MUREX

Deployment Guide for Caps/Floors on RFR

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Legal Notice

Introduction

This document explains how to deploy the RFR-adjusted Bachelier model on client environment and set the minimum configuration to price RFR caps/floors. We assumed that the compounded RFR index and its corresponding pricing curve have already been deployed.

Before the deployment, client should also be aware of the compounded index and their volatility source. The volatility source can be either proxy volatility from Ibor Caps/Floors volatility (transition model) or RFR Caps/Floors volatility (target model) for specific quoted tenor. Before the deployment, client should confirm the compounded index in scope for Cap/Floor and their volatility source.

The deployment instruments include:

- *License update*
- *Run the Installation steps*
- *Rate pricing model assignment*
- *RFR volatility source mapping*
- *RFR Cap and Floor volatility setup and assignment*
- *Cap and Floor volatility model assignment and setting update*
- *Rate Curve assignment*

This document is used to guide client on steps required to deploy the Caps/Floors on RFR and client needs to prepare their own runbook to deploy binary, license and configurations to client testing/production environment.

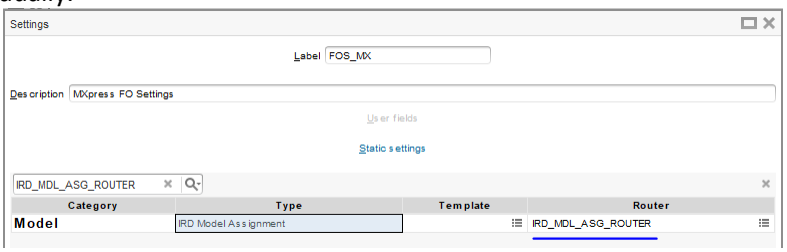
Note: *In this document, we assume that USD SOFR Caps/Floors would use USD LIBOR Caps/Floors volatility and GBP SONIA 3M Caps/Floors would use quoted 3M RFR volatility for pricing. This is only indicative and would be subject to market data availability.* Caps/Floors volatility is tenor specific so client would need to decide the volatility source for different tenors accordingly.

Deployment Instructions

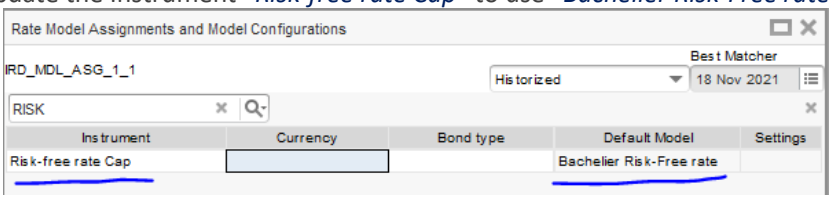
- ## License update (Prepared by Murex)
  - Deploy the license (customerrights) which includes the pricing model, *Bachelier Risk-Free rate*, and model to handle *RFR volatility*.
    - *Bachelier Risk-Free rate:* MXSESSION->Model List-> Bachelier Risk-Free rate.
    - *RFR volatility:* MXSESSION->Optional Modules-> RFR_Volatility.

- ## Run the installation steps
  - Once the license is deployed, from Rich client session (customized installation) the following maintenance steps need to be run:
    - *AdaptTables*
    - *RatesStandardMaintenance*

- ## Rate Pricing Model Assignment
  - With this delivered binary, a new instrument type Risk-free rate cap has been created. It is assigned to caps, floors, and all embedded options on compounded indices. During the maintenance steps, all lines in the rate pricing model assignments whose instrument type is Cap have been duplicated with the Risk-free rate Cap instrument type (and using the same model) to avoid impacts.
  - Manual assignments need to be applied as below to update the model to Bachelier Risk-Free Rate.
    - Client can login as CONFIG group and go to *Infrastructure/FO desk/Settings*.
    - Open FO desk and go to *Model/IRD Model Assignment* and update the model template individually.

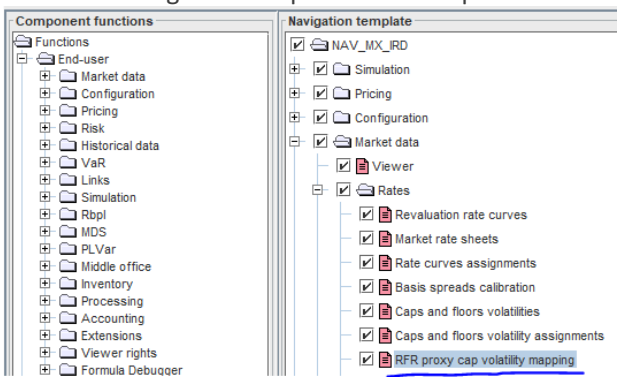


    - Update the Instrument "*Risk-free rate Cap*" to use "*Bachelier Risk-Free rate*".

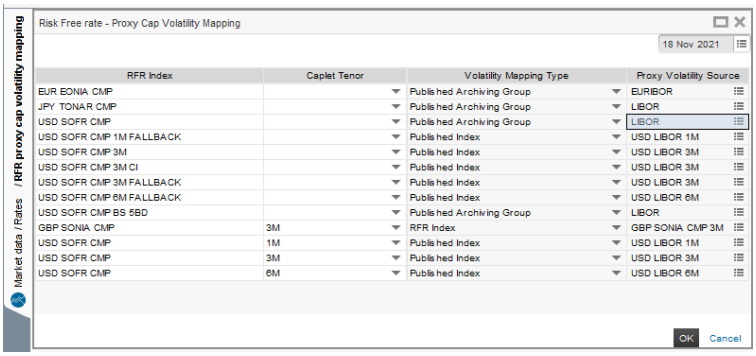


- ## RFR proxy volatility mapping

  - The mapping between the compounded RFR indices and the Libor volatilities to use as proxy is defined in a dedicated screen, called "*RFR proxy cap volatilities mapping*" under *Market Data/Rates*.
  - User can book trades using RFR index without any specific tenor, while the RFR vol curve is on a specific tenor. For example: 3m cap on GBP SONIA CMP index can be mapped to GBP SONIA 3M CMP vol curve, 6m cap on GBP SONIA CMP index can be mapped to GBP SONIA 6M CMP vol curve. This setting can also specific the volatility source of compounded RFR index to use different RFR volatility source based on their schedule generators. This setting is shared by users and market data sets and historized. This screen needs to be added to the navigation template from a supervisor session.



  - **RFR Index** can be generic RFR compounded index (such as USD SOFR CMP) or tenor specific RFR index (USD SOFR CMP 3M FALLBACK).
  - **Caplet Tenor**: Calculation frequency of the RFR cap/floor being priced, based the periodicity of its schedule generator. The tenor must be chosen among the predefined list: 1M, 3M, 6M, 1Y (=12M). To price an RFR caps/floor on another tenor, a dedicated index needs to be created to assign the corresponding surface.
  - **Volatility Mapping Type** decides the proxy volatility source type (Published Archiving Group, Published Index, RFR index). The definition of the three choices is as below.
    - **Published index**: in this case, the volatility surface used to price the option on the compounded index will be the one of these published indices.
    - **Published archiving group**: in this case, the volatility surface used to price the option on the compounded index will be the one of the closest tenors in this archiving group. The calculation frequency of the deal is retrieved to find the closest tenor.
    - **RFR index**: in this case, the volatility surface used to price the option on the compounded index will be RFR index.



Note: *For a RFR cap, the value of the Caplet Tenor will be the periodicity of the driving schedule generator. The router will perform an exact match on the RFR index and Caplet Tenor (12M=1Y). If it doesn't find the deal's tenor (ex: 2M) in the mapping, the assignment with empty Caplet Tenor will be applied.*

- ## Caps and floors volatilities and assignment for RFR Cap/Floor Volatility

  - This step is only required when the tenor specific RFR Cap/Floor volatility is available. For more details on the system configuration, client can refer to docid: 828.
  - Client is required to create cap and floor volatility groups accordingly. This step is similar to Ibor cap/floor volatility group setup.
  - The assignment can be set as below
    - Go to Market data/Cap Floor volatility assignment.
    - Insert assignment rules for the tenor specific RFR index and its corresponding volatility group.

Currency	Component	MarketDataSet	Vol. Group
GBP	GBP SONIA CMP 3M		GBP RFR NVOL
GBP	GBP SONIA CMP 3M CI		GBP RFR NVOL

Note: *The volatility group can be existing volatility or newly created. We would recommend creating a dedicated group as pillars of Libor forward volatility would not be the same RFR forward volatility.*

- ## Cap Floor Volatility Model Assignment for RFR Cap/Floor Volatility

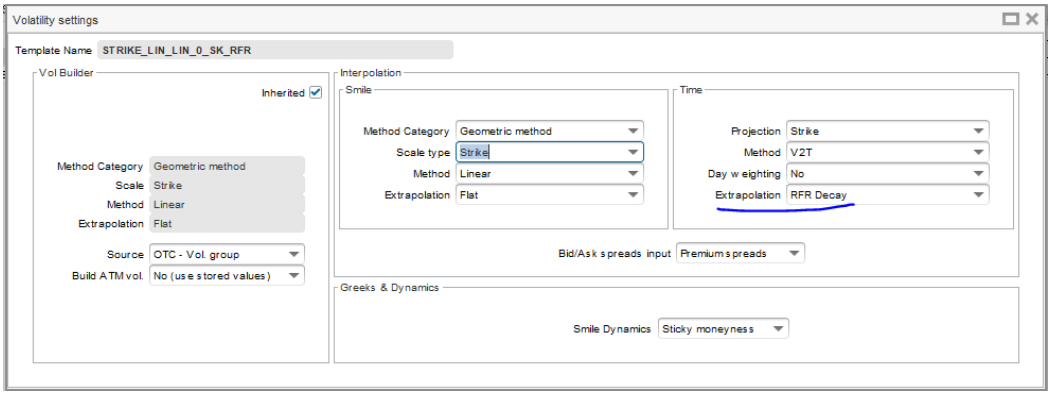
  By default, a cap/floor volatility surface (both forward/forward and forward deduced from par volatilities) is constructed in such a way that flat forward volatilities prior to the first quoted pillar are assumed regardless of the underlying of the volatility group. However, in the cases where the underlying of a Cap/floor volatility group is an RFR compounded index with daily compounding, there is an option of changing time extrapolation method for the maturities prior to the first pillar. The new method is called RFR Decay time extrapolation. In brief, the extrapolated volatility is deduced from the values corresponding to the leftmost quoted pillar of the surface exclusively.

  - The setting can be done as below
    - Client can login as CONFIG group and go to *Infrastructure/FO desk/Settings*.
    - Open FO desk and go to *Model/Cap Floor Volatility Model Assignment*.

Category	Type	Template	Router
Model	Cap Floor Volatility Model Assignment		R_FOS_MX

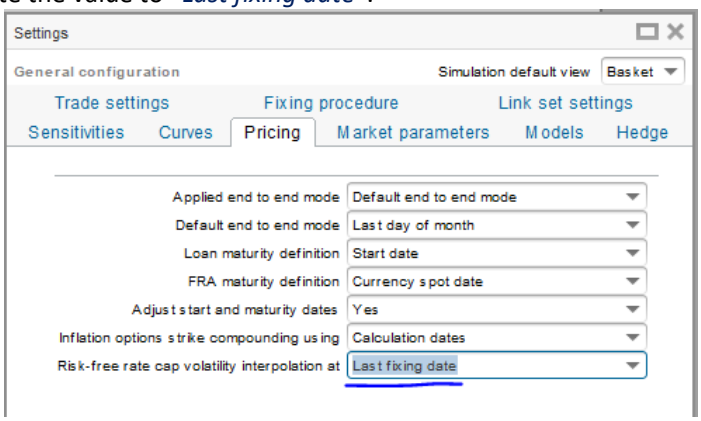
    - Open the Router and update the model template for tenor specific RFR compounded index to have a dedicated model template where the extrapolation is based on *RFR Decay*.

Currency	Instrument	Marketdata Set	Interpolation Model	Settings ID*
GBP	GBP SONIA CMP 3M		VolX	STRIKE_LIN_LIN_0_SK_RFR
GBP	GBP SONIA CMP 3M CI		VolX	STRIKE_LIN_LIN_0_SK_RFR



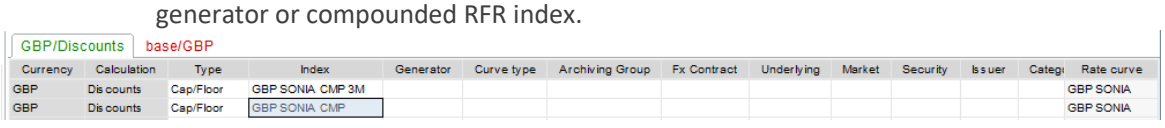
- ## Risk-free rate cap volatility interpolation at
  - This setting allows the user to set volatility interpolation to be *calculation end date* or *last fixing date*. It is to be noted that the setting impacts only the RFR volatility. There is no functional change for caps on published index and RFR caps using LIBOR volatility. The setting decides the date which is used to:
    - interpolate the caplet volatility.
    - calculate the caplet time to expiry given to the pricing model.
    - determine the vol pillar calibration date.
    - calculate the vol pillar forward rates.

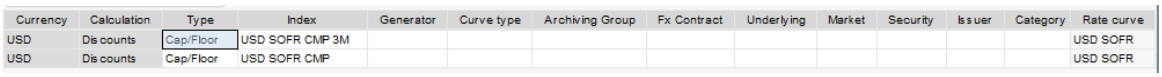
    When the setting is on:
    - calculation end date: this date is the caplet calculation end date.
    - last fixing date: this date is the last underlying fixing date.
  - The setting can be set as below.
    - Client can login as CONFIG group and go to *Infrastructure/FO desk/Settings*.
    - Open FO desk and go to *Static settings/Pricing/Risk-free rate cap volatility interpolation at* to update the value to "*Last fixing date*".



Note: *The market convention is to quote RFR caplet volatility in the last fixing date convention. Consequently, the volatility in the MX.3 should be interpolated and displayed in last fixing date convention. This setting would improve the pricing accuracy for lookbacks/observations shifts.*

- ## Rate Curve Assignment
  - For RFR Cap/Floor, we would assume it follows *mono-curve setup* where estimation curve is the same as discounting curve.
  - The setting can be done as below:
    - Go to Market data/Rates/Rate curves assignments.
    - Check the curve assignment for Type = Cap/Floor for Forward and Discount based on the generator or compounded RFR index.



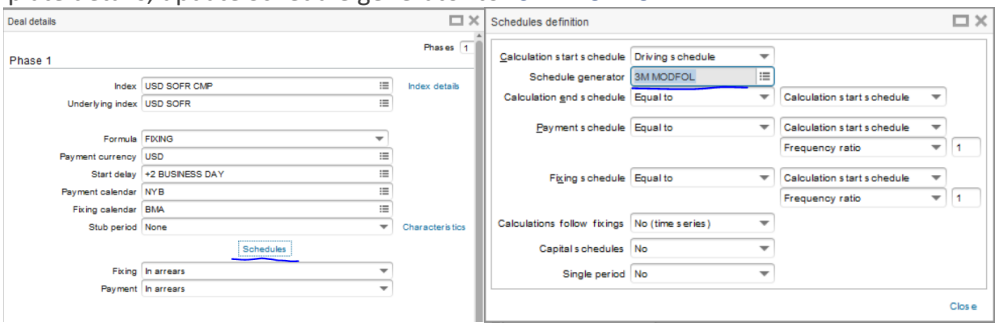


Note*: If the discount curve has already been switched to OIS discounting then this step is not required.*

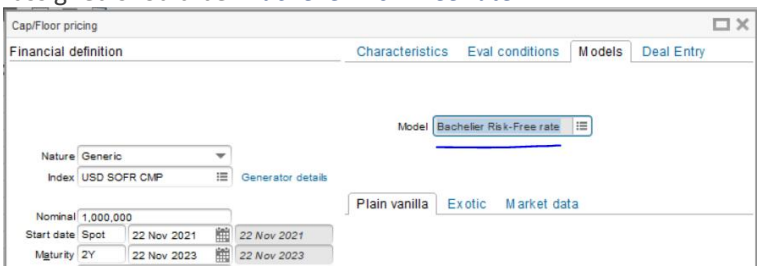
Sanity Check

The sanity check steps below are to check quickly if the deployment instructions are executed properly. It should not be used as model validation guideline nor user story.

- ### Cap/Floor on RFR with Proxy Volatility
  - In e-tradepad, trigger a pricing of Cap/Floor and input index "*USD SOFR CMP*".
  - In template details, update Schedule generator to "*3M MODFOL*".



  - Check the model assigned should be "*Bachelier Risk-Free rate*".



  - Open the flows details and we should see IBOR Vol and Vol as below.

Global flow schedule Source:Notepad

Flow Tp	Start Date	End Date	Remaining Capital	Strike	Net Strike	Applicable Strike	Main IBOR Vol	Main Vol	First fixing Date	Last fixing Date
INT	22 Nov 2021	22 Feb 2022	1,000,000.00	0.00000	0.00000	0.00000	0.492	0.175	22 Nov 2021	18 Feb 2022
INT	22 Feb 2022	23 May 2022	1,000,000.00	0.00000	0.00000	0.00000	0.473	0.321	22 Feb 2022	20 May 2022
INT	23 May 2022	22 Aug 2022	1,000,000.00	0.00000	0.00000	0.00000	0.453	0.403	23 May 2022	19 Aug 2022
INT	22 Aug 2022	22 Nov 2022	1,000,000.00	0.00000	0.00000	0.00000	0.427	0.450	22 Aug 2022	21 Nov 2022
INT	22 Nov 2022	22 Feb 2023	1,000,000.00	0.00000	0.00000	0.00000	0.523	0.545	22 Nov 2022	21 Feb 2023
INT	22 Feb 2023	22 May 2023	1,000,000.00	0.00000	0.00000	0.00000	0.620	0.640	22 Feb 2023	19 May 2023
INT	22 May 2023	22 Aug 2023	1,000,000.00	0.00000	0.00000	0.00000	0.711	0.731	22 May 2023	21 Aug 2023
INT	22 Aug 2023	22 Nov 2023	1,000,000.00	0.00000	0.00000	0.00000	0.804	0.823	22 Aug 2023	21 Nov 2023
PRE										

- ### Cap/Floor on RFR with RFR Volatility
  - In e-tradepad, trigger a pricing of Cap/Floor and input index "*GBP SONIA CMP*".
  - Update Schedules/Schedule generator to "*3M MODFOL*".
  - Check the model assigned should be "*Bachelier Risk-Free rate*".
  - Open the flows details and we should see *Vol* as below.

Flow schedule Source:Notepad Leg:1

Flow Tp	Calculation Start date	Calculation End date	Remaining Capital	Strike	Net Strike	Applicable Strike	Main Vol	First fixing Date	Last fixing Date
INT	18 Nov 2021	18 Feb 2022	1,000,000.00	0.00000	0.00000	0.00000	1.038	18 Nov 2021	17 Feb 2022
INT	18 Feb 2022	18 May 2022	1,000,000.00	0.00000	0.00000	0.00000	1.483	18 Feb 2022	17 May 2022
INT	18 May 2022	18 Aug 2022	1,000,000.00	0.00000	0.00000	0.00000	1.600	18 May 2022	17 Aug 2022
INT	18 Aug 2022	18 Nov 2022	1,000,000.00	0.00000	0.00000	0.00000	1.657	18 Aug 2022	17 Nov 2022
INT	18 Nov 2022	20 Feb 2023	1,000,000.00	0.00000	0.00000	0.00000	1.512	18 Nov 2022	17 Feb 2023
INT	20 Feb 2023	18 May 2023	1,000,000.00	0.00000	0.00000	0.00000	1.409	20 Feb 2023	17 May 2023
INT	18 May 2023	18 Aug 2023	1,000,000.00	0.00000	0.00000	0.00000	1.329	18 May 2023	17 Aug 2023
INT	18 Aug 2023	20 Nov 2023	1,000,000.00	0.00000	0.00000	0.00000	1.265	18 Aug 2023	17 Nov 2023