ActiveViam

FRTB Accelerator Interpretation and Implementation of BCBS 457

SBM GIRR

4.0

Contents

1 GIRR

This section describes how the SBM GIRR 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 GIRR 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 accelerator is configured for GIRR

1.1 Interpretation Note

The FAQ for [MAR21.8] specifies that inflation and cross-currency bases should be considered for Vega risk factors, without an underlying residual maturity dimension. However, [MAR21.93] and [MAR21.94] do not specify the correlation parameter ρ_{kl} when one of the underlyings is an Inflation or Basis curve (and hence do not have an underlying maturity).

In the FRTB Accelerator , when one of the underlying curves is an inflation or cross-currency basis curve, we use [MAR21.94] with $\rho_{kl}^{(DELTA)}$ equal to 0% or 40% as determined by [MAR21.48] and [MAR21.49].

1.2 Data Model (Core)

This section describes the data used for the GIRR calculations, including how the data is structured.

For GIRR, the **Curve** (Underlying) refers to one of the following:

- "risk-free yield curve" [MAR21.8](1)
- "flat curve of market-implied inflation rates" [MAR21.8](2)
- "cross-currency basis curve" [MAR21.8](3)

Each of these curves has a **Curve Name**, **Curve Type**, and **Curve Currency**.

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

The **Bucket** is determined by the **Curve Currency**.

1.2.1 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 (not including vertices)

Field	Key	Risk Measure	Description
Risk Class	Y	All	"GIRR"
Risk Measure	Y	All	"Delta", "Vega", or "Curvature"
Sensitivity Tenor	Y	Delta	The tenor in the yield curve
Option Maturity	Y	Vega	The maturity of the option
Underlying Maturity	Y	Vega	The residual maturity of the underlying
Sensitivity		Delta & Vega	The sensitivity value s_k
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? Y/N
Optionality		Delta	Should the Delta sensitivity be included in the Curvature Calculation? Y/N
Interpolated Sensitivities		Delta & Vega	Sensitivities interpolated to the prescribed vertices

1.2.2 Risk Factor [MAR10.9]

The **Risk Factor** is used to identify sensitivities. However, it is not used directly in the calculations, instead the **Curve** and the tenor fields are used. This means that multiple **Risk Factor Names** may be used for the same risk-factor.

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 (not including vertices)
Risk Class	Y	All	“GIRR”
Risk Measure	Y	All	“Delta”, “Vega”, or “Curvature”
Sensitivity Tenor	Y	Delta	The time to maturity of the traded instrument
Option Maturity	Y	Vega	The maturity of the option
Underlying Maturity	Y	Vega	The residual maturity of the underlying
Curve Name (Underlying)		All	Name of the curve

For Curvature, there is only a single risk factor per bucket and the **Curve Name** can be the currency/bucket.

Implementation notes (vectors of vertices):

- The risk-factor name spans all tenors/maturities, so it represents multiple [MAR10.9] risk-factors.
- In the input files (default file format), multiple vertices and sensitivities may either be provided on the same row or different rows.
- In the datastore, we use vectors to store the sensitivities for all tenors. For Vega, these vectors are storing a two-dimensional array (indexed by both underlying and option maturities).
- In the cubes, we use analysis hierarchies to expand the vectors.

1.2.3 Curve

The **Curve** refers to one of the following:

- “risk-free yield curve” [MAR21.8](1)
- “flat curve of market-implied inflation rates” [MAR21.8](2)
- “cross-currency basis curve” [MAR21.8](3)

Field	Key	Description
As-of Date	Y	Timestamp (at close of business) for the data (T-1)
Curve Name (Underlying)	Y	Name of the curve
Risk Class	Y	“GIRR”
Curve Type		“Yield”, “Basis”, or “Inflation” (Delta and Vega)
Curve Currency		The currency of the curve. This is also the **Bucket**.

1.3 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 ActivePivot at query time.

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

1.3.1 ETL (Reference Implementation)

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

1.3.2 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: Curve Name + Curve Type
- Vega: Curve Name + Curve Type
- Curvature: Curve Name

1.3.3 Normalisation

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

1.3.4 Vectorisation

For efficiency, Delta and Vega sensitivities are stored in vectors. The entries of the vectors represent the tenors/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.

1.3.5 Interpolation

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

1.3.6 Query Time (Core)

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

1.4 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 (rho) 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 "GIRR Delta" and "GIRR Vega", which contain tabs that walk through these calculation steps and include the measures mentioned here.

1.5 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” -> “GIRR 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**.

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 **Curve Name** level and (for yield curves) the **Tenors** level.

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 **Risk Factor**.

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 [MAR21.42]–[MAR21.44], the values are looked up based on the configuration for the **Curve Type** and **Tenor**. For specified currencies, these risk weights may be divided by the square root of 2.

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 WS_k in [MAR21.4](3).

For each **Risk Factor** k, the **Delta/Vega Sensitivities** measures are multiplied by the **Delta/Vega Risk Weight**.

Curvature Delta Sensitivities

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

For each **Bucket**, it is all the **Delta Sensitivities** in that **Bucket** whose **Curve Type** is "Yield", filtered by **Optionality**.

Curvature Shock Up/Down Prices

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

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

Delta/Vega Risk Position Double Sums

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

Within each **Bucket**, each pair of **Risk Factors**, is categorised according to:

- Delta
  - Same or different **Curve Name**
  - Combinations of **Curve Type**
  - Combinations of **Tenors**
- Vega
  - Same or different **Curve Name**

- Combinations of **Curve Type**
- Combinations of **Option Maturities**
- Combinations of **Underlying Maturities**

Within each category, the pairs of **Delta/Vega Weighted Sensitivities** are multiplied together and summed.

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

Delta/Vega Risk Position Correlations

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

Within each **Bucket**, and for each category of **Risk Factor** pairs (see Delta/Vega Risk Position Double Sums) the values are looked up from the configuration for [MAR21.45]-[MAR21.49], and [MAR21.93]–[MAR21.94].

Note: See Interpretation Note for inflation and cross-currency basis curves for Vega.

Delta Vega Risk Position

The **Delta**/**Vega** **Risk Position** measures are K_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 optimised so that it is performed with $O(N)$ (linear) time complexity, where N is the number of **Risk Factors**.

Curvature Risk Position Up/Down

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

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

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 K_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 Delta and 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 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).

1.6 Input Files (Reference Implementation)

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

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

1.6.1 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 GIRR 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	May be single value or vector, with the same number of entries as Tenors.
Risk Class	RiskClass	“GIRR”
Sensitivity Tenor	SensitivityDates	May be single value, vector, or empty. If empty, treated as the prescribed tenors: 0.25;0.5;1;2;3;5;10;15;20;30.
Risk Factor Name	RiskFactor	(Optional) If not present, generated during ETL.
Curve Type	RiskFactorType	“Yield”, “Inflation”, or “Basis”
Curve Name	Underlying	

Data Model Field	File Column	Notes
Optionality	Optionality	Should this sensitivity be included in the Curvature calculations ('Y') or not ('N')?
Covered Bond Rating	CSRRating	(Optional) For covered bonds, "high" for rating AA- or above; otherwise "low"

1.6.2 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 GIRR 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	"GIRR"
Option Maturity	OptionMaturity	May be single value, vector, or empty. If empty, treated as the prescribed maturities: 0.5;1;3;5;10.
Underlying Maturity	UnderlyingMaturity	May be single value, vector, or empty. If empty, treated as the prescribed tenors: 0.5;1;3;5;10.
Sensitivities	VegaSensitivities	May be single valued or a two-dimensional array indexed by Option Maturity × Underlying Maturity
Sensitivity Currency	VegaCcy	
Risk Factor Name	RiskFactor	(Optional) If not present, generated during ETL.
Curve Type	RiskFactorType	"Yield", "Inflation", or "Basis"

Data Model Field	File Column	Notes
Curve Name	Underlying	
Curve Currency	RiskFactorCcy	

1.6.3 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 GIRR 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	“GIRR”
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’)?

Data Model Field	File Column	Notes
Curve Name	Underlying	
Curve Currency	RiskFactorCcy	

1.7 Config Files

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

1.7.1 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	girr.buckets.level	GIRR Bucket@GIRR Buckets@Buckets
Risk Factor Name	risk-factors.level	Risk Factor@Risk Factors@Risk
Sensitivity Tenor	vertices.level	Vertex@Vertices@Risk
Option Maturity	girr.vega.option.maturity	Vertex@Vertices@Risk

Data Model Field	Property	Reference
Underlying Maturity	girr.vega.underlying.maturity	Maturity@Maturities@Risk
Curve Name	market-data.underlying.level	Underlying@Underlying@Market Data
Curve Type	girr.curve.type.level	GIRR Curve Type@GIRR Curve Types@Market Data
Curve Currency	girr.ccy.level	GIRR Curency@GIRR Currency@Market Data
PV Applied	girr.pv.applied.level	PVApplied@PVApplied@Currencies
	girr.delta.double-sums.levels	Vertex1@GIRR Delta Double Sums@Double Sums, Vertex2@GIRR Delta Double Sums@Double Sums, Curve@GIRR Delta Double Sums@Double Sums
	girr.vega.double-sums.levels	OptionMaturity1@GIRR Vega Double Sums@Double Sums, OptionMaturity2@GIRR Vega Double Sums@Double Sums, UnderlyingMaturity1@GIRR Vega Double Sums@Double Sums, UnderlyingMaturity2@GIRR Vega Double Sums@Double Sums

1.8 Datastore (Reference Implementation)

This section describes how the SA datastore schema is used for the GIRR risk class.

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

1.8.1 Risk Factor Descriptions

The risk-factor description starts with the RiskFactorDescription store, which contains the description of risk-factor independent of the curve, and a reference to the UnderlyingDescription store for a description of the curve.

1.8.2 Sensitivities

The sensitivities stores contain the sensitivity values, they are referenced from the **TradeBase** store.

Risk Measure	Sensitivity Store
Delta	Delta
Vega	Vega
Curvature	Curvature

1.8.3 TradeBase

The **TradeBase** 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 GIRR risk-class. See the TradeBase 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	“GIRR”
Risk Measure	Risk Measure	“Delta”, “Vega”, or “Curvature”

1.8.4 RiskFactorDescription

The RiskFactorDescription store contains the description of risk-factor.

The following table lists the fields in the store that are used for the GIRR 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	“GIRR”
Risk Measure	Risk Measure	“Delta”, “Vega”, or “Curvature”
Curve Name	Underlying	

1.8.5 UnderlyingDescription

The **UnderlyingDescription** store contains the description of the curve.

The following table lists the fields in the store that are used for the GIRR risk-class. See the UnderlyingDescription store documentation for details on the store.

Data Model Field	Store Field	Notes
As-Of Date	AsOfDate	
Curve Name	Underlying	
Risk Class	RiskClass	“GIRR”
Curve Type	GIRR Curve Type	“Yield”, “Basis”, or “Inflation”
Curve Currency	GIRR ccy	

1.8.6 Delta

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

The following table lists the fields in the store that are used for the GIRR risk-class. See the Delta 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	

Data Model Field	Store Field	Notes
Risk Class	RiskClass	“GIRR
Risk Measure	Risk Measure	“Delta”
Sensitivities	DeltaSensitivities	Vector-valued. Same size as Sensitivity Tenors
Sensitivity Tenors	SensitivityDates	Vector-valued
Sensitivity Currency	Ccy	
Interpolated Sensitivities	DeltaSensitivities - Interpolated	Vector-valued. Indexed by prescribed Tenors
Optionality	Optionality	‘Y’ or ‘N’

1.8.7 Vega

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

The following table lists the fields in the store that are used for the GIRR risk-class. See the Vega 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	“GIRR
Risk Measure	Risk Measure	“Vega”

Data Model Field	Store Field	Notes
Sensitivities	VegaSensitivities	Vector-valued. Size of Option Maturity × Underlying Maturity
Option Maturity	OptionMaturity	Vector-valued
Underlying Maturity	UnderlyingMaturity	Vector-valued
Sensitivity Currency	Ccy	
Interpolated Sensitivities	VegaSensitivities - Interpolated	Vector-valued. Indexed by prescribed Option Maturity × Underlying Maturity

1.8.8 Curvature

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

The following table lists the fields in the store that are used for the GIRR risk-class. See the Curvature 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	“GIRR”
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

Data Model Field	Store Field	Notes
Risk Weight	RiskWeight	(optional) Vector-valued
PV Applied	PVApplied	'Y' or 'N'
Sensitivity Currency	Ccy	

1.9 Cube Schema (Reference Implementation)

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

Data Model Field	Cube Level	Notes
As-Of Date	AsOfDate	Slicing Hierarchy
Trade ID	TradeId	
Risk Class	Risk Class	"GIRR"
Risk Measure	Risk Measure	"Delta", "Vega", "Curvature"
Bucket	GIRR Bucket	
Risk Factor Name	Risk Factor	
Sensitivity Tenor / Option Maturity	Vertex	Analysis Hierarchy
Underlying Maturity	Maturity	Analysis Hierarchy
Curve Name	Underlying	

Data Model Field	Cube Level	Notes
Curve Type	GIRR Curve Type	
Curve Currency	GIRR Currency	
		Levels for the Delta Double Sums and Correlations
		Levels for the Vega Double Sums and Correlations

1.10 Configuration (Core)

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

1.10.1 Tenor Risk Weights

Maps Tenors to Risk Weights.

The file **GIRR_Delta_Weightings*.csv** is loaded into the **GIRRDeltaWeighting** store.

Data Model Field	File Column	Datastore Column	Notes
Sensitivity Tenor	Vertex	Vertex	0.25;0.5;1;2;3;5;10;15;20;30
RW_k in [MAR21.42]	Risk Weight	RiskWeight	

1.10.2 Major Currencies

The list of major currencies for [MAR21.44].

The file **GIRR_Major_Currency*.csv** is loaded into the **GIRRMajorCurrency** store.

Data Model Field	File Column	Datastore Column	Notes
Curve Currency	FRTB Selected CCY	FRTB Selected CCY	

1.10.3 Vertices

The list of GIRR Delta Tenors and 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 (Vega) 0-9 (Delta)
Sensitivity Tenor / Option Maturity	Vertex	Vertex	0.25;0.5;1;2;3;5;10;15;20;30 Delta Tenors in [MAR21.42] 0.5;1;3;5;10 Vega Option Maturities in [MAR21.8](4)(a)
Risk Class	Risk Class	RiskClass	“GIRR”

Data Model Field	File Column	Datastore Column	Notes
Risk Measure	Risk Measure	Risk Measure	“Delta” or “Vega”

1.10.4 Underlying Residual Maturity Vertices

The list of GIRR Vega Underlying Maturities.

The file **Option_Residual_Maturity_Vertices.csv** is loaded into the **OptionResidualMaturityVertices** store.

Data Model Field	File Column	Datastore Column	Notes
	Index	Index	0-4
Underlying Maturity	OptionResidualMaturityVertex	Vertex	0.5;1;3;5;10 Vega Option Maturities in [MAR21.8](4)(b)
Risk Class	Risk Class	RiskClass	“GIRR”

1.10.5 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	"GIRR"
$LH_{\text{risk class}}$ in [MAR21.92]	Vega LH	Liquidity Horizon	"60"

1.10.6 Miscellaneous Parameters

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

Parameter	Parameter Name	Default Value
ρ_{kl} in [MAR21.45]	sa.girr.delta.differentcurve.correlation	0.999
ρ_{kl} floor in [MAR21.46]	sa.girr.delta.different-vertex.correlation-floor	0.4
θ in [MAR21.46]	sa.girr.delta.different-vertex.theta	0.03
ρ_{kl} multiplier in [MAR21.47]	sa.girr.delta.different-vertex-and-curve.correlation	0.999
ρ_{kl} in [MAR21.48]	sa.girr.delta.inflation-vs-yield.correlation	0.4
ρ_{kl} in [MAR21.49](1)	sa.girr.delta.basis-vs-yield.correlation	0
ρ_{kl} in [MAR21.49](2)	sa.girr.delta.basis-vs-inflation.correlation	0
ρ_{kl} in [MAR21.49](3)	sa.girr.delta.basis-vs-basis.correlation	0
γ_{bc} in [MAR21.50]	sa.girr.delta.different-ccy.correlation	0.5
RW_k divider in [MAR21.44]	sa.girr.delta.rw.major.currency.adjustment	1.4142135623731
RW_k in [MAR21.43] (Basis curves)	sa.girr.delta.basis.risk-weight	0.016

Parameter	Parameter Name	Default Value
RW_k in [MAR21.43] (Inflation curves)	sa.girr.delta.inflation.risk-weight	0.016
Decimal places in ρ_{kl} in [MAR21.46]	sa.girr.delta.vertex.correlation.rounding-dp	3
RW_σ in [MAR21.92]	sa.vega.rw	0.55
α in [MAR21.93](1)(a)	sa.vega.rho-option-maturity.alpha	0.01
α in [MAR21.93](2)(a)	sa.vega.rho-underlying-maturity.alpha	0.01

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