

Interpretation and Implementation of BCBS 457 – SBM FX

Atoti FRTB

5.2

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FX

This section describes how the SBM FX Risk Class is implemented and how the BCBS 457 specification is interpreted.

Also covered here is the specialization of the data, calculations, and configuration for the FX risk-class, including:

- The data model, which describes the data used for the calculations and how it is structured, and how the data model is represented in the:
 - input files
 - datastore
 - cube
- The calculations, both in the ETL and at query time
- The parameters used in the query time calculations
- How the Solution is configured for FX

Implementation Note

Base Currency and Jurisdiction

Atoti FRTB provides support for using a base currency, as described in [MAR21.14], and for changing the base and reference currencies as part of the jurisdictional support. This support involves transformations and filtering of the sensitivities and risk-factors; the details of this are documented in [FRTB FX Base and Reporting Currencies](#) and are beyond the scope of the current document.

If base currency and jurisdictional support are not required, then setting the counter currency to be the same as the reporting currency for all FX Delta and Curvature risk-factors (as in [MAR21.24](2)) will avoid the translations and filters.

For Vega, no translations or filters are applied.

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 of 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.

Risk Factor and Bucket Naming

In the BCBS 457 specification, for Delta and Curvature the FX risk-factors are a currency pair where the counter currency is the reporting/base currency ([MAR21.14]), and similarly for the FX buckets ([MAR21.86]).

Because the reporting/base currency is fixed when calculating the capital charge, it can be dropped from the bucket name. So that the Delta and Curvature buckets are the left-hand side of the currency pair. This is consistent with worked example 3 in the note that accompanies BCBS 457.

The risk-factor name, when generated will still be the currency pair as this is used when supporting multiple jurisdictions.

For FX Vega, the currency pair is not restricted to the reporting/base currency. So the bucket name is the currency pair.

Data Model (Core)

This section describes the data used for the FX calculations, including how the data is structured. This is a simplified description, for details on jurisdictional support including handling the reporting/base currency, see accompanying “FRTB FX Base and Reporting Currencies” document.

For FX Delta and Curvature, the **Risk Factor Currency** (Underlying) refers to the FX rate between the instrument currency and the reporting/base currency [MAR21.14](1). For FX Vega, the **Currency Pair** (Underlying) refers to the FX rate [MAR21.14](2).

The **Risk Factor** is used to identify sensitivities. However, it is not used directly in the calculations, instead the **Risk Factor Currency**, **Counter Currency**, **Currency Pair**, and tenor fields are used (as appropriate for the risk-measure). This means that multiple **Risk Factor Names** may be used for the same risk-factor.

The **Bucket** is the same as the **Risk Factor Currency** or **Currency Pair**.

Sensitivities

| Field | Key | Risk Measure | Description |
|------------------|-----|--------------|---|
| As-of Date | Y | All | Timestamp (at close of business) for the data (T-1) |
| Trade ID | Y | All | A unique identifier for the trade (or position) |
| Risk Factor Name | Y | All | A unique identifier for the risk-factor |
| Risk Class | Y | All | “FX” |
| Risk Measure | Y | All | “Delta”, “Vega”, or “Curvature” |
| Option Maturity | Y | Vega | The maturity of the option |
| Sensitivity | | Delta & Vega | The sensitivity value s_k |

| Field | Key | Risk Measure | Description |
|----------------------------|-----|--------------|--|
| Shock Up/Down | | Curvature | The up and down shocked prices. |
| Sensitivity Currency | | All | Currency in which the sensitivity or shocked price is expressed. |
| Risk Weight | | Curvature | Risk weight used for the shocked prices |
| PV Applied | | Curvature | Has the PV been subtracted from the shocked prices? |
| Optionality | | Delta | Should the Delta sensitivity be included in the Curvature Calculation? |
| Interpolated Sensitivities | | Vega | Sensitivities interpolated to the prescribed vertices |

Risk Factor [MAR10.9]

The **Risk Factor** is used to identify sensitivities. However, it is not used directly in the calculations, instead the Underlying, **Counter Currency**, and tenor fields are used (as appropriate for the risk-measure). This means that multiple **Risk Factor Names** may be used for the same risk-factor.

For Delta and Curvature, the **Risk Factor Currency** (Underlying) refers to the FX rate between the instrument currency and the reporting/base currency [MAR21.14](1). For Vega, the **Currency Pair** (Underlying) refers to the FX rate [MAR21.14](2).

| Field | Key | Risk Measure | Description |
|-----------------------------------|-----|-------------------|---|
| As-of Date | Y | All | Timestamp (at close of business) for the data (T-1) |
| Risk Factor Name | Y | All | A name for the risk-factor |
| Risk Class | Y | All | “FX” |
| Risk Measure | Y | All | “Delta”, “Vega”, or “Curvature” |
| Option Maturity | | Vega | The maturity of the option (Vega) |
| Risk Factor Currency (Underlying) | | Delta & Curvature | The left-hand side of the risk-factor currency pair |

| Field | Key | Risk Measure | Description |
|----------------------------|-----|----------------------|--|
| Counter Currency | | Delta & Curvature | The right-hand side of the risk-factor currency pair |
| Currency Pair (Underlying) | | Vega | The risk-factor currency pair |

The **Bucket** is the same as the **Risk Factor Currency** or **Currency Pair**.

Calculations

This section describes ETL from the reference implementation and the transformations / calculations applied to the sensitivities in the post-processors after they have been aggregated.

First, the ETL (Extract, Transform, Load) layer will apply some transformations as the data is loaded from the input files into the datastore.

Once the data is loaded into the datastore, it is available in the cube. The sensitivities in the cube may be partially aggregated upon commit to the datastore for BITMAP and LEAF aggregate providers. The remainder of the sensitivity aggregation is performed by Atoti Server at query time.

Then, also at query time, the post-processors calculate the capital charge from the aggregated sensitivities.

ETL (Reference Implementation)

The ETL (Extract, Transform, Load) layer provided with Atoti FRTB, using the default file format, will perform the following transformations when data is loaded from the input files into the datastore.

Risk Factor Name

If the risk-factor name is not included in the input file (using the default file format), a name is generated as follows:

- Delta: *Risk Factor Currency | Counter Currency*
- Vega: *Risk Factor Currency | Counter Currency*
- Curvature: *Risk Factor Currency | Counter Currency*

Normalisation

In the default file format, each row of the sensitivities' files contains the sensitivity as well as a description of the risk factor. The data normalisation splits this information across three stores in the datastore, as described in the data model.

Vectorisation

For efficiency, Vega sensitivities are stored in vectors. The entries of the vectors represent the maturities of the risk factors.

In the default file format, we allow sensitivities to be provided as either single values or as vectors. During the ETL, sensitivities are grouped together into vectors.

Interpolation

For compatibility with risk engines, Vega sensitivities may be loaded for any maturity. During the ETL, these sensitivities are interpolated to match the maturities in the specification.

Query Time (Core)

For the FX risk class, there are three main chains of post-processor calculations: Delta, Vega, and Curvature.

Delta and Vega

The calculation steps for Delta and Vega are the same:

1. The calculations start by applying currency conversion to the aggregated raw sensitivities from the cube to get the Sensitivities.
2. The risk-weights are applied to get the Weighted Sensitivities (per risk-factor).
3. The (ρ) correlations are then used to calculate the Risk Position (per bucket).
4. The Risk Positions are combined across all buckets to calculate the Risk Charge.

In the bookmarks folder “ActiveViam FRTB” → “Basel Framework” → “SBM”, there are bookmarks “FX Delta” and “FX Vega”, which contain tabs that walk through these calculation steps and include the measures mentioned here.

Curvature

For Curvature, the calculation steps are:

1. Start with vectors of shocked prices indexed by risk-weight (per risk-factor).
2. The risk-weight then determines which Shock Up/Down Prices we want, subtracting the trade **PV** if necessary.
3. The delta sensitivities are filtered sensitivities from the Delta calculations, and aggregated per Curvature risk-factor.

4. These are then combined to calculate the CVR Up/Down (per risk-factor).
5. The Risk Position Up/Down are calculated per bucket.
6. The greater of the up and down risk-positions is identified by the Risk Position Scenario and used for the Risk Position (per bucket).
7. The Risk Positions are combined across all buckets to calculate the Risk Charge.

The bookmark “ActiveViam FRTB” -> “Basel Framework” -> “SBM” -> “FX Curvature” contains tabs that walk through these calculation steps and includes the measures mentioned here.

Delta/Vega Sensitivities

The **Delta/Vega Sensitivities** measures are the s_k in [MAR21.4](1) and (2).

For each **Sensitivity Currency**, the **Interpolated Sensitivities** are converted to the reference currency using the IFxRates API (supplied by the reference implementation). After this currency conversion, the values are aggregated for each **Risk Factor** (Vega) or **Bucket** (Delta).

For Delta, if the **Counter Currency** for a **Risk Factor** does not equal the reporting currency, then filtering and translations may be used. See [Base Currency and Jurisdiction](#).

Delta Sensitivities Long/Short

The **Delta Sensitivities Long/Short** measures are the Positive or Negative **Delta Sensitivities**.

The Positive or Negative determination is made at the **Risk Factor Currency** and **Counter Currency** levels.

Curvature Scenario Up/Down PV.CCY

The **Scenario Up/Down PV.CCY** measures are vectors of shocked prices indexed by risk weight.

For each **Sensitivity Currency**, the **Shock Up/Down** prices are converted to the reference currency using the IFxRates API. After this currency conversion, the values are aggregated for each **Bucket**.

If the **Counter Currency** for a **Risk Factor** does not equal the reporting currency, then filtering may be used. See [Base Currency and Jurisdiction](#).

Delta/Vega/Curvature Risk Weight

The **Delta/Vega/Curvature Risk Weight** measures are RW_k in [MAR21.4](3) and $RW_k^{(Curvature)}$ in [MAR21.5](2)(e).

For Delta and Curvature, following [MAR21.87], the risk weights are looked up from the configuration. For specified currency pairs (and first-order crosses), where the right-hand side of the pair is the base or reporting currency, the risk weight may be divided by the square root of 2 (as per [MAR21.88]).

For Vega, following [MAR21.92], the value is looked up based on the configuration for the **Risk Class** (and its liquidity horizon).

Delta/Vega Weighted Sensitivities

The **Delta/Vega Weighted Sensitivities** measures are w_{s_k} in [MAR21.4](3).

For each **Risk Factor** (Vega) or **Bucket** (Delta), the **Delta/Vega Sensitivities** measures are multiplied by the **Delta/Vega Risk Weight**.

Curvature Delta Sensitivities

The **Curvature Delta Sensitivities** measure is s_{i_k} in [MAR21.5](2)(f).

For each Curvature **Bucket**, it is all the **Delta Sensitivities** in the same bucket, filtered by **Optionality**.

Curvature Shock Up/Down Prices

The **Curvature shock-up/down prices** measures are $V_i(x_k^{RW(Curvature)\pm}) - V_i(x_k)$ in [MAR21.5](2).

Using linear interpolation, the shocked prices corresponding to the **Curvature Risk Weight** are determined from the **Curvature Scenario UP/Down.CCY** vectors. And, if **PV Applied** is not true/yes, the trade **PV** is subtracted.

Curvature CVR Up/Down

The **Curvature CVR Up/Down** measures are $c_{VR_k^\pm}$ in [MAR21.5](2).

The **Curvature Delta Sensitivities** are multiplied by the **Curvature Risk Weight** and subtracted from/added to the **Curvature Shock Up/Down Prices** (respectively).

Delta/Vega Risk Position Double Sums

The **Delta/Vega Risk Position Double Sums** measures are the $\sum_k \sum_l w_{s_k} \cdot w_{s_l}$ intermediate values that were requested for the 2017 and 2018 QIS exercises.

For Delta, since there is only a single **Risk Factor** per bucket, the double sums are the square of the aggregated **Delta Weighted Sensitivities**.

For Vega, within each **Bucket**, each pair of **Risk Factors** is categorised according to the combinations of **Option Maturities**. Within each category, the pairs of **Vega Weighted Sensitivities** are multiplied together and summed.

Delta/Vega Risk Position Correlations

The **Delta/Vega Risk Position Correlation** measures are ρ_{kl} in [MAR21.4](4).

For Delta, since there is only a single **Risk Factor** per **Bucket**, the ρ_{kl} correlations are always 100%.

For Vega, within each **Bucket**, and for each combination of **Option Maturities** (see Risk Position Double

Sums) the values are looked up from the configuration for [MAR21.94].

Note: The $\rho_{kl}^{(Delta)}$ in [MAR21.94] is always 100%, since there is only a single Delta **Risk Factor** per **Bucket**.

Delta Vega Risk Position

The **Delta/Vega Risk Position** measures are κ_b in [MAR21.4](4).

For each **Bucket**, the **Delta/Vega Risk Position** is calculated from the **Delta/Vega Weighted Sensitivities** and **Delta/Vega Risk Position Correlations** using the formula in [MAR21.4](4).

Implementation Note: This calculation has been optimized so that it is performed with $\mathcal{O}(N)$ (linear) time complexity, where N is the number of **Risk Factors**.

Curvature Risk Position Up/Down

The **Curvature Risk Position Up/Down** measures are κ_b^\pm in [MAR21.5](3).

Within each **Bucket**, the **Curvature CVR Up/Down** values are combined using the formula in [MAR21.5](3).

Implementation Note: This calculation has been optimized so that it is performed with $\mathcal{O}(N)$ (linear) time complexity, where N is the number of **Risk Factors**.

Curvature Risk Position Scenario

Within each **Bucket**, the **Curvature Risk Position Scenario** measure identifies which of the **Curvature Risk Position Up** and **Curvature Risk Position Down** values is the greater.

Curvature Risk Position

The **Curvature Risk Position** measure is κ_b in [MAR21.5](3).

Within each **Bucket**, it is the greater of the **Curvature Risk Position Up** and **Curvature Risk Position Down** values.

Delta/Vega Risk Charge

The **Delta/Vega Risk Charge** measures are Δ_{Delta} and Δ_{Vega} in [MAR21.4](5).

They are calculated by combining the **Delta/Vega Risk Positions** (and aggregated **Delta/Vega Weighted Sensitivities**) over all **Buckets** according to [MAR21.4](5).

Curvature Risk Charge

The **Curvature Risk Charge** measure is $\Delta_{Curvature\ risk}$ in [MAR21.5](4).

It is calculated by combining the **Curvature Risk Positions** (and aggregated **CVR Up** or **CVR Down** values)

over all **Buckets** according to [MAR21.5](4).

Input Files (Reference Implementation)

This section describes how the input files containing the sensitivities and mappings are used for the FX risk class

The sensitivities are loaded from the Delta, Vega, Curvature, or **CRIF** sensitivity files.

SBM_Delta_Sensitivities*.csv

The Delta Sensitivity Data is loaded from the **Delta** files.

The following table lists the fields in the file format that is used for the FX risk-class. See the **Delta** file format documentation for details on the file format. See Data Model (Core) for a description of the data model.

| Data Model Field | File Column | Notes |
|----------------------|--------------------|---|
| As-Of Date | AsOfDate | |
| Trade ID | TradeID | |
| Sensitivity Currency | DeltaCcy | |
| Sensitivities | DeltaSensitivities | |
| Risk Class | RiskClass | “FX” |
| Risk Factor Name | RiskFactor | (Optional) If not present, generated during ETL. |
| Risk Factor Currency | Underlying | |
| Counter Currency | FXCounterCurrency | |
| Optionality | Optionality | Should this sensitivity be included in the Curvature calculations (‘Y’) or not (‘N’)? |
| | FxComplexDelta | ‘Y’ to use filtering; ‘N’ to use automatic translations. |

| Data Model Field | File Column | Notes |
|------------------|----------------------|--|
| | FxOtherCcy | If the trade involves an FX pair, this is the other currency in the pair. |
| | FXDividerEligibility | 'Y' if the trade does not reference the base/reporting currency; 'N' if it does. |

SBM_Vega_Sensitivities*.csv

The Vega Sensitivity Data is loaded from the **Vega** files.

The following table lists the fields in the file format that is used for the FX risk-class. See the [Vega](#) file format documentation for details on the file format. See Data Model (Core) for a description of the data model.

| Data Model Field | File Column | Notes |
|----------------------|-------------------|--|
| As-Of Date | AsOfDate | |
| Trade ID | TradeID | |
| Risk Class | RiskClass | "FX" |
| Option Maturity | OptionMaturity | May be single value, vector, or empty. If empty, treated as the prescribed maturities: 0.5;1;3;5;10. |
| Sensitivities | VegaSensitivities | May be single value or vector, with the same number of entries as maturities. |
| Sensitivity Currency | VegaCcy | |
| Risk Factor Name | RiskFactor | (Optional) If not present, generated during ETL. |
| Risk Factor Currency | Underlying | |
| Counter Currency | FXCounterCurrency | |

SBM_Curvature_Sensitivities*.csv

The Curvature Sensitivity Data is loaded from the **Curvature** files.

The following table lists the fields in the file format that are used for the FX risk-class. See the [Curvature](#) file format documentation for details on the file format. See Data Model (Core) for a description of the data model.

| Data Model Field | File Column | Notes |
|----------------------|----------------------|---|
| As-Of Date | AsOfDate | |
| Trade ID | TradeID | |
| Risk Class | RiskClass | “FX” |
| Risk Factor Name | RiskFactor | (Optional) If not present, generated during ETL. |
| Shock Up | Shift_Up_PV | |
| Shock Down | Shift_Down_PV | |
| Sensitivity Currency | CurvatureCcy | |
| Risk Weight | RiskWeight | (Optional) |
| PV Applied | PV Applied | Has the Trade PV already been subtracted from the shocked PVs (‘Y’) or not (‘N’)? |
| Risk Factor Currency | Underlying | |
| Counter Currency | FXCounterCurrency | |
| | FXDividerEligibility | ‘Y’ if the trade does not reference the base/reporting currency; ‘N’ if it does. |

Config Files

This section describes the reference implementation configuration used for the FX risk class

frtb-config.properties

| Data Model Field | Property | Reference |
|-------------------------|------------------------------|--|
| As-Of Date | as-of-date.level | AsOfDate@Date@Dates |
| Trade ID | trade.level | TradeId@Trades@Booking |
| Risk Class | risk-class.level | RiskClass@Risk Classes@Risk |
| Risk Measure | risk-measure.level | Risk Measure@Risk Measures@Risk |
| Bucket | fx.buckets.level | FX Bucket@FX Buckets@Buckets |
| | fx.buckets.original.level | FX Original Bucket@FX Original Buckets@Buckets |
| Risk Factor Name | risk-factors.level | Risk Factor@Risk Factors@Risk |
| Option Maturity | fx.vega.option.maturity | Vertex@Vertices@Risk |
| Risk Factor Currency | risk-factors.level | Underlying@Underlying@Market Data |
| Counter Currency | fx.counter.ccy.level | FX Counter Currency@FX Counter Currency@Risk |
| | fx.curvature.divider.level | FX Curvature Divider Eligibility@FX Curvature Divider Eligibility@Risk |
| | fx.delta.divider.level | FX Delta Divider Eligibility@FX Delta Divider Eligibility@Risk |
| | fx.delta.other.ccy.level | FX Delta Other Currency@FX Delta Other Currency@Risk |
| | fx.delta.complex.trade.level | FX Delta Complex Trade@FX Delta Complex Trade@Risk |
| PV Applied | fx.pv.applied.level | PVApplied@PVApplied@Currencies |

| Data Model Field | Property | Reference |
|------------------|-----------------------------|---|
| | fx.delta.double-sums.levels | Ccy@FX Delta Double Sums@Double Sums |
| | fx.vega.double-sums.levels | Ccy@FX Vega Double Sums@Double Sums, Maturity1@FX Vega Double Sums@Double Sums, Maturity2@FX Vega Double Sums@Double Sums |

Datastore (Reference Implementation)

This section describes how the [SA datastore schema](#) is used for the FX risk class.

The schema starts with the SaSensitivities store, which is an index of all the facts in the SA Cube. The **SaSensitivities** store has references to the risk-factor descriptions and sensitivities.

Risk Factor Descriptions

The risk-factor description starts with the RiskFactorDescription store, which contains the description of risk-factor independent of the currency (Delta and Curvature) or currency pair (Vega), and a reference to the UnderlyingDescription store for a description of the currency (Delta and Curvature) or currency pair (Vega).

Sensitivities

The sensitivities stores contain the sensitivity values. They are referenced from the **SaSensitivities** store.

| Risk Measure | Sensitivity Store |
|--------------|-------------------|
| Delta | Delta |
| Vega | Vega |
| Curvature | Curvature |

SaSensitivities

The **SaSensitivities** store is the base store in the SA Cube Schema. Each row in this table represents a fact in the SA Cube.

The following table lists the fields in the store that are used for the FX risk-class. See the [SaSensitivities](#) store

documentation for details on the store. See [Data Model \(Core\)](#) for a description of the data model.

| Data Model Field | Store Field | Notes |
|------------------|--------------|---------------------------------|
| As-Of Date | AsOfDate | |
| Trade ID | TradeId | |
| Risk Factor Name | Risk Factor | |
| Risk Class | RiskClass | “FX” |
| Risk Measure | Risk Measure | “Delta”, “Vega”, or “Curvature” |

RiskFactorDescription

The **RiskFactorDescription** store contains the description of risk-factor.

The following table lists the fields in the store that are used for the FX risk-class. See the [RiskFactorDescription](#) store documentation for details on the store.

| Data Model Field | Store Field | Notes |
|----------------------|-------------------|---------------------------------|
| As-Of Date | AsOfDate | |
| Risk Factor Name | Risk Factor | |
| Risk Class | RiskClass | “FX” |
| Risk Measure | Risk Measure | “Delta”, “Vega”, or “Curvature” |
| Risk Factor Currency | Underlying | |
| Counter Currency | FXCounterCurrency | |
| Sensitivity Tenors | Maturity | for Vega only |

UnderlyingDescription

The **UnderlyingDescription** store is a placeholder for the description of the Risk Factor Currency or Currency Pair.

The following table lists the fields in the store that are used for the FX risk-class. See the [UnderlyingDescription](#) store documentation for details on the store.

| Data Model Field | Store Field | Notes |
|----------------------|-------------------------|--------------------|
| As-Of Date | AsOfDate | |
| Risk Factor Currency | Underlying | |
| Risk Class | RiskClass | “FX” |
| | UnderlyingFXOriginalCcy | Same as Underlying |

Delta

The **SaSensitivities** store contains the Delta sensitivities.

The following table lists the fields in the store that are used for the FX risk-class. See the [SaSensitivities](#) store documentation for details on the store.

| Data Model Field | Store Field | Notes |
|----------------------|----------------------|---------------------|
| As-Of Date | AsOfDate | |
| Trade ID | TradeId | |
| Risk Factor Name | Risk Factor | |
| Risk Class | RiskClass | “FX” |
| Risk Measure | Risk Measure | “Delta” |
| Sensitivity Currency | Ccy | |
| Sensitivities | DeltaSensitivities | |
| Optionality | Optionality | ‘Y’ or ‘N’ |
| | OriginalOptionality | Same as Optionality |
| | FXComplexTrade | ‘Y’ or ‘N’ |
| | FXOtherCcy | |
| | FXDividerEligibility | ‘Y’ or ‘N’ |

Vega

The **SaSensitivities** store contains the Vega sensitivities.

The following table lists the fields in the store that are used for the FX risk-class. See the [SaSensitivities](#) store documentation for details on the store.

| Data Model Field | Store Field | Notes |
|----------------------|-------------------|--------|
| As-Of Date | AsOfDate | |
| Trade ID | TradeId | |
| Risk Factor Name | Risk Factor | |
| Risk Class | RiskClass | “FX” |
| Risk Measure | Risk Measure | “Vega” |
| Sensitivity Currency | Ccy | |
| Sensitivities | VegaSensitivities | |

Curvature

The **SaSensitivities** store contains the Curvature shocked prices.

The following table lists the fields in the store that are used for the FX risk-class. See the [SaSensitivities](#) store documentation for details on the store.

| Data Model Field | Store Field | Notes |
|------------------|---------------|---|
| As-Of Date | AsOfDate | |
| Trade ID | TradeId | |
| Risk Factor Name | Risk Factor | |
| Risk Class | RiskClass | “FX” |
| Risk Measure | Risk Measure | “Curvature” |
| Shock Up | Shift_Up_PV | Vector-valued. Same size as Risk Weight |
| Shock Down | Shift_Down_PV | Vector-valued. Same size as Risk Weight |
| Risk Weight | RiskWeight | (optional) Vector-valued |
| PV Applied | PVApplied | ‘Y’ or ‘N’ |

| Data Model Field | Store Field | Notes |
|----------------------|----------------------|------------|
| Sensitivity Currency | Ccy | |
| | FXDividerEligibility | 'Y' or 'N' |

Cube Schema (Reference Implementation)

The following table lists the levels and hierarchies in the Cube schema that are used in the FX data model.

| Data Model Field | Cube Level | Notes |
|-----------------------|---------------------|---|
| As-Of Date | AsOfDate | Slicing Hierarchy |
| Trade ID | TradeId | |
| Risk Class | Risk Class | "FX" |
| Risk Measure | Risk Measure | "Delta", "Vega", "Curvature" |
| Bucket | FX Bucket | |
| Risk Factor Name | Risk Factor | |
| Option Maturity | Vertex | Analysis Hierarchy |
| Risk Factory Currency | Underlying | |
| Counter Currency | FX Counter Currency | |
| | | Levels for the Delta Double Sums and Correlations |
| | | Levels for the Vega Double Sums and Correlations |

Configuration (Core)

This section describes how the calculations are configured for the FX risk class

Delta Special Crosses

The list of currency pairs in [\[MAR21.88\]](#).

The file **FX_Special_Crosses*.csv** is loaded into the **FXDeltaSpecialCrosses** store.

| Data Model Field | File Column | Datastore Column | Notes |
|----------------------------------|-------------|------------------|-------|
| Left-hand side of currency pair | Num | Num | |
| Right-hand side of currency pair | Den | Den | |

Vertices

The list of FX Vega Option Maturities.

The file **Vertices*.csv** is loaded into the **Vertices** store.

| Data Model Field | File Column | Datastore Column | Notes |
|------------------|--------------|------------------|--|
| | Index | Index | 0-4 |
| Option Maturity | Vertex | Vertex | 0.5;1;3;5;10 Option Maturities in [MAR21.14](2) |
| Risk Class | Risk Class | RiskClass | “FX” |
| Risk Measure | Risk Measure | Risk Measure | “Vega” |

Vega Liquidity Horizons

The file **Vega_Liquidity_Horizons*.csv** is loaded into the **VegaRiskWeights** store.

| Data Model Field | File Column | Datastore Column | Notes |
|----------------------------------|-------------|-------------------|-------|
| Risk Class | Risk Class | RiskClass | “FX” |
| $LH_{risk\ class}$ in [MAR21.92] | Vega LH | Liquidity Horizon | “40” |

Miscellaneous Parameters

The file **FRTBParameters*.csv** is loaded into the **FRTBParameters** store.

| Parameter | Parameter Name | Default Value |
|----------------------|----------------|---------------|
| RW_k in [MAR21.87] | sa.fx.delta.rw | 0.15 |

| Parameter | Parameter Name | Default Value |
|---|---|-----------------|
| RW_k divider in [MAR21.87] | sa.fx.delta.rw.selected.pair.adjustment | 1.4142135623731 |
| γ_{bc} in [MAR21.89] | sa.fx.correlation | 0.6 |
| CVR_k divider in [MAR21.98] | sa.fx.curvature.divider | 1.5 |
| Reporting Currency | sa.fx.reporting-currency | EUR |
| Base Currency | sa.fx.base-currency | EUR |
| Is the Base Currency used? | sa.fx.use.base-currency | false |
| Divide CVR_k by divider in [MAR21.98] | sa.fx.use.fx-divider | false |
| RW_σ in [MAR21.92] | sa.vega.rw | 0.55 |
| α in [MAR21.93](1)(a) | sa.vega.rho-option-maturity.alpha | 0.01 |

}