edit... button)
- Accrued day-count method: * ACT360
- Face amount: 100
- Issued amount: (empty)
- Currency: EUR
- Issuer: * Swap counterpart
- Market: TARGET
- Calc type: * SWAP
- Quote style: * Basis Point

Figure 15 Basis swap settings [General]

Note: the quote for the basis swap above would be added to the 3M Euribor rates.

2.7 Cross Currency Basis Swap

2.7.1 Cross Currency Basis Swap class

The “spreaded” float leg of a plain vanilla cross currency basis swap (1 swap) is defined in the “General”-tab. The flat float leg is summarily defined in the “Tag”-tab.

The two snapshots below show the settings for a EUR/SEK 3M/3M Basis Swap.

The screenshot shows the 'General' tab of a financial instrument configuration window. The instrument class is 'EUR/SEK BASIS SWAP' with ID #331. The 'Type' is set to 'BASIS SWAP (1SWP)'. The 'Maturity' is set to 'Date' with a value of '3M'. The 'Settle' is set to 'Date' with a value of '3M'. The 'Coupon' is set to '0.000000 %' and the 'Coupon freq' is '4'. The 'Ex-coupon code' is 'BD0' and the 'Accrued day-count method' is 'ACT360'. The 'Face amount' is '100' and the 'Currency' is 'SEK'. The 'Calendars' are 'TARGET' and 'SWEDEN'. The 'Calc type' is 'SWAP' and the 'Quote style' is 'Basis Point'.

Figure 16 Currency basis swap class settings [General]

Note specifically the type (BASIS SWAP (1SWP)) and the quote style (Basis point).

For the flat currency, it is required to set the coupon frequency, the currency, the day count method, `flt_reset_days` and `ccbs_is_mtm`.

Tag name	Value	From date
flt_coupon_freq		
flt_coupon_freq_flat	4	
flt_currency		
flt_currency_flat	EUR	
flt_daycount_method		
flt_daycount_method_flat	ACT360	
flt_reset_days	2	
ccbs_is_mtm	1	

Figure 17 Currency Basis swap class settings [Tag]

Other settings for the flat float leg are assumed the same as the base float leg.

Tag	Type	Comment
flt_coupon_freq_flat	number	The coupon frequency of the float leg quoted flat. Available choices are 1,2,4 and 12.
flt_currency_flat	string	The currency of the float leg quoted flat.
flt_daycount_method_flat	string	The daycount method of the float leg quoted flat. Available choices can be seen in the "Accrued daycount method"-dropdown in the general tab.
flt_reset_days	number	The number of reset days for the float leg rates.
ccbs_is_mtm	number	If set to 1 (=true) it is a mark-to-market ccbs and if set to 0 (=false) it is not

2.7.2 Cross Currency Basis Swap instrument

When the basis swap instrument is defined based on a class (as in 2.7.1) it only needs to be complemented by a maturity (or maturity code) and the real-time link information.

Current instrument: *

EURSEK_BasisSwap1Y_3M3M

from instrument class ID #126825

General | Extended | Special | FRN | Rating Adj. | Deliverables | Tag | R

Long name: EURSEK_BasisSwap1Y_3M3M

Class: EUR/SEK BASIS SWAP Type: * BASIS SWAP (

Issue date: First coupon date:

Maturity * Settle *

Date

Code 1Y_MF Edit... Code BD2 Edit...

Coupon: % Coupon freq: 4

Ex-coupon code: BD0 Edit... Accrued day-count method: * ACT360

Face amount: 100 Issued amount:

Currency: SEK Issuer: * Swap counterpa

Calendars: TARGET SWEDEN

Calc type: * SWAP Quote style: * Basis Point

2.8 Cross Currency Fix-Float Swap

2.8.1 Cross Currency Fix-Float Swap class

The fixed leg of a plain vanilla currency fix-float swap is defined in the “General”-tab. The float leg, quoted flat, is summarily defined in the “Tag”-tab.

The two snapshots below show the settings for a USD/KRW fix-float swap.

Current instrument class: *
 USDKRW FIXFLT CCS

ID #354

General | Extended | Special | FRN | Rating Adj. | Deliverables | Tag

Long name:

Class: Type: * SWAP

Issue date: First coupon date:

Maturity *
 Date
 Code

Settle *
 Date
 Code BD2

Coupon: % Coupon freq: 2

Ex-coupon code: BDO Accrued day-count method: * ACT365

Face amount: 100 Issued amount:

Currency: KRW Issuer: * Swap counterpai

Calendars: SOUTH KO USA

Calc type: * SWAP Quote style: * Yield

Figure 18 Currency fix-float swap class settings [General]

For the float leg currency, it is required to set the coupon frequency, the currency and the day count method.

Tag name	Value	From date
flt_coupon_freq		
flt_coupon_freq_flat	2	
flt_currency		
flt_currency_flat	USD	
flt_daycount_method		
flt_daycount_method_flat	ACT360	
flt_reset_days	2	

Figure 189 Currency fix-float swap class settings [Tag]

Other settings for the flat float leg are assumed the same as the fixed leg.

Tag	Type	Comment
flt_coupon_freq_flat	number	The coupon frequency of the float leg.

		Available choices are 1,2,4 and 12.
flt_currency_flat	string	The currency of the float leg.
flt_daycount_method_flat	string	The daycount method of the float leg. Available choices can be seen in the “Accrued daycount method”-dropdown in the general tab.
flt_reset_days	number	The number of reset days for the float leg rates.

2.8.2 Cross Currency Fix-Float Swap instrument

When the currency swap instrument is defined based on a class (as in 2.8.1) it only needs to be complemented by a maturity (or maturity code) and the real-time link information.

Current instrument: *

USDKRW FIXFLT NDCCS 1Y

from instrument class ID #127996

General | Extended | Special | FRN | Rating Adj. | Deliverables | Tag | R ◀ ▶

Long name: USDKRW FIXFLT NDCCS 1Y

Class: USDKRW FIXFLT CCS Type: * SWAP

Issue date: First coupon date:

Maturity * Date Code 1Y_MF Edit...

Settle * Date Code BD2 Edit...

Coupon: % Coupon freq: 2

Ex-coupon code: BD0 Edit... Accrued day-count method: * ACT365

Face amount: 100 Issued amount:

Currency: KRW Issuer: * Swap counterpa

Calendars: SOUTH KO USA

Calc type: * SWAP Quote style: * Yield

3. Curves

All curves need to be setup with only one type of instrument. The blending of different types of instruments will be done at runtime and blending of instruments with different tenors will typically generate an error.

A complete set of curves for a currency comprises of:

- Discounting curve e.g. OIS.
- IRS curve for the main floating leg tenor.
- FRA's or Futures for the main tenor.
- Basis swap curves (or IRS curves) for other tenors.
- FRA's or Futures for other tenors.

Note: short instruments up to the first FRA are typically created synthetically via OIS or tenor basis spreads.

For EUR this would typically mean:

- Eonia is used for discounting.

6M tenor (main):

- IRS: Annual fixed vs. 6M EURIBOR; 1yr – 60yrs.
- FRA: 6M EURIBOR; 0x6, 6x12, 12x18, 18x24 possibly also 1x7, 2x8, ...

(Synthetic FRAs before 6M may be created from 6M/EONIA (or 3M/6M) basis term structure at runtime.)

3M tenor:

- Basis swaps (quoted as either 1 swap or 2 swaps): 3M/6M; 1yr – 50 yrs.
- Money market futures: 3M EURIBOR (convexity adjusted)
- FRA: 3M EURIBOR; 0x3, 3x6, 6x9,... possibly also 1x4, 2x5, ...

(Synthetic FRAs before 3M may be created from 3M/EONIA (or 3M/6M) basis term structure at runtime.)

1M tenor:

- Money market monthly IRS: 2M-12M.

- Basis swaps (quoted as either 1 swap or 2 swaps): 1M/6M; 1yr – 50 yrs.

(Synthetic FRAs before 1M may be created from 1M/EONIA (or 1M/6M) basis term structure at runtime.)

12M tenor:

- Basis swaps (quoted as either 1 swap or 2 swaps): 6M/12M; 1yr – 50 yrs.
- FRA: 12M EURIBOR; 12x24

(Synthetic FRAs before 12M may be created from 6M/12M (or 12M/EONIA) basis term structure at runtime.)

4. Setup of tags

The tags described in the previous chapters need to be defined in Database tool. This is done in [Tables | Tag ...].

The following tags are needed.

Tag name	Tag type	Key type	Used for
flt_coupon_freq	number	instrument	IRS, FRA, MMFUT, BS-2
flt_coupon_freq_flat	number	instrument	BS-2, BS-1, CCBS, CCIRS
flt_daycount_method	string	instrument	IRS
flt_daycount_method_flat	string	instrument	CCBS, CCIRS
flt_currency_flat	string	instrument	CCBS, CCIRS
flt_reset_days	number	instrument	IRS, FRA, MMFUT, BS-2, BS-1, CCBS, CCIRS
irs_class_name_base	string	instrument	BS-2, BS-1
irs_class_name_flat	string	instrument	BS-2, BS-1
ccbs_is_mtm	number	instrument	CCBS