FX Base and Reporting Currencies

Base Currency and Jurisdictional Support

Version 1.0

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1. Document History

Author	Document Version	Accelerator Version	Date	Comment
RM	1.0	2.0.0	2019-06-28	Initial Publication

2. Contents

3. Introduction

This document describes how the FRTB Accelerator handles FX Delta sensitivities including:

- Translations from the base currency to the reporting currency

- Translations to different jurisdictions (i.e. to support different reporting currencies)

- Determining if the FX Delta sensitivity should be divided by 1.5 with the net curvature risk charges (CVR_k^+ and CVR_k^-) in [MAR21.98]

Four use-cases are documented, including explanations of how to use the accelerator in each case and how the accelerator manages the translations.

- **Simple Usage:** When there is only a single jurisdiction and the base currency is not used, then there is no need to perform any translations.

- **Upstream Translations:** If the translations are provided by the upstream system (i..e the risk engine), then the accelerator only needs to filter for the applicable translations and does not need to perform them. This is specified on a trade-by-trade basis.

- **Base Currency Translations:** When there is only a single jurisdiction and the base currency is used, then the accelerator can provide the translations between the base currency and the reporting currency.

- **Jurisdictional Translations:** When a trade needs to be reported in multiple jurisdictions, then the accelerator can provide translations between multiple reporting currencies.

Note: for all Delta sensitivities the currency pair **Underlying**/**FXCounterCurrency** is the FX rate that is shocked when calculating the sensitivity. Where **Underlying** is the risk-factor/bucket of the sensitivity, and **FXCounterCurrency** is the reporting/base currency for which the sensitivity is calculated.

3.1 Companion Workbook

A sample workbook has been included which demonstrates the translations implemented in the FRTB accelerator. This workbook provides worked examples and can be used to experiment with how the accelerator will handle different input and configuration options.

3.2 Terms and Conventions

reporting/base currency: shorthand to refer to the bank's reporting currency (if the base currency is not used) or to the bank's base currency (where used).

Simple Trade: A trade whose conversions between base and reporting currencies can happen automatically. The accelerator will automatically provide the translations between currencies for both the base currency and multiple jurisdictional support. Example of a simple trade include foreign currency equity or bond purchases. A simple trade is identified by setting the value **FxComplexDelta=N**.

Complex Trade: A trade whose conversions between base and reporting currencies cannot happen automatically. The accelerator will not calculate any translations between currencies for these trades; instead a separate entry is expected for each base or reporting currency, and the accelerator will apply filters to use the applicable entries. A complex trade is identified by setting the value **FxComplexDelta=Y**.

Base Currency Ambiguity

When computing the FX Delta sensitivity in [MAR21.24], the FX spot rate used will be for the **currency pair** whose *right hand* currency is the bank's "base currency". This is the **opposite** from the common definition of a currency pair where the term "base currency" is often used to refer to the *left hand* currency of the pair.

Sensitivity Currency

The Accelerator automatically converts sensitivities between currencies using the FX spot rates. In general (and in the workbook) sensitivities are expressed in the relevant reporting/base currency.

3.3 Risk Factor Naming

In the BCBS 457 specification, the FX risk-factors are a single currency ([MAR21.14]), and each FX bucket contains a single risk-factor.

The FX Delta and Curvature sensitivities are calculated by shocking the FX rate for the currency pair of the risk-factor and the reporting/base currency.

To support multiple jurisdictions, the accelerator needs to handle multiple sensitivities for the same risk-factor. And for technical reasons, these different sensitivities must use different names for the risk-factors.

Hence, in the accelerator, the generated risk-factor names are a currency pair, even though the risk-factor is actually a single currency.

4. No Translation Cases

In the following use-cases the accelerator does not perform any translations of the FX Delta sensitivities.

4.1 Simple usage

Only a single Jurisdiction. No Base Currency.

In this case, there is no need for any translations and the accelerator does not perform any.

Configuration

- set the parameter **sa.fx.use.base-currency=false** (default value)

Input

- Set the field **Underlying** to the risk-factor/bucket of the sensitivity.

- Set the field **FXCounterCurrency** to the reporting currency.

Note: the currency pair **Underlying**/**FXCounterCurrency** is the FX rate that is shocked when calculating the sensitivity.

With the counter currency of all FX Delta sensitivities set to the reporting currency, and the base currency support turned off, the accelerator does not perform any translations.

4.2 Upstream Translations

Use filtering on multiple rows instead of translations.

This case applies at the trade/sensitivity level. It represents trades/sensitivities where the translations are applied upstream (i.e. in the risk engine) and, instead of applying translations, the accelerator will choose from among the provided values.

Input

- Multiple rows are expected for the sensitivity; one for each reporting/base currency.

- Set the field **FxComplexDelta=Y** for each row representing the sensitivity.

- Set the field **FXCounterCurrency** equal to the reporting/base currency for which the sensitivity was calculated.

This case can be used for FX instruments which are too complex for the translations performed by the accelerator. Instead these translations can be performed upstream in the risk-engine; the accelerator is then provided with the sensitivities for all the translations and, when calculating the risk charge, filters out those sensitivities which are not applicable.

Only those sensitivities with the **FXCounterCurrency** equal to the reporting/base currency are used. All others are ignored.

Note: when using a base currency, the translation risk sensitivities will have the risk-factor/bucket set to the reporting currency, while the **FXCounterCurrency** equals the base currency.

5. Accelerator Translations

5.1 Base Currency Translations

Only a single Jurisdiction. Base Currency used.

In this case, the only translations that are needed are from the base currency to the reporting currency.

Parameters:

- Set **sa.fx.use.base-currency=true**

- Set **sa.fx.base-currency** to the base currency.

Input:

- for all rows in the FX Delta and Curvature sensitivities files, set **FXCounterCurrency** equal to the base currency.

- For non-FX instruments denominated in the base currency, sensitivities should be provided with the instrument's currency as the risk-factor/bucket. These sensitivities cannot be calculated using the formula provided in [MAR21.24] since the FX rate of a currency to itself must be 1 and cannot be shocked. However, for non-FX instruments, the sensitivity is the PV and this can be used.

In this case, the sensitivities used in the accelerator are:

- For the non-base-currency risk-factors/buckets, the original sensitivities (from the input) are used.

- For the reporting-currency risk-factor/bucket, the translated sensitivities are also used.

    - The translated sensitivities are -100/101 times the original sensitivity.

    - This includes the translated sensitivity for instruments denominated in the base currency. Note: the original sensitivity is not used directly.

Note: this section applies to sensitivities with **FxComplexDelta=N**. As per previous section, the applicable sensitivities with **FxComplexDelta=Y** are also used.

5.2 Jurisdictional Translations

Multiple Jurisdictions (with different reporting currencies).

In this case, the accelerator will convert sensitivities from a local legal entity to a parent/group legal entity; this includes a change in the reporting currency.

Parameters:

- Set **sa.fx.reporting-currency** to the reporting currency. Since there are multiple jurisdictions, this reporting currency will take different values in different parameter sets.

Input:

- for all rows in the FX Delta and Curvature sensitivities files, set **FXCounterCurrency** equal to the reporting/base currency of the local legal entity.

- For non-FX instruments denominated in the reporting/base currency of the local legal entity, sensitivities should be provided with the instrument's currency as the risk-factor/bucket. These sensitivities cannot be calculated using the formula provided in [MAR21.24] since the FX rate of a currency to itself must be 1 and cannot be shocked. However, for non-FX instruments, the sensitivity is the PV and this can be used.

It is assumed that when translations are required for different jurisdictions that the sensitivities are provided for the local legal entity (for reporting to the local regulator), and that they are then translated to sensitivities for the group (for reporting to the regulator of the group's headquarters). Additionally, as part of this translation, it is assumed that the group funds the local legal entity through a funding book.

For the local legal entity, the sensitivities are as per the previous cases. For the group, the sensitivities are:

- For the risk-factors/buckets not equal to the group's reporting/base currency, the original sensitivities (from the input) are used.

- For the sensitivities whose **FXCounterCCY** does not equal the group's reporting/base currency, a funding book sensitivity is added. This sensitivity is -100/101 times the original sensitivity. These sensitivities are added to the **FXCounterCCY** risk-factor/bucket, which is expected to equal the local legal entity's reporting/base currency.

6. Configuration and Input

6.1 Parameters

The following parameters are specified for each parameter set. They are applied for all trades and sensitivities and may change between jurisdictions.

Parameter	Default Value	Description
`sa.fx.reporting-currency`	`EUR`	Sets the reporting currency.
`sa.fx.base-currency`	`EUR`	Sets the base currency defined in [MAR21.1](b). Only used if `sa.fx.use.base-currency=true`.
`sa.fx.use.base-currency`	`false`	Flag used to enable the base currency approach. If set to false, the `sa.fx.base-currency` parameter is ignored.
`sa.fx.use.fx-divider`	`false`	Flag used to enable the FX divisor for CVR. If set to true, the eligible inputs are divided by the value of `sa.fx.curvature.divider`.
`sa.fx.curvature.divider`	`1.5`	The value by which to divide the CVR_k^+ and CVR_k^- values, when they do not reference the reporting/base currency [MAR21.98]

6.2 Delta Sensitivities

The following fields are specified for each Delta Sensitivity. They may have different values for different trades and sensitivities, and do not change between jurisdictions.

Field	Type	Description
Underlying	Currency	The risk-factor/bucket of the sensitivity.
FXCounterCurrency	Currency	The reporting/base currency for which the sensitivity was calculated.

FXComplexDelta	Y/N flag	Choose between the "complex trade" case ("Y") and the "simple trade" case ("N").
FXOtherCurrency	Currency	Optional additional currency used in the trade (for determining if the sensitivity should be included when dividing the CVR by 1.5). Used when **FXComplexDelta=N**.
FXDivisorEligibility	Y/N flag	Should the sensitivity be included when dividing the CVR by 1.5. Used when **FXComplexDelta=Y**.

Note: the currency pair **Underlying/FXCounterCurrency** is the FX rate that was shocked when calculating the sensitivity.

7. FX CVR Divisor

In [MAR21.98], the net curvature risk charge (CVR_k^+ and CVR_k^-) can sometimes be divided by 1.5 depending on if the trade references the reporting/base currency.

The accelerator will calculate the CVR values for both the trades which reference the reporting/base currency, and for those that don't. The CVR values for those that do not reference the reporting/base currency are divided by 1.5, then added to the CVR values for those that do. The formula is:

$$CVR_k^\pm = \frac{CVR_{k\,\{eligible\}}^\pm}{1.5} + CVR_{k\,\{non-eligible\}}^\pm$$

For simple trades, the accelerator will determine if the trade references the reporting/base currency by comparing it with the **Underlying** and **FXOtherCcy** (or **FXCounterCurrency**) fields. If the currencies in either of these two fields matches the reporting/base currency, then the sensitivity is considered to reference the bank's reporting/base currency.

Note: the **FXOtherCcy** field is optional and only needs to be used when the trade involves a second currency. If this field is set it compared to the reporting/base currency, if it is not set then **FXCounterCurrency** is used instead.

For complex trades, the **FXOtherCcy** field is not used. Instead the **FXDivisorEligibility** flag should be set to Y or N to indicate which Delta sensitivities should be included when dividing by the CVR values by 1.5.

Note: for FX Curvature shocked prices, we only support the "complex" case where the cube facts are filtered according to the reporting/base currency, and a similar **FXDivisorEligibility** flag is used.

8. Appendix: Funding Book

The accelerator supports sharing FX Delta sensitivities between a local legal entity and it's group/parent. For this, we use a model where the group uses a funding book to fund the local entity.

The funding book is assumed to be in the reporting currency of the parent entity, and the local entity will draw funds in their own reporting currency; this will create FX sensitivities within the funding book.

A trade in the local entity that is funded from the funding book can have the following impact on FX Delta sensitivities:

- The subsidiary increases its exposure to the groups reporting/base currency by drawing from the funding book.

- The local entity may gain a FX exposure to the currency of the trade (unless it is in the same currency as the local entities reporting/base currency).

- The group will gain an FX exposure to the local entity's reporting/base currency through the funding book.

- The group will gain an FX exposure to the currency of the trade.

9. Appendix: Translation Calculations

This section provides the details of the translations performed by the accelerator, included when they are applied.

For simple FX trades/sensitivities (**FxComplexDelta=N**), the above cases are all covered by the following set of rules:

- If the risk-factor/bucket does not equal the reporting/base currency, use the sensitivity from the input.

- If the base currency is specified, add a translation sensitivity:

    - The risk-factor/bucket equals the reporting currency

    - The value is -100/101 times the sensitivity from the input.

- If the **FXCounterCurrency** does not equal the reporting/base currency, add a funding book sensitivity:

    - The risk-factor/bucket equals **FXCounterCurrency**

    - The value is -100/101 times the sensitivity from the input.

- If the base currency is specified, and the **FXCounterCurrency** does not equal this base currency, add a combined translation/funding sensitivity:

    - The risk-factor/bucket equals the reporting currency

    - The value is -100/101 times -100/101 times the sensitivity from the input